

Report 153

Polymers in Telecommunication Devices

G.H. Cross

Volume 13, Number 9, 2002

Rapra Review Reports

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	The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied	- Abstract
Location —	with temp. over the entire range of temps. (110-190C) investigated. 57 refs. GOODRICH B.F. USA Accession no.771897	Companies or - organisations mentioned

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Polymers in Telecommunication Devices

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ISBN 1-85957-361-4

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1 Introduction

1.1 Materials in Photonics

The way we communicate and compute across the globe is increasingly reliant on the manipulation of optical signals. Where previously electronic circuits manipulated such signals, photonic circuits now take their place. This transition has given birth to the field of photonics. In photonics technologies, devices are no longer limited solely to the silicon wafer and often require broader functionality than can be offered on this traditional platform. Another semiconductor wafer platform indium phosphide, and the compound semiconductors that are compatible with it, offer the potential to integrate active devices (lasers, amplifiers, modulators, etc.), and passive (light guiding) structures on a common substitute. Most active devices based on the silicon platform are conversely much less well developed. Further removed is the position that the ferroelectric ceramic lithium niobate has established as the platform of choice for electro-optic devices. Yet silicon still underpins a significant share of the photonics sector, acting as a well-tried and tested technology for devices. Using doped silica-on-silicon or silicon-on-insulator techniques, passive optical waveguide devices can be integrated with active devices fabricated on other platforms using 'silicon optical bench' methods.

It is against this background amongst the clamour for recognition and acceptance in the photonics revolution that polymers have been able to make their own unique bid against their rivals and even to form alliances with them to provide the best that such combinations can offer.

This Review Report will overview all elements of the optical transmission and switching systems that serve the telecommunications network. It will be shown that solutions using polymers have been found or are being proposed for many application areas in the network. A critical comparison between polymers and alternative material systems will be made on occasion and it will be seen that no single material system yet dominates. Polymer technologies may thus be considered on a level playing field with the alternatives.

1.2 Telecommunication Photonics

Connecting the spans of optical fibre of the optical telecommunications network are nodes at which devices act to route, switch, filter, amplify, attenuate, reshape or modulate the optical data stream. In many

of these nodes, an optical-electrical-optical transduction process is necessary but it is the central theme of research and development that these nodes will eventually become 'transparent' to the optical data traffic passing through them. For the foreseeable future, such 'transparency' will mean traffic carried on wavelengths in the near infrared region, between 1300 and 1700 nm. Dense Wavelength Division Multiplexing (DWDM) is being deployed to carry data on individual wavelength channels separated by 100 GHz and each channel can be modulated at 10 Gbit/s allowing Time Division Multiplexing (TDM) to carry multiple data streams within each wavelength channel. By multiplying the wavelength channel count with the channel modulation bandwidth the capacity of a DWDM link is obtained. Thus, 32 channels carrying 10 Gbit/s provide 320 Gbit/s of aggregate capacity. The International Telecommunications Union (ITU) has defined three bands in the near infrared region; 'S' (1400-1520 nm), 'C' (1520-1560 nm) and 'L' (1560-1650 nm), as industry standards for transmission.

Additional wavelengths are relevant to the discussion. DWDM traffic within these ITU bands may be further multiplexed with traffic at 1310 nm and certain amplifier devices (Erbium-Doped Fibre Amplifiers, EDFA) require optical pumping at 980 nm. Thus devices designed for compatibility with the optical telecommunications system may have to cope with relatively high intensities of light at all of these wavelengths. This is a particularly important consideration for polymer materials, as will be described in Section 2.1.1, since hydrocarbons often present a small but significant absorption to the longer of these wavelengths of interest.

1.2.1 Optical Fibre

Optical fibres may be classified as either monomode or multimode. The former are required for the highest bandwidth and longest reach transmission since, as the name suggests, only one mode of propagation, at each wavelength, is allowed by the optogeometrical design. Thus, the problems that would arise from multiple modes, each travelling at slightly different velocities (intermodal dispersion), are largely avoided. Silica, doped with germanium to form a small core of diameter around 8 μ m, is the incumbent material used throughout the telecom network. Multimode fibre, used for shorter haul, lower bandwidth applications, has a larger core size (around 50 μ m) and is also predominantly silicabased but recent developments in polymer optical fibre show promise. Whilst the deployed fibre in the long haul and metro (city wide) system is required to be of monomode dopedsilica, local area network applications such as inter-office and campus networks are often configured using multimode fibre. It is in these latter areas that polymer technology is most favourably placed to compete against silica, as is described in Section 4.1.

1.2.2 Planar Waveguides

Between the terminations of the optical fibre, active and passive devices combine to provide photonic switching nodes. The preferred format for these devices is as planar optical waveguide systems patterned into wafer-processed optical circuits. A planar optical waveguide requires only that a material of refractive index higher than its surroundings (the 'core') be provided with optogeometrical parameters suitable for either monomode or multimode transmission of light. Where possible, the device's cross-section is designed so that the cross-section of the mode carried in the adjoining fibre is of similar size and shape. This minimises the coupling loss between fibre and device. Often termed 'channel' waveguides, the requirement for monomode propagation relies on a specific refractive index difference between core and surroundings ('cladding') coupled with maximum allowable transverse (vertical) and lateral dimensions for the core. The single propagating mode travels at a velocity governed by the relative proportion of optical field distributed amongst the layers of the waveguide. The mode thus travels at that velocity constrained by the weighted average refractive indices of the various layers. The result is an 'effective refractive index', N, and a propagation constant, k_z , interrelated through:

$$k_z = \frac{2\pi}{\lambda} N \tag{1}$$

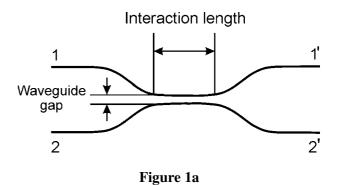
where λ is the free space wavelength.

Planar waveguide circuits may be patterned into a very wide variety of materials. Those most compatible with the optical fibre system are patterned in silica-onsilicon wafer substrates, perhaps by doping the required core regions with phosphorus or by codeposition with germanium oxide (a.1). Higher refractive index contrast, which can bring advantages such as a reduced device 'footprint' are provided by silicon-on-insulator technology (a.2) or by fabricating core and cladding in III-V compound semiconductor materials on a semiconductor substrate, (e.g., indium phosphide), however, polymers can also offer reasonably high contrast combinations. This and the opportunity for versatile choice of contrast (refractive index tuning) are features that will be discussed later (see Section 3.2).

1.2.3 Waveguide Photonic Devices

In general, the devices acting at the nodes of the system can be divided into either 'active' or 'passive' types. 'Active' devices require some form of intervention to change their properties as light passes through and this makes the distinction between these two classes of device. For example, a power splitter consisting of a simple pair of coupled planar waveguides (**Figure 1a**) is one example of a passive device since the power splitting ratio is determined by the design of the device and its fixed material properties. In the case of a thermooptic switch, an active device, a heater electrode applied over one arm of a planar waveguide 'Y' junction power splitter for example (**Figure 1b**) can be used to change its power output characteristics.

The basic requirement for materials in all device types is that of low optical absorption loss at near infrared wavelengths (preferably less than 0.5 dB/cm) and stability to ageing through a moderate temperature range (-40 to 70 °C) and under conditions of high optical intensities. Issues arising through the action of moisture and oxidative degradation are less of concern in well-packaged devices. For active devices, it is the magnitude of the functional property that is important.



Plan view of a channel waveguide directional coupler. In the central interaction region, power can be transferred across the gap between the two waveguides (a.45).

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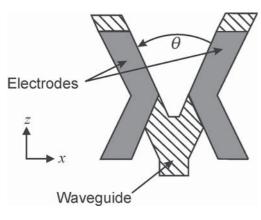


Figure 1b

'Y' junction thermo-optic waveguide switch. The electrodes placed over the waveguides in the region of bifurcation apply heat to reduce the refractive index in those regions. Power may then emerge either from the left or the right output guides.

The thermo-optic coefficient of polymers is large and negative, for example, and provides lower power switching in devices than is required in the equivalent silica-based devices.

Further examples of devices will be used throughout this report to illustrate the limitations and advantages of polymers as they are applied in each case.

2 Basic Polymer Material Requirements

2.1 Wavelength Constraints

The telecommunications network wavelengths have been defined and have evolved, as performance imperatives have demanded them to. The earliest implementation of long distance optical transmission used wavelengths around 1300 nm. At these wavelengths, silica optical fibre exhibits a minimum in its refractive index dispersion. This means that the small frequency spread that arises naturally in data pulses sent down the fibre does not result excessively in spatial spread of the pulse. Thus higher data rates (more closely spaced pulses) can be transmitted using TDM. The longer wavelength also meant reduced Rayleigh scattering and this, coupled with the development of high purity (anhydrous) silica meant that propagation losses were much reduced. The move towards 1550 nm as the centre wavelength of choice for wavelength

division multiplexing (WDM) and DWDM systems during the 1990s was largely in response to the development of fibre optical amplifiers whose gain envelope covered this region, which also happens to lie at an absorption minimum for silica. Rayleigh scattering at these longer wavelengths is reduced yet further, but methods for dispersion compensation are required as silica dispersion re-emerges in this wavelength region. Currently, with the advent of semiconductor optical amplifiers (SOA) and the prospect of Raman amplification, further wavelength bands (short, S and long, L) to either side of the 1550 nm (C) band will be opened up for use.

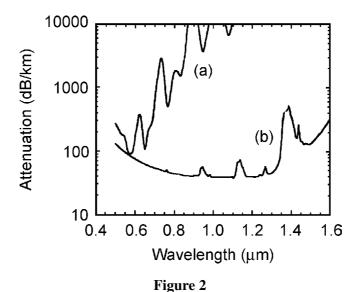
In short links, using multimode fibre, low cost laser diodes operating at 830 nm can be used since data rates are lower and propagation loss is not as significant for the shorter spans in local area or campus networks.

2.1.1 Absorption Loss

The main optical phonon modes made of inorganic materials (principally the C-X vibration modes; X = hydrogen, deuterium or halogen) have overtones that in their higher orders (greater than 2) coincide with the near infrared regions of interest for telecommunications between 1300 and 1700 nm. The absorbance spectrum in a sample of polymer optical fibre for example (**Figure 2, trace a**) shows these features clearly. The absorption strength decreases by approximately one order of magnitude per overtone order but the loss is quite prohibitive for even short distance optical propagation at these wavelengths. In the visible region losses are reduced sufficiently to allow the use of polymer optical fibre up to a few hundred metres.

However, great progress has been made in reducing the influence of overtone absorption, largely through increasing the effective mass of the oscillators. For example, if fluorine (19) replaces hydrogen (1), the effective mass of the C-X system increases by a factor of 8 and lowers the frequency of the fundamental mode and its associated overtones (see **Figure 2, trace b**). Thus perfluorinated acrylate polymers when fabricated into waveguides have shown losses as low as 0.03 dB/cm at 1300 nm and 0.05 dB/cm at 1550 nm (a.3).

Electronic excitations due to organic chromophores occur at much shorter wavelengths than the telecommunication band wavelengths but they can be significant. In a class of polymers developed for electro-



Loss spectrum of a polymer optical fibre based upon hydrogenated polymer (trace A) showing the relative reduction in absorbance for successive orders of the vibrational overtones and the prohibitive loss at telecommunications wavelengths. Trace B shows the loss spectrum for a perfluorinated polymer optical fibre (a.31).

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optic applications, for example, it has been found that organic chromophores with absorption bands in the visible to near infrared range are highly desirable, having large molecular optical nonlinearities (*vide infra*). When incorporated into a polymer matrix however, the effects of inhomogeneous broadening cause absorption tails to extend towards the near infrared region. In the worst cases, the absorption tail extends out to the 1300 nm region and can be implicated in the photo-induced degradation of chromophores even at these long wavelengths.

2.2 Morphological Requirements

2.2.1 Crystallinity and Scattering Loss

Refractive index inhomogeneities give rise to scattering of light and the principal intrinsic sources of scattering in polymers would be the interfaces between ordered (crystalline) and disordered (amorphous) regions of a polymer. This well understood phenomenon has resulted in the commercial development of purely amorphous polymers whose high optical clarity allows their use in optical applications such as micro-optical components, contact lenses and optical recording media such as DVD and CD. The requirements for optical waveguiding however are at least as stringent as these applications demand since the light must pass through mm to cm of material.

2.2.2 Polarisation Dependent and Birefringence

Planar waveguide circuits are fabricated by thin film formation methods on a variety of substrates. Polymers are usually spun or dip coated from solution followed by high temperature drying and annealing (19, 209, 252). The processes can induce stresses during which polymer chains align parallel to the substrate plane (392, a.4). Depending on the polarisability of the chain and its attached side groups, this alignment produces a birefringence (279, 361). When the polarisability is highest in the chain direction, the refractive index measured in the plane of the substrate, $n_{1/2}$, is higher than that measured normal to the substrate plane, n_{\perp} . This occurs most strikingly in the case of polyimides where the birefringence, $\Delta n_B (\Delta n_B = [n_{//} - n_{\perp}])$, can be as high as 0.24 (a.5). Negative birefringence also can occur. In the deposition of polystyrene, for example, the pendant phenyl rings align preferentially towards the film plane normal and give rise to a higher measured refractive index in this direction.

Birefringence is important since the operation of certain photonic devices, particularly interferometers and couplers, rely on a carefully designed optical path length for the active regions of the device. Changes in material refractive index according to the polarisation direction lead to different operating conditions since the optical path length differs. However, provided a means for inducing birefringence in a controlled way is available, this property can be usefully used to control the polarisation state of light travelling through a waveguide or even to act as a means for lateral confinement of guided waves. These aspects are described further in Sections 3.1 and 4.3.

2.3 Photochemical and Thermal Stability

The operating characteristics of some devices, particularly those designed for interferometry, place stringent requirements on the degree of ageing that can be tolerated. Ageing in any form will impinge on the refractive index of the material as a primary source of drift in the operating points of such devices. Ageing might also induce additional propagation loss and be the primary cause of catastrophic failure in devices. Such failure might manifest itself as loss of interlayer adhesion particularly at the interfaces a polymer makes with a material of significantly different thermal expansivity.

2.3.1 Thermal Stability and Range of Operation

Pure thermolysis (anaerobic) is clearly of no consequence for ageing *per se* in polymers used in telecommunications. The upper operating temperature specification of 70 °C is well below the documented temperatures for pure thermolysis in hydrocarbon polymers. However, any free radicals remaining from the synthesis or arising thermally in the handling and processing of the polymer can act as a source of initiation for auto-oxidation, which over time can lead to progressive loss of mechanical stability and perhaps a slow drift in the optical properties. However, thermal oxidation can be essentially eliminated provided the known susceptible sites in hydrocarbon polymers are omitted from the structure. Thus, the classes of high temperature stable polymers include polyimides,

polycarbonates and polybenzocyclobutenes, e.g., Cyclotene, where there is a high aromatic content and where any aromatic α carbon positions are fluorinated (255, 345).

The required operating temperature range (-40 to 70 °C) should not coincide with major thermal transitions such as the glass-to-rubber transition (T_g). The step change in thermal expansivity at this point would lead to changes in the device operating conditions that might prove catastrophic. In fact, the requirement for thermal stability mentioned previously usually results in polymers with sufficient chain rigidity that the T_g is well above 100 °C. Crosslinking, often introduced to allow multiple solution cast layers to be formed without crazing, further increases the T_g . Stable operation is then assured under normal conditions and is particularly important for the retention of polar order in electrooptic polymers as is discussed in Section 5.2.2 (8, 16, 82, 106, 209, 285, 297, 320, 344, 361, 390, 398, 433).

2.3.2 Photostability

The major wavelength ranges of operation were described previously and whilst these are well distanced from the regions where direct photolysis of the polymer would be important, there are still issues that might be considered due to the extremely high photon flux that the waveguide must carry.

The power output from fibre pigtailed (the attachment of an optical fibre to a photonic device) telecommunication sources is in the region of a few mW, but taken with the cross-section into which this power is fed (in the region of a few tens of μ m²) leads to intensities in the region of a few hundred MWm⁻². At these intensities, non-linear optical effects such as two-photon absorption and parametric processes such as second harmonic generation are quite possible.

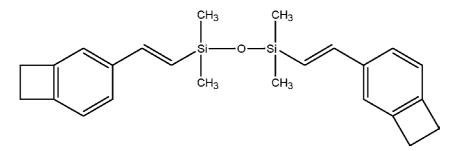


Figure 3

Structure of the monomer unit of the commercial polycyclobutene, 'Cyclotene'. The polymer is optically transparent, highly stable and resistant to moisture uptake and is therefore of interest for use in optical waveguides.

These would induce excitations in the visible region that potentially could impact on photostability, particularly in polymers having chromophores absorbing in these regions. There has been an effort to quantify the photo-induced degradation of chromophores in polymers when illuminated at near infrared wavelengths (a.6, a.7). Much of the degradation seen can be ascribed to direct excitation of the chromophore in its long wavelength absorption tail followed by relaxation through ground state molecular oxygen to produce reactive singlet oxygen (a.8). The alternative postulation is that singlet oxygen might be directly produced by illumination at wavelengths around 1300 nm. The partially forbidden transition in molecular oxygen at 1270 nm can in principle produce singlet oxygen directly (a.9). For polymers without such long wavelength chromophores however, there is no evidence to suggest that the high photon fluxes in the near infrared produce any significant degradation.

3 Waveguide Fabrication

Fabricating optical fibres and planar waveguide circuits from polymers offers some unique opportunities yet also presents a unique set of challenges. Compared, for instance, to silica-based waveguide technology, the use of polymer waveguide methods can offer a wider range of index differences between core and cladding that may allow tighter waveguide bends, therefore more compact devices. This potential advantage and the possibility of waveguide fabrication on various substrates and therefore hybrid integration with other technologies, provides a significant driving force for research and development.

As the telecommunications industry is discovering, the key to the wide commercial take up of high bandwidth optical communications is cost of deployment. Component assembly and packaging costs are one large part of the cost equation but the costs of the optical chip itself, the number of chips per wafer and processing costs are also significant. Where polymers could contribute, but have yet to prove themselves, is in the cost of processing. Coupling the mass production methodologies of plastic moulding with materials meeting the basic material requirements detailed previously is not straightforward. Some advances have been made however and these will be outlined along with the many alternative waveguide fabrication methods discussed in the following sections.

3.1 Refractive Index Tuning

The refractive index difference between the core and cladding regions of an optical waveguide structure, Δn_c , is a key design parameter and is given by:

$$\Delta n_C = n_{core} - n_{clad} \tag{2}$$

Coupled with the transverse physical dimensions of the waveguide (its core thickness and width) this parameter determines the number of allowed propagating modes of the waveguide and their transverse power distribution.

One interesting example of this is in the 'oversize' buried rib channel waveguide shown in **Figure 4a**. This device is designed with dimensions so that only a single mode (of each of two orthogonal polarisations) can propagate, but it has specific geometrical properties (discussed later in 3.2.2) that greatly relax the restrictions placed otherwise on Δn_c .

The electric field amplitude of the channel waveguide mode extends beyond the core region and exhibits exponentially decaying amplitude here (**Figure 4b**). This part of the field, the evanescent field, will determine how much light can couple to adjacent waveguide modes or to radiation modes and thus determines how much light could be lost from the waveguide.

For a given set of transverse dimensions, the exponential decay constant of the field is intimately related to Δn_c . The higher this index difference is, the more tightly confined the optical field and *vice versa*. Waveguide bends result in waveguide mode power radiating from the mode through a mechanism related to this confinement. The bending losses can be quantified using a simple expression that illustrates this point. The bending loss in a step index waveguide structure can be found from the following:

$$\alpha_B = C \exp\left(-\frac{R}{R_c}\right) \tag{3}$$

where C is a constant, R is the radius of curvature and R_c is given by:

$$R_c = \frac{a}{\left(n_{core}^2 - n_{clad}^2\right)} \tag{4}$$

Examination of Equations 3 and 4 shows that the loss increases exponentially as the index difference given in the denominator of Equation 4 becomes smaller. The reason for this is that the mode becomes less well confined, (i.e., 'spreads out'), as the index difference decreases.

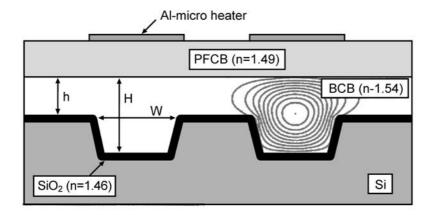
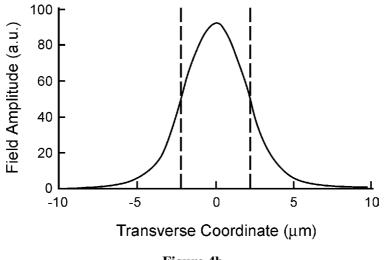


Figure 4a

Cross-sectional view of a polymeric channel waveguide thermo-optic device fabricated on silicon showing schematically the contours of field amplitude for the confined waveguide mode. BCB and PFBCB refer to benzocyclobutene and perfluorinated benzocyclobutene polymers, respectively.

(Redrawn with permission from R. Moosburger and K. Petermann, IEEE Photonics Technology Letters, 10, 684. Copyright 1998, IEEE.)





Field amplitude profile of a slab waveguide mode showing the distribution of the field amplitude amongst the layers of the structure. Such a distribution defines the 'effective refractive index' of the mode.

Control over the refractive index of the multiple layers making up the waveguide is not simply a process of choosing different polymers but can include the modification of the polymer layer after deposition. Some of these methods are described in Sections 3.1.1 to 3.1.3.

3.1.1 Primary Structure Tuning

The observed refractive index of a material represents its polarisability density, modified by

local field effects that change the electric field amplitudes acting on the polarisable entities in the bulk material. The Clausius-Mosotti formalism provides the starting point for this description of refractive index:

$$\alpha = \frac{3}{4\pi N} \left(\frac{n^2 - 1}{n^2 + 2} \right) \tag{5}$$

where α is the polarisability and *N* is the number density of polarisable units.

In a more complex material, comprising many atom types and atom groupings, as in a polymer, the combination of polarisable units and their fractional volume occupancy makes up the observed refractive index. A composite Clausius-Mosotti formalism that would apply for simple additivity of polarisable effects would be given, for a composite of *i* different polarisable sub-units, as:

$$\frac{n^2 - 1}{n^2 + 2} = \sum_i \frac{4}{3} \pi N_i \alpha_i$$
(6)

where N_i is the number density of the *i*th polarisable unit.

The effect of halogenation on the polarisability of the phenyl ring systems serves to illustrate this concept. **Table 1** provides the polarisability for a number of halogen-substituted aromatic six-member ring systems and also gives the molar volume. Notice that the replacement of fluorine for hydrogen results in a negligible change in the polarisability and yet the increase in molar volume produced reduces the refractive index considerably. Within the series of halogen-substituted aromatics, increases in polarisability more than offset the increased molar volume and thus increase the refractive index.

The polycarbonate systems developed by Akzo-Nobel for thermo-optic waveguide switches (a.10) provide an excellent model system to illustrate refractive index control using halogens. The basic structures developed have the general structural formulae given in **Figure 5**.

The polycarbonate can be made up in formulations that contain differing amounts of F_6 , Br_4 and the crosslinking agent DPMA. When Br_4 is omitted, the refractive index at 1565 nm is given as 1.4861, whereas on the addition of Br_4 , included as an oligomeric unit, the refractive index increases, taking values at least as high as 1.5131. Note that the fluorination suppresses

the refractive index quite strongly, even in the copolymers with Br_4 . Bisphenol A polycarbonate in its purely hydrogenated form has a refractive index of 1.57. In a further example, the use of bromobenzene as a diffused dopant in polymethylmethacrylate (PMMA) as been used to control the refractive index profile in graded index fibre preforms (270). The use of fluorination to reduce the index of polymer fibre cladding materials has also been reported (241).

The refractive index may also be tuned according to co-polymerisation methods that use chromophores in co-monomers with colourless co-monomers. The refractive index shows a strong dispersion near regions of optical absorption. In normal dispersion, the index increases as the wavelength is shortened to approach the wavelength at which the absorption is seen. Co-polymers based on dye-functionalised methacrylate monomers have been used to provide the core and cladding materials for electro-optic devices (a.11).

3.1.2 Photo-Curing and Photobleaching

The utility afforded by altering the refractive index of a polymer film using photo-induced mechanisms is that the exposure may be controlled using lateral patterning. Channel waveguides can then be formed in the photosensitive layer.

One early example of this was demonstrated using the photocuring of methacrylate monomer doped into a polycarbonate host matrix of high index (a.12). The cured methacrylate has a low index (around 1.48). Thus, if after curing using an opaque mask to define the channel regions in a thin film, the unreacted monomer is removed by evaporation, these regions have a higher refractive index than their surroundings. The index differences obtained were up to 0.04 offering the

Table 1 Polarisability, α , molar volume, V_m and refractive index at 589 nm, n_D compared to the ratio, α/V_{nf} for the homologous series of halobenzenes				
Compound	α (10-24 cm³)	V_m (cm ³)	α/V_m (10-24)	n _D
C ₆ H ₆	10.3	86.21	0.12	1.501
C ₆ H ₅ F	10.3	93.46	0.11	1.468
C ₆ H ₅ Cl	14.1	101.73	0.14	1.525
C ₆ H ₅ Br	14.7	104.93	0.14	1.557
C ₆ H ₅ I	15.5	111.36	0.14	1.620

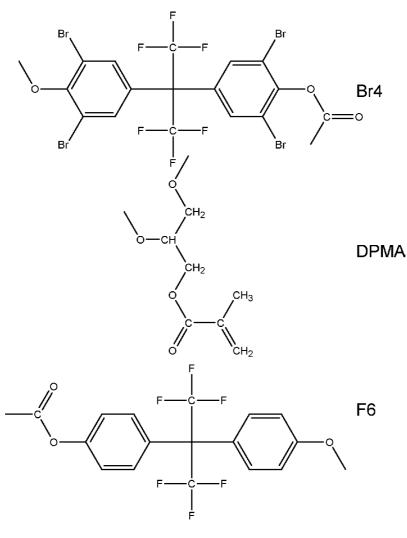


Figure 5

General structural formulae for the three major components of a proprietary polycarbonate system. Varying the molar ratios of the components, F_6 and Br_4 controls the refractive index, lowering or raising the index, respectively. The presence of 2,3 dihydroxypropylmethacrylate (DPMA) provides a facility for subsequent crosslinking of the polymer film.

possibility of small bend radius multimode or monomode waveguide structures.

The most widely implemented photo-induced refractive index change has been the photobleaching of dyes either doped or covalently bonded to the polymer host. Some of these photo-induced processes are reversible. For example, the photobleaching of polymer films containing azo dye derivatives such as Disperse Red 1 (CI 11 110; DR1, **Figure 6**) relies in part on the photo-conversion of coloured *trans* conformation to the colourless *cis* form (a.13). Thermal reconversion is possible to restore the colour but studies show that samples irradiated for these purposes exhibit permanent colour change attributable to photo-degradation (a.14).

The refractive index change works by reducing the polarisability of the constituent groups upon irradiation. Chromophores where the molecular structure consists of a long conjugated chain as in the disperse red dyes decompose to smaller fragments with shorter wavelength absorption properties. The refractive index changes in films can be quite large. For a polymethacrylate copolymer consisting of methyl methacrylate (90%) and DR1 methacrylate (10%) the refractive index measured at 633 nm changes from 1.602 to 1.515 for complete bleaching. This strong effect is due in part to the proximity of the absorption maximum (at between 470 and 490 nm) to the measurement wavelength, the effects of chromatic dispersion being influential.

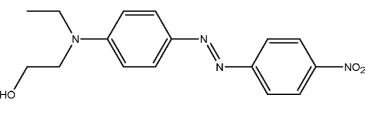


Figure 6

Structure of disperse red 1 (DR1). The general identifiers of this class are that of an electron donor (D) separated from an electron acceptor (A) by a p conjugated chain. DR1 is a typical 'D-π-A' molecule used in electro-optic polymer applications.

3.1.3 Poling Induced Birefringence

The disperse red dye is one of an important class that have become of great interest for polymers which can exhibit an electro-optic response (256, 346, 434). The dye is dipolar and has a large second order nonlinear optical coefficient co-directed with the dipole moment. One further property of such molecules is a large anisotropy in the polarisability. Thus if a polymer containing these molecules has a field applied to it under appropriate conditions, the dipolar alignment will create a birefringence, usually with the higher refractive index aligned along the applied field direction. This property has been explored not only as a means of lateral confinement for waveguide modes (a.15) but also as a way of inducing polarisation rotation to optical fields propagating through the device (a.16).

For lateral waveguide mode confinement, the poling electrodes are placed across the regions of the polymer film where the channels are to be defined. After poling at elevated temperature and allowing the film to cool whilst maintaining the field the dipolar groups remain oriented preferentially along the direction of the poling field. Due to the anisotropy in the polarisability, the refractive index of the film measured normal to the substrate plane under the poling electrodes is then larger than that to either side. The refractive index in the plane of the substrate is lower however under the electrode region and thus waveguides fabricated by this means only offer lateral confinement for transverse magnetic (TM) polarised modes. An induced increase in the TM index of up to 0.06 (at 830 nm, dispersion enhanced) has been demonstrated using this method. The use of this technique for polarisation rotation will be discussed in Section 4 (passive devices).

3.2 Physical Processing Methods

One of the key questions that drive interest in the field of polymer waveguide technology is whether

the great advantages of thermoplastic or thermosetting moulding techniques can deliver cost savings in the processing of photonic devices. Unless such methods can be easily implemented, the standard semiconductor processing methods using photolithographic patterning must be used and cost savings are not readily achieved against rival material technologies. Whatever the method however, it is usually possible to consider any suitable substrate as a platform on which to fabricate waveguide photonic devices from polymers. Silicon wafer substrates have proved most popular since they allow compatibility with semiconductor fabrication plant processing equipment but they also provide a good thermal sink and an opportunity to cleave devices from the processed wafer.

3.2.1 Thin Film Formation – Slab Waveguide Confinement

The fundamental requirement for any planar waveguide component is to trap light in a thin guiding layer between two low loss layers of lower refractive index. The thickness of the guiding layer combines with the index differences between guide layer and surroundings to provide confinement to either a single or a multiple of waveguide modes. For monomode conditions the thickness of the waveguide can vary between some fractions of a micron to a few microns. For telecommunications, there is a preference that the resulting waveguide mode has a size similar to that carried by the optical fibres connecting the device to the network. Thus the thickness and index difference combinations should be such that modes with sizes of around 8 microns are produced.

Soluble polymers and polymer precursors may be cast by spinning the liquid or solution on conventional photoresist spinners to form flat layers of the desired thickness. Drying is normally carried out at elevated temperatures and in a vacuum over several hours.

One of the consequences of these procedures is that the resulting film may become birefringent as a result of the anisotropic stresses imposed. In particular, the drying of the film can lead to chain alignment in the film plane. This occurs since drying the film produces a density gradient through the film thickness. The solvated polymer film may be considered to be a viscoelastic medium whose T_g is well below the ambient. If the drying takes place below the normal dried T_g of the polymer, the density gradient prevents main chain conformational relaxation in regions of the dried film but chains are still free to relax in the solvated regions. If drying takes place above the dried T_g then on cooling below T_o a further source of chain alignment and consequent birefringence can arise through differences in thermal expansivity between certain layer interfaces. Predominantly this will occur between the support substrate and the polymer film. For example, the volume expansivity of silicon $(4.7 \times 10^6 \text{ K}^{-1})$ is substantially smaller than for glassy polymers, (e.g., polystyrene, 70×10^6 K⁻¹).

Multilayer deposition of polymers by solvent casting (spinning, dip coating, etc.), introduces further constraints. Many polymers are soluble in the same solvents and therefore a means to prevent solvation of lower layers in a deposition sequence is needed. The provision of crosslinking is used in many cases to solve this problem, which can result in crazing if not prevented.

3.2.2 Channel Fabrication – Lateral Confinement

So that the light can be directed laterally, a means for creating confinement in the layer plane is required. Some methods using refractive index tuning were discussed in Section 3.1 but each of these (photobleaching or induced birefringence) are not widely applicable. Of more general applicability are the physical processing methods such as wet or dry etching (225, 260) and replication by moulding (35, 261, 416).

Topographic patterning using etching can follow wellestablished methods developed in the semiconductor electronics industry. Reactive ion etching (RIE) is the most well established dry etch procedure using an oxygen plasma. This method can be applied to a wide variety of polymer material types such as commercial polyimides (a.17) (for multimode short wavelength operation), fluorinated polyimides (a.18) (for monomode long wavelength operation), deuterated polysiloxane (a.19) (monomode, long wavelength) as well as polymethacrylate types (a.20) and others. One of the common problems however is the generation of sidewall roughness, which increases waveguide propagation loss through scattering. Recoating methods, where the material into which the RIE has been performed is reapplied to the rough surface has been shown to greatly improve the loss characteristics (a.11), as has careful control over the RF power and oxygen flow rate (225).

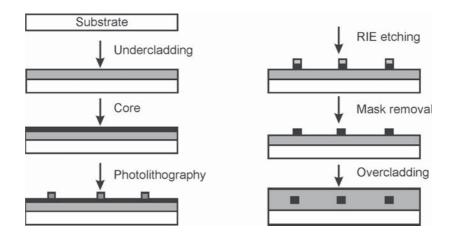
In addition to dry etching, many curable polymers can be patterned using wet etching in direct analogy with photoresist materials (a.21). The surface roughness problems experienced with RIE are not mirrored in the wet processing methods but the range of materials is of course limited.

One method of fabrication involves etching a channel into a lower cladding polymer layer followed by coating with the higher index polymer guiding layer and a further overcoating with a low index top cladding layer. Ideally, the thickness of the guiding layer film to either side of the channel region is too thin to allow waveguide mode propagation, (i.e., is below the 'cut-off' thickness), and well-confined channel modes result. Alternatively, the lower cladding and guiding layer polymers are first deposited and then exposed ribs are etched. These are then overcoated with the upper cladding layer polymer to provide buried rib channel waveguides (see **Figure 7**).

In an interesting version of the first methodology, large core single mode channel waveguides have been fabricated using Cyclotene deposited onto channels etched into a silicon wafer surface (a.22). This concept relies on a special condition for monomode channel waveguiding that is independent of the refractive index difference between core and cladding (a.23). Silicon trenches are first etched using RIE with a gas mixture of SF_6 and O_2 and a layer of thermal oxide is grown on the etched silicon surface. The polymer is then spun onto this oxide-clad channel leaving a thickness, h, to both sides of, and a thickness, H, within, the channel region. A further polymer layer, a perfluorinated version of Cyclotene, is deposited on the surface of the structure. The channel widths, w, that allow single mode propagation are restricted by the following condition (a.24):

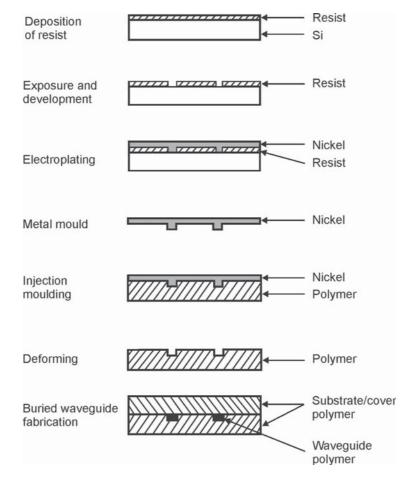
$$\frac{w}{H} \le 0.3 + \frac{h/H}{\sqrt{1 - (h/H)^2}}$$
(7)

These waveguides have the potential to offer a more generic fabrication process due to the de-restriction of





Fabrication steps used in the processing of channel waveguides using standard photolithographic processes (a.46) (Reproduced with permission from J. Kobayashi, T. Matsura, S. Sasaki and T. Maruno, Journal of Lightwave Technology, 1998, 16, 610. Copyright 1998, IEEE.)





Fabrication steps used in metal mould replication of channel waveguides (a.26) (Reproduced with permission from A. Neyer, T. Knoche and L. Müller, Electronics Letters, 1993, 29, 399. Copyright 1993, IEE.) refractive index matching between core and cladding, whilst offering modes with sizes suitable for low loss optical fibre coupling. The cross-section of this device is shown in **Figure 4a**.

3.2.2.1 Replication Moulding

Current commercial drivers in the telecommunication industry emphasise component cost over performance. The polymer advantage in the foregoing methods is not as clearly recognised as in the idea that mass production using replication moulding might offer substantial cost savings in manufacture. Surprisingly perhaps this is not by any means a new concept. The Bell Telephone Laboratories were demonstrating the basic methodologies as early as 1974 (a.25) although the re-emergence of the ideas recently involve materials that are of low loss to telecommunication wavelengths (a.26) and benefit from silicon micromachining methods for the moulds.

The basic processing techniques using metal moulds are shown in **Figure 8**.

Despite its intrinsic appeal this area is still much less explored than the topographic patterning and photodelineation methods described above. There are limitations on the types of polymers into which the embossed patterns can be made whilst maintaining the required optical properties. PMMA, featuring in the work of the early 1970s, was still the predominant material of choice in the work of the early 1990s.

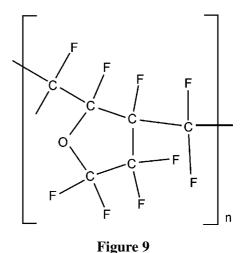
4 Passive Polymer Applications

Routing of optical signals over short distances is a task well suited to polymer optical waveguide technologies. Short distances are emphasised since long distance communication signal transmission is still exceptionally well served by silica-based optical fibre technology. However, in the case of optical interconnection between devices on circuit boards and for board-to-board interconnections the versatility of fabrication and flexibility offered by polymers is attractive. These applications are predominantly of multimode type, using laser wavelengths provided by laser diodes emitting in the long wavelength visible to near infra-red region (650-830 nm). Similarly, the use of multimode polymer optical fibre is as a fairly simple 'light pipe' in these wavelength regions. These applications and then the development and demonstration of single mode planar waveguide circuits will form the focus of this section.

4.1 Polymer Optical Fibre

Polymer optical fibre (POF) has a very large core size compared to its silica counterparts. The core sizes are often between 0.5 mm and 1 mm in diameter or so with a cladding layer only a further few hundred microns in thickness. This compares with a 50 µm core for silica multimode fibre. The key differences relate to the physical flexibility at these large diameters that polymers offer and the ease of interconnection because of the large core size. Simple plastic moulded components can be used to splice fibres, which simplifies installation and reduces cost. Despite these perceived advantages, silica fibres still carry the bulk of short distance optical telecommunication transmission. The traditional problems with POF are the limited bandwidth (due to the large step index difference between core and cladding) and propagation loss, particularly at the longer wavelengths. Thus there has been little penetration of POF into local area links and their deployment has been restricted (although these alternative markets are potentially very large) to transportation and consumer electronics applications.

The incumbent polymer, PMMA, has a good transmission window at around 650 nm and thus in the region of low cost diode laser sources but the loss is still up to 190 dB/km (a.27). Over distances of a few tens of metres therefore, there is still a considerable penalty to pay in loss of power. This problem has been addressed using deuterated and fluorinated variants of methacrylate polymers (see Section 2.1.1) but the extra cost of these materials currently acts as a commercial disincentive. The most advanced commercial perfluorinated POF has the structural formula given in **Figure 9**. Known as 'CYTOP' this completely



Structure of the fully perfluorinated cyclic ether polymer, 'Cytop'

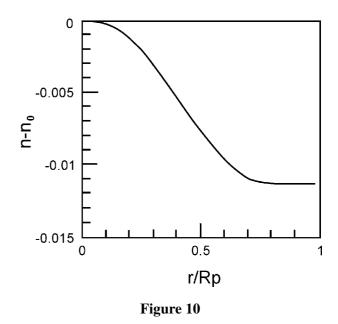
perfluorinated cyclic ether polymer has losses of only 100 dB/km at 1.3 μ m and slightly higher at 1.55 μ m. The loss characteristics are more akin to those of silica where, below the water impurity absorption band, loss increases steadily towards shorter wavelengths according to the Rayleigh scattering law.

The bandwidth of an optical fibre is the parameter defining the spacing that is needed between adjacent optical pulses (bits) carried on the fibre over a set distance. For the step index structures in conventional POF there is a limitation imposed by intermodal dispersion. This effect results in pulse broadening and eventually overlapping and is caused by the many individual modes carrying the power in the pulse travelling at slightly different speeds. This limits the length and the bit rate that the POF link can sustain. For PMMA step index fibre this 'bandwidth length product' (Δ B.L) is in the region of 10 MHz.km at 650 nm (a.27). Comparisons with silica multimode fibres $(\Delta B.L = 200 \text{ MHz.km} \text{ at } 650 \text{ nm})$ reveal a fundamental difference in composition at the core/cladding interface. Silica fibres have a graded refractive index profile over the core/cladding boundary region. Thus the refractive index drops off slowly away from the core. This feature acts to equalise the modal velocities and thus reduce the dispersion.

4.1.1 Graded Refractive Index Profiles

A method of forming a graded refractive index profile in POF was found in 1990 by researchers at Keio University in Japan (a.28). Other groups (270, 271, 294, 332) have since explored the method. Two monomers that form polymers with widely differing refractive indices and reactivity ratios were copolymerised from a monomer mixture inside a PMMA tube. The monomers, methyl methacrylate (MMA) and vinyl phenyl acetate (VPAc), form polymers with refractive indices of 1.49 and 1.57, respectively, and the reactivity ratio of the former is higher than the latter. At the walls of the tube, the monomers swell the PMMA forming an annular gel region within which polymerisation occurs readily. MMA polymerises faster than VPAc and thus as the polymer wall grows out into the core of the tube, the final phases of polymerisation in the gel region increasingly yield the higher index polymer. A graded index is formed which exhibits a quadratic radial dependence (see Figure 10).

Such fibres can achieve a bandwidth length product of 300 MHz.km at 650 nm, which is better than or equal to that achievable using multimode silica. However, this bandwidth is limited by material dispersion at these



Radial profile of the refractive index core/cladding difference $(n-n_0)$ in a graded index polymer fibre. R_p is the radius of the fibre perform

(Redrawn with permission from T. Ishigure, E. Nihei, Y. Koike, C.E. Forbes, L. LaNieve, R. Straff and H.A. Deckers, IEEE Photonics Technology Letters, 7, 403. Copyright 1995, IEEE.)

wavelengths, and the propagation loss becomes prohibitive for longer wavelength transmission.

The use of perfluorination as discussed earlier can dramatically reduce the long wavelength loss and the perfluorinated graded index fibre has now been commercialised by Asahi Glass (Japan) (a.29). In the first demonstration of this, the interfacial gel polymerisation technique was used but with perfluorinated monomers (a.30). Measurements of the loss in the wavelength range 1 μ m to 1.3 μ m show a loss of 40 dB/km (a.31). The measured bandwidth length product at 850 nm is 1 GHz.km and at 1.3 μ m, 10 GHz.km. The increase in bandwidth at longer wavelength reflects the reduced material dispersion at these wavelengths (42).

4.1.2 Monomode Polymer Fibre

A brief explanation is required on the absence of any significant volume of work on monomode POF. The primary reasons are that it is the advantages offered by the large core size and high numerical aperture of the multimode graded index POF that provide a competitive edge to the silica alternatives. Simple and cheap fibre connectors and small bend radii without fractures are key features. Single mode operation on the other hand is only required for high bandwidth and long distance transmission at wavelengths where polymers are too lossy in any case and silica is well established. Nevertheless, there are some possibilities for short lengths of single mode POF where some active functionality is incorporated into the fibre.

One such example is in the realm of non-linear optics (see Section 5.3) where the polymer can act as a host to molecular centres of high optical nonlinearity and thus provide device functionality (a.32).

4.2 Multimode Planar Waveguides

As was discussed previously, the use of multimode polymer waveguides is restricted to short distance propagation due to high losses and intermodal dispersion. However, these are not impediments when considering polymer technology for optical signal distribution either on-chip, between circuit elements such as transmitters and receivers, or between boards of a system such as a backplane distribution system.

The requirements for increased processor speeds in computing ultimately places limits on the packing density of metal tracks on the processor chip (a.33). High density and operating speeds leads to power dissipation problems and cross talk. Connecting the active components using densely packed optical waveguides however removes these problems. Predictions have shown that such optical transmission over a few mm is favoured over electrical connections when clock rates exceed 1 Gb/s.

Most experimental work has explored polyimides (a.34, a.35) since they are high temperature stable polymers that offer good planarisation properties. Measurements are usually made at short wavelengths (632.8-830 nm) on multimode guides patterned by standard photolithography and deposited on a layer of thermally grown silicon dioxide on silicon.

Since the target application areas are largely in high speed computing no further discussion should be made in this report but it should be mentioned that the use of polymers in this field continues to be an area of active study.

4.3 Monomode Planar Waveguides and Devices

Monomode polymer waveguides offer the possibility of the fabrication of passive optical waveguide

devices on a variety of different substrates (115, 252, 290, 311, 344, 361, 398, 401, 414, 415). Monomode propagation is necessary for the operation of many waveguide photonic switches, filters, and modulators but in order for these devices to remain stable, the material itself must exhibit stability to changes in the ambient conditions. Before discussing specific devices the issues of the stability of polymers that have been of concern to device engineers will be considered.

Teams of researchers at the NTT laboratories in Japan have perhaps performed the most extensive and intensive study of the properties of polymer waveguides under conditions of varying temperature and humidity (a.18, a.19, a.36-a.39). Their work describes waveguides fabricated from polyimides, polyacrylates and polysiloxanes, and deuterated and perfluorinated versions of these polymers. The key issues are the changes in propagation loss and refractive index when waveguides of these materials are exposed to changes of humidity and temperature. The negative thermo-optic (T-O) coefficient of polymers is a well-understood phenomenon, arising through volume expansion and contraction as temperature is raised or lowered. PMMA for example shows a T-O coefficient of around -1×10^{-4} K⁻¹. The water sorption properties are also well known for most commercial polymers but the effects of water uptake on the refractive index and optical absorption loss are less well characterised. Water exhibits a vibrational mode (the second overtone of the O-H stretching mode) centred on 1.41 µm and thus the absorption loss measured at 1.3 or 1.55 µm, to either side of this vibration, will increase with sorbed water content. To measure these effects accurately, the researchers used a 'meander' type of waveguide pattern that provided individual monomode waveguides of total length 57 cm but fabricated on a more convenient substrate of dimensions 5 x 6 cm (a.38). Deuterated and fluorinated MMA monomers were used to form the polymers from which these channel waveguide structures were fabricated by RIE. The fluorinated materials, with the lower refractive index were used as cladding layer polymers. The results showed that a small, yet measurable, increase in loss at 1.3 µm can be detected as the ambient humidity is raised to 100% relative humidity (RH) (the loss increases by about 0.03 dB/cm). Such a loss increase is not too much of a worry compared to changes in the refractive index of the waveguide materials. To study these changes, the researchers fabricated an arrayed waveguide grating (AWG). This device can perform the function of demultiplexing or multiplexing

optical signals of different wavelengths between input and output optical ports. The precise design and operation of this elegant device (a.40) lie outside the scope of this review but the important point is that the transmission properties are a function of the effective refractive index of the waveguides comprising the device. Measurements of the centre wavelength of transmission for this device and the way this changes with %RH can reveal the effective index change with humidity. On an increase in %RH the effective index was seen to increase by around 2 x 10⁻⁵ % RH⁻¹. It is these changes that would require that devices from polymers of this type be hermetically sealed.

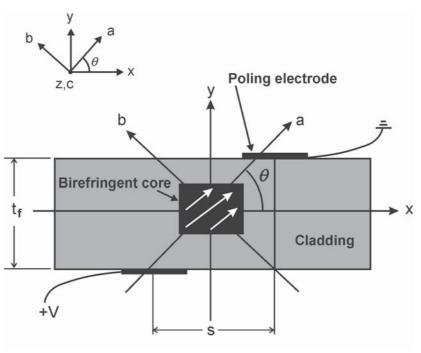
Other polymer systems are found to be far less affected by water sorption. The polysiloxanes, for example, were shown to exhibit exceptionally good environmental stability (a.19). Polymers in this class are particularly hydrophobic. Waveguides were fabricated from a combination of polymers formed from deuterated and non-deuterated phenylsilyl chloride monomers. These provided the core and cladding polymers, respectively. The exceptional stability against water sorption was proved by an absence of loss increase even under conditions of 90% RH at 75 °C for 1000 hours. Similarly, the commercial polymer 'Cyclotene' has a very low reported moisture uptake. A member of the class of BCB, Cyclotene (1,3bis(2-bicyclo[4.2.0]octa-1,3,5trien-3-yethenyl)-1,1,3,3-tetramethyl disiloxane) has been formulated as a polymer with high heat resistance and low moisture uptake and low dielectric constant for the electronics industry as a passivation layer material. It also has excellent optical properties (a.41) and channel waveguides fabricated using a formulation containing the crosslinking agent 2,6-bis(4 azidobenzylidene)-4methylcyclohexanone, showed reasonably low propagation losses (0.8 dB/cm) at 1300 nm. Further improvement would be possible with fluorinated versions of this type of material.

Allied Signal, during the late 1990s, developed a polymeric waveguide technology based on partially halogenated, photocurable polyacrylates (a.42). This system provides polymers of exceptionally low loss at telecommunication wavelengths due in part to vibrational overtone shifting through halogenation but also through considerations of refractive index homogeneity. In particular, the photo-curing process, which proceeds directly from the monomer mixtures, provides polymer crosslinked networks of very low residual stress. A further consideration in these materials is the resulting surface energy of the resulting polymers. The Allied group made the interesting connection between refractive index and surface free energy, noting that low index and low surface energy were connected. Perfluorinated polymers, whilst of low refractive index, also possess well-known low surface free energies that make them difficult to bond to substrates or other layers during device fabrication. Addition of small quantities of chlorinated hydrocarbon raises both the index and surface energy allowing better wetting and bonding properties. Channel waveguides showed optical propagation losses of 0.08 dB/cm at 1550 nm. This exceptionally low value (for polymers) was accompanied by very good thermal stability and moisture resistance. Cycling between dry and humid (85% RH) conditions at 85 °C, showed no additional loss that might be caused by O-H impurity stretching overtones.

Passive devices fabricated in the polymer generally are of identical design to those fabricated in other material systems such as silica. Thus there are examples of AWG (a.43, a.44), directional couplers (a.45, a.46) and grating wavelength filters (a.47), for example, but interest increases in those passive devices that have no equivalent comparison.

One rather inventive range of devices uses birefringence in polymers, either artificially induced or naturally arising, as a means to control the state of polarisation of light travelling through the device. As outlined in Section 3.1.3, polymers doped with dipolar rod-shaped molecules having anisotropy in the polarisability may be processed using electric field poling to provide a material with an induced birefringence. Hwang and co-workers have taken this idea and extended the concept to provide a length of waveguide along which the birefringence gradually rotates in the transverse plane (xy) (a.48). Poling induces a birefringent system that has two principal axes, a and b with a birefringence, $\Delta n = (n_a - n_b)$. As depicted in Figure 11, the electrodes used for the poling may be displaced laterally by varying distances, s, along the waveguide path so that the principal axes may rotate through a maximum of 45°. The field of the input light of either of the two waveguide mode polarisations, E_x and E_{y} , thus gradually transforms into field components, E_a and E_b . A phase difference will gradually accumulate between these two components so that after a length determined primarily by the induced birefringence, the state of polarisation can be fully rotated through 90°.

The poled polymer also becomes an electro-optic material as is discussed in Section 5.2.2 and thus devices prepared using this method may not simply





Positioning of the poling electrodes used to induce a 45° polar alignment in the fabrication of passive polymer polarisation rotators. The induced principal axes (*a* and *b*) are rotated from the those of the waveguide coordinate system (*x* and *y*) by an angle, θ , specified at a point at the centre of rotation (a.48).

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act in a passive way to rotate the polarisation but may also act as active polarisation controllers, offering further device functionality (a.49). overpopulated world of telecommunication device technologies, but it is in the realm of functional devices that the best chances for this lie.

5 Functional Polymer Applications

What has excited the research community most about the potential use of polymers in telecommunications is the flexibility afforded by the synthetic chemistry. It has been possible to add optical functionality to polymers that then provide a processible material system suitable for device fabrication. At the simplest level, the polymer acts as a 'host' matrix for the active 'guest' moieties (28, 96, 247, 286, 325, 336, 346, 437) but by incorporating these active groups in the synthesis of the polymer itself, greater stability and higher functional densities have been achieved (58, 182, 257, 307, 308, 309, 312, 329, 341, 354, 362, 370, 375, 423, 428, 435, 436). Using this intrinsic versatility, polymers have been demonstrated that either out-perform incumbent materials or have functional properties that are unique in themselves. Polymers have yet to make a big impact in the highly competitive and

5.1 Thermo-Optics

Polymers have certain thermal properties that indicate they be considered for devices that rely on the thermooptic response. These are the large thermo-optic coefficient (the refractive index of polymers changes markedly with temperature) and the low thermal conductivity (417) (which means that the drive power is concentrated close to the point of operation). Both of these two features combine to provide devices that show markedly lower operating power than the equivalent devices fabricated in silica for example, but in addition, make possible the fabrication of devices whose operation would be prohibitive in practice for this competing material system (199).

Application of a voltage to an electrode having a leakage resistance leads to heating and if this electrode is placed over the waveguide region of a device fabricated from a polymer, it produces a lowering of the refractive index in that region of the order of -10^{-4} K⁻¹. The polymer expands and thus lowers the polarisability density (see Equation 6). To a propagating waveguide mode, the lowering of refractive index reduces the effective refractive index, changing the propagation velocity and the power confinement characteristics. Both effects can then provide a mechanism for device operation.

Consider the simplest configuration of routing switch based on a Mach-Zehnder interferometer (shown in Figure 12). At the device input, the incident power is fed into a coupler region. This first directional coupler acts as a 3 dB power splitter and distributes light equally into the two waveguide paths. These paths then separate for a distance (L_H) over which the thermo-optic effect can be applied before being brought together to a region over which directional coupling can determine the port at which the light is output. The heater element imparts a phase change to the light in the upper arm of the interferometer so that when the two waves recombine in the output coupler device, their phase is shifted by π . The second coupler would otherwise perform the reverse operation of the first so that in the event that no phase shift is imparted, all the power would emerge in port 1. If the phase change is π or integer multiples thereof, the light emerges from port 2 and into the single mode fibre (SMF).

The drive power required for this operation depends not only the device design but on the material thermooptic properties. The phase change, $\Delta \phi$, imparted to the mode propagating in the active arm of the interferometer is given by:

$$\Delta \phi = \frac{2\pi}{\lambda} \Delta N L_H \tag{8}$$

where λ , N and L are the wavelength, effective refractive index and length of interaction, respectively. The change in effective refractive index can be approximated, assuming that all layers of the device have similar thermo-optic coefficients, through:

$$\Delta N = \frac{dn}{dT} \Delta T \tag{9}$$

where $\frac{dn}{dT}$ and ΔT are the thermo-optic coefficient and temperature change, respectively. As mentioned previously, polymers generally have thermo-optic coefficients of around -10^{-4} K⁻¹ whereas silica has a positive thermo-optic coefficient (a.50) of around 2 x 10^{-5} K⁻¹. It is not only that the temperature changes required are a factor 5 or so smaller that gives polymers their fundamental advantage but also that the specific heat capacity is higher (~ 1-2 kJkg⁻¹ K⁻¹), and the thermal conductivity (~ 0.2 Wm⁻¹ K⁻¹), lower, than in silica (a.51) (0.75 kJkg⁻¹ K⁻¹, 1.3 Wm⁻¹K⁻¹, respectively). Comparisons of drive power show that whereas a silica-based T-O switch requires 500 mW of drive power, the equivalent polymer device (a.52) needs only a tenth of this, around 4.8 mW.

The device described above can operate with exceptionally low drive powers but its response is cyclical and the reliability of the device requires that the design specification is stringently reproduced and maintained throughout the device's working life. An alternative device, a digital optical switch, has the advantage that there are only two stable states of operation for the device. A schematic diagram of the waveguide layout and positioning of the heater electrodes is given in **Figure 13a**. This so-called 'X' switch relies

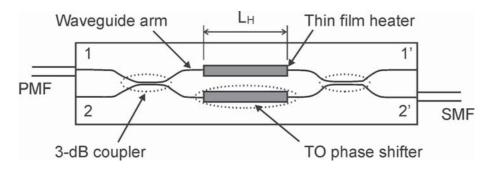


Figure 12

Layout of the waveguides and electrodes used in a Mach-Zehnder thermo-optic switch. Optical power is fed to the device through port 1 using a polarisation maintaining fibre (PMF) (a.52).

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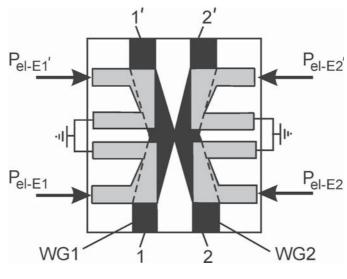


Figure 13a

Layout of the waveguides and electrodes used in an 'X' type thermo-optic switch (a.53). (Reproduced with permission from N. Keil, H.H. Yao and C. Zawadzki, Electronics Letters, 1996, 32, 1470. Copyright 1996, IEE.)

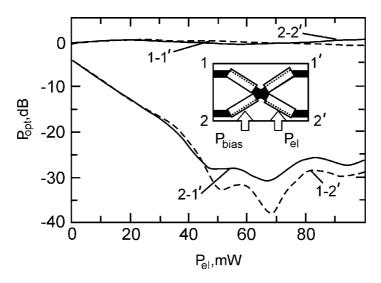


Figure 13b

Switching characteristics of the 'X' type switch. A fixed electrical bias power of 45 mW is applied to electrode 2 and the power applied to electrode 2' is varied to produce the 'bar' state power switching characteristics shown. The numerical symbols, e.g., 1-1', indicate power input-power output ports. Simply changing the bias power applied to electrode 1 generates the 'cross' state where for example, light entering port 1 leaves through port 2' (a.53).

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on 'modal evolution', the redistribution of optical power between the waveguides, through the transition region (a.53, a.54). In the absence of applied heating, the light simply passes through and emerges from port 1. However, when power is applied to the heater electrodes, the light transfers to the alternative port and has a power transfer characteristic shown schematically in **Figure** **13b.** As can be seen, the range of drive power over which the power transfer saturates can be relatively wide. This gives designers and fabricators some rather more relaxed tolerances with which to work. Furthermore, the device would be essentially immune to the effects of ageing from whatever source this arose. Devices such as these and similar types that have a 'Y' type waveguide geometry (a.55) (see **Figure 1b**) typically have drive powers of a few 10s of mW which is acceptably low for the telecom industry.

5.2 Electro-Optics

Among the functional properties of particular interest, the electro-optic (E-O) effect, a member of the family of non-linear optical effects, rates as the most intensively studied in polymers (29, 50, 52, 55, 82, 106, 107, 116, 211, 212, 223, 224, 317, 330, 331, 345, 347, 348, 351, 354, 356, 378, 379, 380, 381, 388, 389, 393, 422, 423, 426, 435, 438). The E-O effect in telecommunications can underpin the operation of many devices, but the one most commonly cited is the intensity modulator. This device takes the continuous wave output from a laser source and impresses a data stream on this carrier wave. It is thus an intrinsic component in time division multiplexing. The arguments for the use of polymers in such devices are twofold:

- i) the potential electro-optic coefficient, *r*, for polymers (> 50 pmV⁻¹) can be far in excess of conventional optical waveguide materials such as lithium niobate (31 pmV⁻¹), III-V semiconductors (0.6 pmV⁻¹), or poled silica (10 pmV⁻¹)
- ii) the refractive index of polymers at microwave drive frequencies is very close to that at optical frequencies.

The former will be explained in due course in terms of the synthesis, formulation and processing of particular polymers but the latter is an intrinsic property of polymers that continues to give them an opportunity to take a unique place in photonics technology.

The electro-optic response transduces an applied electrical field into a refractive index change and thus a phase change to light propagating in the material. The phase change produced, $\Delta \phi$, accumulates with propagation distance, *L*, and is proportional to the applied field, *E*, provided the frequency, *f*, of the applied field is low. At higher frequencies, depending on the arrangement of the electrodes, the phase change also depends on the frequency, generally reducing for fixed field strength with increasing frequency. At low frequencies, we can ignore the details of the design of the device and simply relate these quantities through:

$$\Delta \phi = -\frac{\pi}{\lambda} n^3 r E L \tag{10}$$

where *n* and *r* are the refractive index and electro-optic coefficient, respectively.

5.2.1 High Frequency Operation

As an example to illustrate the effects of drive frequency, we will consider the design features of an electro-optic modulator of the Mach-Zehnder type, where the applied field is a microwave signal that is applied to a microstrip electrode that runs parallel to the optical waveguide. At low applied frequencies, the efficiency at which the field induces phase changes to the propagating optical waveguide mode is constant along the length of the electrode. However, this assumes that the two waves (optical and electrical) do not dephase appreciably along this path. At higher frequencies, however, the microwave signal will usually travel with a slower phase velocity than the optical wave and this incrementally reduces the efficiency of accumulated phase change along the path. This phase mismatch is related to the differences in the optical and microwave refractive indices and for this type of electrode design the relative phase change as a function of frequency is given by:

$$\Delta \phi(f) = \frac{\sin[\pi f/f_o]}{[\pi f/f_o]} = sinc[\pi f/f_o]$$
(11)

where:

$$f_0 = (c/Ln_m) [1 - n_o/n_m]^{-1}$$
(12)

and n_m and n_o are the microwave and optical refractive indices, respectively.

Examination of Equations 11 and 12 shows that the relative phase change tends to unity, (i.e., dependent only on the principles described in Equation 10), when either $f \Rightarrow 0$, or when $n_m = n_o$. Interestingly, for the latter condition, the device would operate at maximum efficiency for any frequency of applied microwave field. In polymers, the ratio n_o/n_m is close to 0.9 whereas for the alternative inorganic material, lithium niobate, it is 0.07 (a.56).

This fundamental advantage has continued to drive interest in the development of polymers capable of exhibiting an electro-optic effect. The demonstration of efficient electro-optic modulation at over 110 GHz of a modulator fabricated from an E-O polymer has proved the basic capability of these materials (a.57).

5.2.2 Materials and Processing Considerations

The linear electro-optic effect (Pockels effect) requires a material with a non-centric space group. In polymers this can be achieved by inducing a polar alignment of polarisable dipolar groups by the application of an electric field. Molecules showing a large first hyperpolarisability, β , at telecommunication wavelengths and also possessing a dipole moment, μ , to couple with the poling field, E_p , are usually attached covalently to a polymer matrix (these are then referred to as either 'side chain' or 'main chain' types, depending on the method of covalent incorporation).

There has been a huge research effort over the past two decades into the optimisation of molecular structure for the non-linear optical responses that give rise to electrooptic effects. Running as a common thread through this work is the guiding principle that the molecular nonlinearity is maximised in molecules possessing functional groups with differing electron affinity separated by an easily polarisable π -conjugated spacer. A feature of such molecules is a strong charge transfer absorption band in the visible region. Recent efforts have also concentrated on the steric properties of these model molecules (a.58). One of the inherent problems is that the large dipole moment, the large linear polarisability and the planarity of the molecule all contribute to aggregation driven by van-der-Waals forces. Aggregates cannot contribute to the electro-optic effect and the maximum achievable response is thus limited in part by the concentration of free molecules that co-exist with the aggregated material. The attachment of bulky side groups has been shown to dramatically overcome this limitation. All these features are exemplified in the molecule shown in Figure 14.

The molecular constants, β and μ , may be related to the electro-optic coefficient that can be achieved in a poled polymer through a simple relationship that assumes the individual dipoles are free to rotate under the influence of the poling field. At a temperature above the T_g in glassy polymers, thermal equilibrium is reached quickly since there is plenty of free volume into which the molecular dipoles can rotate. We can represent this condition through:

$$r = CN\beta \left\langle \cos^3 \theta(p) \right\rangle \tag{13}$$

where *C* is a constant, *N* is the number density of free dipolar molecules and θ is the average polar angle of dipoles after poling. The parameter, *p*, upon which θ depends, represents the ratio of the energy of interaction between the poling field and the dipole moment and the thermal energy, for example:

$$p = \frac{\mu E_p}{kT} \tag{14}$$

Putting in some values for β and μ for the molecule of **Figure 14** shows that for moderate poling fields and temperatures, electro-optic coefficients of up to 100 pm/V should be achievable. Such values are far in excess of alternative materials used in photonic waveguide devices. Indeed, polymers using guest/host incorporation of such molecules and poled under such

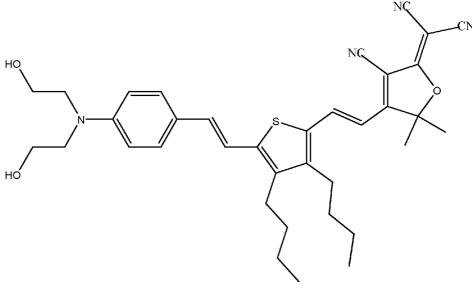


Figure 14

Structure of a molecule of the D- π -A type in which bulky substituents have been added along the chain to reduce the pairwise interactions between molecules that leads to aggregation and a reduction in the achievable electro-optic response.

conditions have been fabricated into electro-optic devices that exhibit exceptionally low drive voltages (a.59). For a phase change of π , we can rearrange Equation 10 to provide a characteristic voltage, V_{π} that is used to compare devices of similar design:

$$V_{\pi} = -\frac{\lambda d}{n^3 L r} \tag{15}$$

where the simplest relationship between voltage and field, E=V/d has been assumed, with d the electrode separation. This voltage in practice does depend on the precise geometry of the device (particularly the relative positioning of electrodes and waveguides) but nevertheless is a defining property. Polymer devices have thus been demonstrated with $V_{\pi} < 1$ V.

Poling at or above the T_g means that thermal equilibrium is established relatively quickly but for the alignment to remain stable, the temperature must be reduced to well below this value with the field applied to 'freeze' it in. The free volume reduces and sterically restricts the dipoles from rotating. However, this condition is essentially metastable, as indeed is the conformational configuration of any polymer that has been cooled at a finite rate from a temperature above T_{o} . The trapped free volume in the polymer after cooling through T_{g} , has a distribution which slowly changes. Considered as a size spectrum of free volume sites, there will be a spectrum of relaxation rates corresponding to the size distribution. The aligned dipolar molecules are supposed to occupy these sites and therefore any measurement that directly reflects the average polar alignment can give an indication of the relaxation kinetics of the polymer. The most universal way that the relaxation has been modelled has been by applying the Kohlrausch-Williams-Watts (KWW) stretched exponential function. The measurement used for illustration is the electro-optic coefficient, which as shown in Equation 13 is directly proportional to the polar order. Thus we represent the KWW expression as:

$$r(t) = r(0) \exp[-(t/\tau)^{b}]$$
 (16)

in which, τ is a characteristic relaxation time (the time taken for the electro-optic coefficient to decay to 1/e of its original value, r(0)) and b is the phenomenological parameter that represents the spread of free volume distribution.

The precise features of the decay of polar order however may not be amenable to such simple analyses as, for example, those that relate the decay time to the observed T_g of the polymer. Although limited success has been found (a.60) by scaling the relaxation times of Equation 16 to a scaling law, $(T_g-T)/T$, this only seems to apply for guest host polymers at temperatures up to 50 °C below the T_g . The use of crosslinking in the polymer lattice can produce polymers whose polar order is substantially unchanged for long periods of time at elevated temperatures (a.61).

5.3 Non-Linear Optics

The electro-optic effect is one manifestation of the class of second order non-linear optical phenomena. Nonlinear optics can provide further functionality in materials that would make possible devices that would operate under a purely optical stimulus. These devices, phase shifters and wavelength converters principally, would therefore further remove the need for electrical intervention in the telecommunication network and help in the move towards an 'all-optical' technology.

5.3.1 Intensity Dependent Refractive Index

Devices that operate in some way using the non-linear refractive index, \tilde{n} , are of special interest. The intensity dependent change in index that arises can be of either sign (positive or negative) dependent on the position and strength of proximal resonances. In silica optical fibres for example, this optical nonlinearity produces self-focussing of signal pulses that acts against dispersion to produce solitons. The refractive index can be given as:

$$\tilde{n} = n_0 + n_2 I \tag{17}$$

where n_0 is the unperturbed value (low field limit) whereas n_2I represents the refractive index change, Δn , achievable with intensity, *I*, determined by the coefficient, n_2 . The most common figure of merit regarding the utility of the non-linear refractive index is given as follows:

$$W = \frac{\Delta n}{\alpha \lambda} \tag{18}$$

where α is the absorption coefficient and λ the wavelength of interest. Devices such as directional couplers or Mach-Zehnder interferometers can be assessed using the 'W' value. Values of this parameter of greater than unity give some indication that a material may offer some promise for devices, also provided that the response time of the non-linear refraction is suitable, i.e., not of thermal origin.

Some mention needs to be made about fully conjugated polymers in this regard. During the 1980s and early 1990s, classes of conjugated polymers based on polythiophenes, polydiacetylenes, and others were intensively investigated for their third order optical nonlinearities (a.60). The delocalised π electron systems in these polymers can be readily excited by incident light to produce non-linear polarisation responses (76, 371, 385, 391, 395, 419).

The polydiacetylenes (PDA) have long been suggested for all-optical non-linear devices. These polymers certainly have relatively large values for n₂ but this is invariably associated with a large value for α and it is difficult therefore to find an operating wavelength where the 'W' value condition of Equation 18 is met. The current thinking regarding the class of PDA is that in only one of the polymers can the relevant device figures of merit be reached at telecommunications wavelengths (a.61). The material in question is poly(2,4-hexdiyne-1,6-diol-bis-p-toluene-sulfonate (PTS). This polymer if grown into a waveguide as a non-scattering single crystal having its principal non-linear crystal axis appropriately aligned could just provide adequate switching properties at 1600 nm (the measurement wavelength) at a reasonably high bandwidth.

5.3.2 Cascaded Third Order Nonlinearities

As an alternative strategy, there is a possibility that the second order optical non-linearity in poled polymers may be used to generate a so-called cascaded third order non-linear response (a.62).

The second order non-linear optical responses, such as second harmonic generation, involve coupled waves at fundamental and sum frequencies each propagating with velocities according to the dispersive conditions imposed by the material or waveguide geometry. Thus the constant interchanging of power between fundamental and second harmonic fields under dispersive conditions, (i.e., where phase matching is not favoured) results in a build-up of phase delay in the fundamental beam. This can be regarded as an effective third order nonlinearity with an effective n_2 value given by the following expression:

$$n_2(eff) = \frac{2\pi \left[d_{eff}^{(2)}\right]^2}{\varepsilon_0 c n^4 \lambda \Delta k}$$
(19)

where $d_{eff}^{(2)}$ is the effective second order non-linear coefficient

and $\Delta k = \frac{4\pi}{\lambda} |n_{\omega} - n_{2\omega}|$ represents the wavevector mismatch for second harmonic generation due to differences in effective indexes at fundamental (n_{ω}) and second harmonic $(n_{2\omega})$ wavelengths. Notice that there is apparently, the possibility of exceptionally large effective n_2 values upon phase matching ($\Delta k = 0$). This method of cascaded third order nonlinearity is of great interest and could be particularly relevant to the second order NLO studies being undertaken on electro-optic polymer waveguides. However, whereas for electrooptics, there is a need for transparency only at the telecommunications wavelengths, this method requires transparency at both the fundamental and second harmonic wavelengths. Since there is a fundamental relationship between the position of the lowest energy electronic excitation and β , such a transparency requirement would inevitably mean a restriction on the maximum achievable second order response.

6 Conclusions and Outlook

The fact that polymers may be coated onto wafer substrates and that they may be processed using standard semiconductor device techniques has driven research and development interest in polymer photonic circuits for almost three decades. However, the earliest published work from Bell Laboratories explored the possibilities for mass manufacturing using replication moulding, which was only revisited later during the 1990s when the requirement for low cost and high volume telecom photonic devices became clear. Therefore, transferring conventional semiconductor processing methods (photolithography, RIE etching) to polymer processing whilst allowing the demonstration and commercial deployment of a limited range of polymer components, has in the meantime removed the potential unit cost advantage. Polymer devices that remain competitive against their inorganic counterparts do so on fundamental performance issues alone. Thus the unique thermo-optic and electro-optic properties described previously will continue to be used to argue the case for their commercial acceptance. These are limited sectors of the whole market however since the deployment of wavelength division multiplexing requires low cost passive devices, such as filters, passive power dividers and couplers, all of which can be fabricated quite satisfactorily from low loss silica waveguide technology in relatively large volumes. Unit costs of semiconductor processing techniques for photonic circuit manufacture remain relatively high however. Silica-based devices use a low refractive index difference to confine light to the channel waveguides.

This puts a limit on the minimum acceptable bend radius in the guide before losses become prohibitive and the result is that devices take up a relatively large area of each wafer. Whilst polymer technologies can in principle offer higher index contrast (and thus more compact devices) only special formulations (fluorinated/halogenated) can offer comparable propagation losses and reliability and there is then the lack of an industry standard allowing 'second sourcing' for systems developers. It would therefore appear that for wider acceptance, there is a need for polymer technologists to pursue the cost advantages proven in methods such as injection moulding whilst retaining the performance imperatives of perfluorination and crosslinking.

During the latter part of the 1990s, a surge in the growth of the telecom sector was seen, fuelled by the expectation that customer demand for bandwidth would vastly outstrip capacity. The investment community responded by funding a variety of start-up companies in photonic component research and development and among these a number of companies aiming to take polymer technologies through to the market. First among these was an offshoot of Akzo-Nobel who had patented a crosslinked polycarbonate system with refractive index tuning and low loss as important defining features. A range of thermo-optic switching devices was available from Akzo-Nobel Electronic products and major telecom systems suppliers were evaluating these devices with an eye to deployment. A unit of Allied Signal then offered for sale its polymer waveguide technology and this was bought by JDS Fitel. Other start-up companies such as Lightwave Microsystems and ZenPhotonics later advertised thermo-optic polymer devices of various types including variable optical attenuators and there also emerged a company offering a packaged polymer electro-optic modulator for evaluation.

After the technology bust of 2000/2001 however, it is not clear whether these companies or their successors will fare better or worse than those basing their product offerings on alternative materials technologies. The current appetite is for lower cost over higher performance. One way to achieve this is through increased integration of devices which in the limit means wafer scale integration. The III-V community currently has the edge here, showing that sources, receivers, modulators and amplifiers can be fabricated together on a single InP wafer. The other way is to reduce the unit cost of production. This will remain a door through which it may prove possible to widen the participation of polymer technologies in this, although now more steadily, growing field.

Abbreviations

AWG	Arrayed waveguide grating (s)
BCB	Benzocyclobutene polymers
CD	Compact disk
DPMA	Dihydroxypropylmethacrylate
DVD	Digital video disk
DWDM	Dense wavelength division multiplexing
EDFA	Erbium-doped fibre amplifiers
E-O	Electro-optic effect
ITU	International Telecommunications Union
KWW	Kohlrausch-Williams-Watts
MMA	Methyl methacrylate
PDA	Polydiacetylene (s)
PFBCB	Perfluorinated benzocyclobutene polymers
PMMA	Polymethylmethacrylate
POF	Polymer optical fibre
PTS	Poly (2,4-hexdiyne-1,6-diol-bis- <i>p</i> -toluene-sulfonate
RH	Relative humidity
RIE	Reactive ion etching
SMF	Single mode fibre
SOA	Semiconductor optical amplifiers
TDM	Time division multiplexing
T_{g}	Glass transition temperature
TM	Transverse magnetic
T-O	Thermo-optic coefficient
VPAc	Vinyl phenyl acetate
WDM	Wavelength division multiplexing

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Abstracts from the Polymer Library Database

Item 1

Polymer Preprints. Volume 41. Number 2. Conference proceedings.

Washington, D.C., 20th-24th Aug.2000, p.1271-2 SYNTHESIS AND LUMINESCENT PROPERTIES OF A NOVEL RIGID-ROD ALTERNATING COPOLYMER CONTAINING OLIGO(ETHYLENE OXIDE) SIDE CHAINS Cheng Huang C; Huang W; Guo J; Yang C-Z Singapore,National University; Nanjing,University (ACS,Div.of Polymer Chemistry)

The discovery of a new of light-emitting devices with mobile ions incorporated into the active polymer layer, has resulted in the introduction of light-emitting chemical cells (LECs). These original devices consist of two electrodes, and an active polymer layer blended with lithium triflate-doped polyethylene oxide (PEO) which facilitates ionic conductivity. An in situ light-emitting pn junction is formed by simultaneous p-type and n-type electrochemical doping of electrolyte-containing conjugated polymer chains between two oppositely charged electrodes. LECs have many advantages such as low operating voltage, high quantum efficiency, high power efficiency and non-sensibility to be work function of the metal electrodes, etc. However the use of a polymer blend in these devices can result in phase separation between the emissive layer and the polymer electrolyte which, in turn, could be detrimental to device performance, such as response times which are necessary for application of LECs in flat panel displays. While various PPV derivatives substituted with alkoxy, alkyl, aryl, halogen and alkylsilyl side groups have been used in LEDs, some oligo(ethylene oxide)grafted PPVs have been reported for LEC applications. Synthesis via the Wittig reaction and characterisation are presented of a novel yellow-green light-emitting rigid-rod copolymer, poly((2,5-bis(triethoxy)-1,4-phenylene vinylene)-alt-(1,4phenylene vinylene), with an alternating structure in which one block is based on para-phenylene vinylene and the other unit is liked with 2,5-substituted para-phenylene vinylene with ethoxy-terminated oligo(ethylene oxide) side chains, along with the fabrication and characterisation of the light-emitting devices from this soluble and processable copolymer with both electronic and ionicconduction. 11 refs.

CHINA; SINGAPORE

Accession no.835350

Item 2

Polymer Preprints. Volume 41. Number 2. Conference proceedings.

Washington, D.C., 20th-24th Aug.2000, p.1405-6 PHOTORESPONSIVE SELF-ASSEMBLED MULTILAYER OF THREE NEW AZO

POLYELECTROLYTES

TuoX; Chen Z; Wu L; Wang X; Liu D Tsinghua,University (ACS,Div.of Polymer Chemistry)

Polymers bearing azobenzene chromophores have attracted considerable attention due to their potential applications in optical data storage and optical controlling process. One of the most interesting properties of azobenzene chromophores is the reversible cis-trans isomerisation, which can be triggered or accelerated by light or thermal effect. When irradiated with UV light, the stable trans form of azobenzene can be isomerised to cis form and cis-to-trans isomerisation can occur upon irradiation of visible light. The reversible isomerisation property has been extensively explored to design various new polymers with special functionalities. Three new polyelectrolytes bearing azobenzene type chromophores in side chains are synthesised and fabricated into multilayer film by a layer-by-layer self-assembly technique. This technique was recently reported and has been widely used to manipulate thin films, and to prepare acentric azo polymer multilayer films suited to non-linear optical devices. The layer-by-layer adsorption of photoactive polyionic containing azobenzene groups has recently been reported. Polyacrylic acid-based polyanion containing three different types of chromophores is synthesised. The dependence of the rate of cis-trans isomerisation on chemical structure of the chromophores in self-assembled multilayers is studied. The photoresponsive behaviours of the chromophores in the selfassembled multilayers are compared with those in aqueous solution and spin-coated films. 6 refs. CHINA

Accession no.835287

Item 3

Composites Part A: Applied Science and Manufacturing 33A, No.1, 2002, p.27-34 OPTIMISATION OF THE COATING OF A FIBRE OPTICAL SENSOR EMBEDDED IN A CROSS-PLY GFRP LAMINATE Barton E N; Ogin S L; Thorne A M; Reed G T

Surrey, University

The effect of thickness and Young's modulus of the fibre coating on the local stress distributions around an optical fibre sensor embedded in the 0 deg. ply of a cross-ply GRP laminate is determined using finite element analysis. Three positions of the sensor are analysed (adjacent to the 0/90 interface, in the middle of the 0 deg. ply or at the laminate surface) and wide ranges of coating modulus (0.045-10 GPa) and coating thickness (5-70 mu m) are investigated. Results of the modelling are validated against closed-form analytical solutions (where available)

and are summarised in the form of a design curve showing the optimum combinations of coating thickness and coating modulus for minimum sensor obtrusivity in such laminates. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.835054

Item 4

Chemical Week 163, No.35, 19th Sept.2001, p.35-6 WAITING FOR LIGHT AT THE END OF THE DOWNTURN Schmitt B: Morrison S

The fast-growing UV and EB radiation-curing chemicals segment is not passing through the economic slowdown unscathed. Sales at some radiation-curing chemicals suppliers have flattened or even dipped this year, the result of slumps in the major end-use markets of printed circuit boards and automotive parts manufacturing. UV/EB-cured coatings, inks and adhesives are on track to average 5%, 6% and 12% annual growth rates, respectively, through 2005. The long-term trends point to stronger demand for the three principal categories of radiation-curing chemicals - photoinitiators, monomers and oligomers.

WORLD

Accession no.834597

Item 5

Polymer Preprints. Volume 41. Number 2. Conference proceedings.

Washington, D.C., 20th-24th Aug.2000, p.1118-9 SIDE-CHAIN POLYURETHANE-IMIDES FOR SECOND ORDER NONLINEAR OPTICS

Sui Y; Yin J; Hou Z; Zhu N; Lu J; Zhu Z; Wang Z Shanghai,Jiao Tong University; Fudan,University (ACS,Div.of Polymer Chemistry)

Second order non-linear optical (NLO) polymers offer great promise for in electro-optic modulators optical interconnects, and other devices due to their large linear electro-optic coefficients, low dielectric constants, flexibility in fabrication and processing techniques compatible with integrated technology. Recent studies on side-chain polyimides indicate that high Tg polymers such as aromatic PIs are a promising choice of matrix materials for NLO polymers that may be utilised to reduce the relaxation of oriented dipoles. A common synthetic route for those NLO PIs is the condensation polymerisation of dianhydrides with diamines containing an NLO chromophore via a polyamic acid (PAA) prepolymer followed by a high temperature imidisation or a chemical imidisation process. This method, however, often involves tedious synthesis of the chromophores containing diamine monomers. Sometimes the fact that few chromophores can survive the relatively harsh chemical conditions of the monomer synthesis and the imidisation of the PAAs and the difficulty in the synthesis of chromophorecontaining diamine compounds limit the type of chromophores that may be incorporated into the PI backbone. NLO PIs are prepared via an iscyanato terminated urethane prepolymer instead of a PAA prepolymer. This new approach avoids troublesome NLOdiamine synthesis. This technique also permits versatility in selection of the chromophores to be incorporated into the PI backbone, in addition to providing two bonding sites for chromophore attachment to give better orientational stability. The synthesised PIs, or polyurethane-imides, might be a better matrix material, as processability and solubility are enhanced without losing the advantageous properties of PIs. The conventional DR-19 with di-hydroxy groups is used as a test NLO chromophore to characterise the novel synthetic approach. 5 refs. CHINA

Accession no.833494

Item 6

Polymer Preprints. Volume 41. Number 2. Conference proceedings.

Washington, D.C., 20th-24th Aug.2000, p.1116-7 ALL-OPTICAL POLING OF A SIDE-CHAIN POLYURETHANE-IMIDE FOR SECOND-ORDER NON-LINEAR OPTICS

Yu X; Sui Y; Yin J; Li Q; Zhong X; Chen Y; Zhu Z; Wang Z

Shanghai, Jiao Tong University (ACS, Div. of Polymer Chemistry)

Second-order non-linear optical polymers (NLO) offer great promise for use in electro-optic modulators, optical interconnects and other devices due to their large linear electro-optic coefficients, low dielectric constants, flexibility in fabrication, and processing techniques compatible with integrated circuit technology. In contrast to crystalline materials, glassy polymers are isotropic, and therefore require poling in order to orient their molecular dipoles and thus generate the desired NLO properties. In the most common electrical poling procedure glassy NLO polymeric thin films are heated to elevated temperature (always above glass transition temperature Tg) to increase the mobility of the non-linear components when a high voltage electric field is applied. Through the electrostatic interaction, the non-linear molecules align with the electric field and then a non-centrosymmetry, which is a requirement for macroscopic second-order non-linear optical properties, is generated. While maintaining the applied field, the temperature is decreased to room temperature, and the non-linear molecules are 'frozen' into their new orientation. Several years ago, a new poling method - all-optical poling (AOP) - was first proposed, which leads to an overall orientation of dipoles with the help of light only. A recent study on the characteristic kinetics and the seeding parameters of AOP of side-chain polyurethane-imide films containing an azobenzene chromophore is presented. 4 refs. CHINA

Accession no.833493

Item 7

Polimery 46, No.3, 2001, p.192-200 Polish **PARAMETERS CHARACTERISING THE INTERACTION BETWEEN INNER PROTECTIVE DUCT AND OPTOTELECOMMUNICATION CABLE** Klepka T

A method and apparatus for investigation of sections of optotelecommunication cables and protective ducts sampled directly from commercial products are described. Examples are presented of results of investigations of three successive installations of telecommunication cable with an outer layer of PE-HD in a protective also made from PE-HD and having a slip layer on the surface of PTFE or with silicone polymer. 11 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

Accession no.833001

Item 8

Advanced Materials 13, No.19, 2nd Oct. 2001, p.1483-7 FUNCTIONALIZED FLUORINATED HYPERBRANCHED POLYMERS FOR OPTICAL WAVEGUIDE APPLICATIONS

Pitois C; Wiesmann D; Lindgren M; Hult A Sweden,Royal Institute of Technology; IBM

Details are given of the use of fluorinated hyperbranched polyhydroxystyrene in optical waveguide applications. The control of refractive index over a wide range and UV crosslinking for ease of processing and stable long-term mechanical properties is discussed. 17 refs.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; SWITZERLAND; WESTERN EUROPE Accession no.832950

Item 9

Polymer 42, No.21, 2001, p.8511-6 **CHROMOPHORE FUNCTIONALISED MALEIMIDE COPOLYMERS WITH HIGH POLING STABILITIES OF THE NONLINEAR OPTICAL EFFECT AT ELEVATED TEMPERATURE**

Samyn C; Ballet W; Verbiest T; Van Beylen M; Persoons A Leuven,Catholic University Precursor polymers were synthesised by radical copolymerisation of maleimide with 4-phenylstyrene, indene or 1-adamantyl methacrylate. Chromophore functionalised copolymers were then synthesised by reacting the copolymers with hydroxyalkyl chromophores under Mitsunobu conditions. Second order susceptibility values of up to 16 pm/V were obtained. The polymers showed high glass transition temperatures of 222-228C, which resulted in a stable non-linear optical response at elevated temperatures. The polymers retained between 72 and 90% of the original non-linear optical activity after more than 200 h of heating at 125C. 25 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.831854

Item 10

Polymer 42, No.24, 2001, p.9863-66 **POLYMERIC PHOTOREFRACTIVE COMPOSITE FOR HOLOGRAPHIC APPLICATIONS**

Won-Jae Joo; Nam-Jun Kim; Hgundee Chun; In Kyu Moon; Nakjoong Kim Hanyang,University

A polymeric composite based on a optically anisotropic chromophore doped polysiloxane was evaluated for diffraction efficiency at 30 volts per micron using degenerative four-wave mixing, and its ability as a holographic data storage medium and phase conjugation mirror were demonstrated. The composite thickness was 100 microns, and it was shown that a phase conjugation mirror could correct a distorted phase object beam. 19 refs.

KOREA

Accession no.831814

Item 11

Journal of Materials Science Letters 20, No.12, 15th June 2001, p. 1077-9 BLUE-GREEN LIGHT SENSITIVE PHOTODIODE MADE FROM SOL-GEL PROCESSED MATERIAL AND A POLYMER

Fan Q; Mcquillin B; Seddon A B Sheffield,University; Sheffield,Hallam University; Nottingham,University

A low-cost photodiode responsive to blue-green light was fabricated on indium tin oxide with sol-gel produced anatase TiO2 and poly(2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylene vinylene) (MEH-PPV). The peak response was 15mA per watt at 500nm wavelength and the photon to current conversion efficiency was 9.4%. The photoresponse corresponded well to the UV-visible spectrum of MEH-PPV itself, but with some losses at lower wavelength. These were ascribed to absorption by the glass substrate and to formation of excitons so deep

within the polymer that they decayed before reaching the interface with TiO2. The current-voltage characteristics of the device in both the light and dark were reported. The stability of the devices was investigated. They showed no variation in photoelectronic response over 24 hours of continuous irradiation in a vacuum, and there was little change in their response after four months storage in ambient conditions. Some possible applications of the devices were suggested. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.831671

Item 12

Journal of Macromolecular Science A A38, No.9, 2001, p.973-80 SYNTHESIS OF POLYURETHANES CONTAINING DIOXYBENZYLIDENECYANOACETATE AS AN **NLO-CHROMOPHORE FOR ELECTRO-OPTIC APPLICATIONS**

Lee J-Y; Park E-J Inje, University

Methyl 2,4-di-(2'-hydroxyethoxy)benzylidenecyanoacetate (3) is prepared by hydrolysis of methyl 2,4-di-(2'-vinyloxyethoxy)benzylidenecyanoacetate (2). Diol 3 is condensed with 2,4-toluenediisocyanate and 3,3dimethoxy-4,4'-biphenylenediisocyanate to yield PUs 4 and 5 containing the NLO-chromophore 2,4dioxybenzylidenecyanoacetate. The resulting PUs are soluble in common organic solvents such as acetone and DMF. Tg values of the polymers obtained from DSC thermograms are in the range of 101-114 deg.C and electro-optic coefficient (r33) of the poled polymer films is in the range of 12-15 pm/V at 633 nm. Polymers 4 and 5 show thermal stability up to 300 deg.C in TGA thermograms, which is acceptable for NLO device applications. 20 refs.

KOREA

Accession no.831579

Item 13

International Polymer Science and Technology 28, No.9, 2001, p.T/61-9 PARAMETERS CHARACTERISING THE **INTERACTION BETWEEN INNER PROTECTIVE DUCT AND OPTO-TELECOMMUNICATION CABLE** Klepka T

Details are given of the use of a test rig which has been developed in order to identify the values of the most important indices characterising the interaction between an inner jacket made of polyethylene and an optotelecommunication cable with an outer covering also of polyethylene during installation and the pulling of the cable through the outer jacket. Data derived from the test rig can

be used in the design of jacket/cable systems. 11 refs. (Article translated from Polymery, No.3, 2001, p.192). EASTERN EUROPE; POLAND Accession no.831546

Item 14

Chemistry of Materials

13, No.9, Sept. 2001, p.3043-50 LOW V PI ELECTROOPTIC MODULATORS FROM CLD-1. CHROMOPHORE DESIGN AND SYNTHESIS, MATERIAL PROCESSING, AND **CHARACTERIZATION**

Zhang C; Dalton L R; Oh M-C; Zhang H; Steier W H Southern California, University

Details are given of the synthesis of a ring-locked, phenyltetraene-based, second-order nonlinear optical chromophore. Thin films and waveguide devices were prepared from chromophore/PMMA and chromophore/ polycarbonate composites to study its electrooptical activity, optical loss, and photostability. 22 refs. USA

Accession no.831091

Item 15

Composites Science & Technology 61, No.13, 2001, p.1863-9 **INTERACTION BETWEEN OPTICAL FIBRE** SENSORS AND MATRIX CRACKS IN CROSS-**PLY GRP LAMINATES - PART 1: PASSIVE OPTICAL FIBRES**

Barton E N; Ogin S L; Thorne A M; Reed G T; Le Page B H Surrey, University

An investigation was carried out into the effect of the obtrusivity of an optical fibre on matrix cracking in a model glass fibre-reinforced epoxy resin cross-ply laminate. It was found that the initiation and development of matrix cracks were insensitive to the presence of the optical fibre in composites subjected to quasi-static loading and cyclic loading when the peak strain was greater than the quasi-static cracking threshold. When cyclic loading with a peak strain below the cracking threshold was carried out, a reduction in matrix-crack growth rate in the vicinity of the optical fibre was observed. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.830497

Item 16 Polymer 42, No.23, 2001, p.9379-84 NONLINEAR OPTICAL PROPERTIES IN NOVEL CROSSLINKED SYSTEM WITH HOST-**GUEST AND SIDE CHAIN**

Young-San Cho; Jae-Suk Lee; Gyoyin Cho; Tatsuo Wada; Hiroyuki Sasabe Kwangju,Institute of Science & Technology; Sunchon,National University; Japan,Institute of Physical & Chemical Research; Chitose,Institute of Science & Technology

A crosslinkable polymer with host-guest and side chain system was studied to increase the content of NLO chromophores in second order nonlinear optics. A very low poling temperature was applied, and the observed UV absorption difference before and after poling was due largely to a low glass transition temperature of the polymer and high content of chromophores introduced by side chain and guest molecules. Through crosslinked polymer matrices highly stable NLO properties were achieved. FTIR and 29Si solid state NMR was used to confirm the crosslink relationship between polymer matrix and chromophore. The d33 values of modified DR1/polymer films are high and there is no change over 2 months at ambient temperature. 27 refs.

JAPAN; SOUTH KOREA *Accession no.830114*

Item 17

Journal of Materials Chemistry 11, No.9, Sept.2001, p.2271-81 SIMPLE ZWITTERIONIC MEROCYANINES AS POTENTIAL NLO CHROMOPHORES

Kay A J; Woolhouse A D; Gainsford G J; Haskell T G; Wyss C P; Giffin S M; McKinnie I T; Barnes T H Industrial Research Ltd.; Otago,University; Auckland,University

A series of zwitterionic pyridylidene-based merocyanines that contained no interconnecting pi-bridge between the donor and acceptor rings was synthesised and their second-order non-linear optical properties evaluated mainly by semi-empirical computational methods. Representative polymer-tetherable derivatives were prepared, as were the corresponding TDI-based PUs. 41 refs.

NEW ZEALAND Accession no.829611

Item 18

Journal of Applied Polymer Science 81, No.11, 12th Sept.2001, p.2744-53 **ELECTRO-OPTIC PROPERTIES OF CARBON DIOXIDE FIXED-POLYMER/NEMATIC LC COMPOSITE FILMS**

Yeong Hee Cho; Byung Kyu Kim Pusan,National University

Preparation and electrooptic properties are reported for a range of UV cured polyurethane diacrylate films containing dispersed liquid crystals/. The materials were produced with a variety of different chemical compositions of the cyclic carbonate used as a base for the polymer, different end capping acrylates, different crosslink densities in the polymer and different photoinitiators for the final curing reaction. Morphology of the films was studied using scanning electron microscopy and electrooptical properties were measured by change of light transmission with applied voltage. Thermal properties of the films were assessed by differential scanning calorimetry. Greatest interaction with the liquid crystal component of the film came with the reactants that gave the smaller domain sizes and contact angle measurements. These also had the highest threshold and driving voltage requirements. 18 refs. USA

Accession no.829377

Item 19

Journal of Polymer Science: Polymer Chemistry Edition

39, No.13, 1st July 2001, p.2189-95

A FACILE APPROACH TO PREPARE SOLUBLE SIDE-CHAIN POLYIMIDES FOR SECOND-ORDER NONLINEAR OPTICS

Yu Sui; Jie Yin; Zhanjia Hou; Na Zhu; Jiongxin Liu; Yangang Liu; Zikang Zhu; Zongguang Wang Shanghai,Jiao Tong University; Fudan,University

A new preparation method for second-order nonlinear optical polyimides (NLO), that is simple and generally applicable has been developed. The method entails the preparation of side-chain substituted polyimides via isocyanate terminated prepolymers prepared directly from NLO chromophore-containing diols. The polymers had good solubility and high glass transition temperatures and good optical quality films were produced by spin coating. A study was also made of the second-order NLO activities and proposals were made for the factors which determine their growth. The new polymers exhibit a large secondorder NLO activity. 31 refs.

CHINA

Accession no.829312

Item 20

Plastics for Portable and Wireless Electronics and Optical Applications. Conference proceedings. Charlotte, N.C., 23rd-24th October 2000, p.11-5 HELPING PLASTIC OPTICAL FIBER CHALLENGE THE PERFORMANCE OF GLASS AND THE SIMPLICITY OF USE OF WIRE Shevchuk G J Lucent Technologies (SPE)

Copper wire and optical fibre are among the most widely used physical media for communications. They share many common traits, particularly as regards their interconnection both in-line in extending link lengths as well as at the link ends, attaching to sources and receivers of the signals to be transported. Both types of interconnections in both media have been implemented with connectors, which allow repeated mating and de-mating. Where permanent joining of two ends of the media are necessary, splices are used. Wire, however, has many forms of interconnection due to the simplicity of making electrical connections. Interconnecting optical fibres on the other hand, requires the guiding of the light out of the end of one fibre into the end of another, without allowing too much of it to escape at the interface. When comparing plastic optical fibre (POF) to glass fibre (GOF), there is significant simplification in its cutting and in eliminating the need for careful stripping of a coating. However, the simplification usually ends there, because additional effort is still needed to ensure that the POF endface is smooth enough to maintain adequate guidance of the light. Additionally, connectors are to provide accurate alignment of the fibre ends to each other. Any and/or simplification in these aspects could greatly improve the usability of POF. 2 refs.

USA

Accession no.829147

Item 21

European Design Engineer Oct.2001, p.35-7 GETTING A FIRM GRIP ON THE AUTOMATED ASSEMBLY OF PLANAR WAVEGUIDE DEVICES Mobarhan K S; Heyler R Newport Corp

Newport Corp.

Many of the optoelectronic devices designed in optical telecommunication networks are essentially passive optical waveguide structures that do not generate any light on their own, but rather channel and guide the light coupled into them to specific output ports. In this type of device one of the key manufacturing challenges is the alignment and attachment of the optical fibre (or fibre arrays) to the waveguide device, which require submicron translational and rotational positioning tolerances. In order to perform this alignment and attachment process, the automated manufacturing machine should be able to securely hold the device as well as the optical fibres and move them with respect to each other along the various linear and rotational axes. The fixtures holding the input and output fibre arrays are typically mounted on precision stages that make it possible to move the fibres, with respect to the device along x, y and z axes. It is also possible to adjust the pitch, roll, and yaw of the fibre arrays. Specialised kinematic gripping fixtures are available with adjustable and interchangeable blades designed to hold planar waveguide structures of various sizes. Details are given.

USA

Accession no.828970

Item 22

Journal of Polymer Science: Polymer Chemistry Edition 39, No.15, 1st August 2001, p.2571-80

SYNTHESIS AND OPTICAL AND ELECTROCHEMICAL PROPERTIES OF NOVEL POLYETHERS CONTAINING ISOLATED DISTYRYLBENZENE DERIVATIVES AND SIDE-AROMATIC 1,3,4-OXADIAZOLE CHROMOPHORES Yun Chen; Shiao-Ping Lai Taiwan,National Cheng Kung University

New polyethers were prepared with and without oxadiazole pendant groups. Cyclovoltammetric investigations indicated that the oxadiazole groups retarded hole injection and decreased the barrier of electron injection in the electrooptical polymer. Solubility of the polymer increased with increasing numbers of methoxy or ethoxy sidegroups in the distyrylbenzene section of chain. Characterisation of the polymers utilised spectroscopy, calorimetry, thermogravimetric analysis and optical and electrochemical studies. The polymers were shown to be amorphous materials, blue emitters as both films and solutions, and to be thermally stable. 24 refs. TAIWAN

Accession no.828811

Item 23 Journal of Polymer Science: Polymer Chemistry Edition 39, No.15, 1st August 2001, p.2557-64 LESSONS LEARNED FROM RESEARCH ON PHOTOREFRACTIVE POLYMERS AND MOLECULAR MATERIALS Luping Yu Chicago,University

Photorefractive materials, whose refractive index alters on exposure to light, were first observed in 1966. This article reviews the types of materials developed since that date, and particularly since the first polymer with these properties was developed in 1990, which have photorefractive properties. Advantages and limitations of various types of polymers on which work has been carried out at Chicago University, and in some cases their polymeric structure, are discussed, and the better materials for photooptic and electrooptic response are indicated. 36 refs.

USA

Accession no.828809

Item 24

Journal of Polymer Science: Polymer Physics Edition 39, No.15, 1st August 2001, p.1794-801 PREPARATION OF POLYMER OPTICAL FIBRES DOPED WITH NONLINEAR OPTICAL ACTIVE ORGANIC CHROMOPHORES Gang-Ding Peng; Li A D Q New South Wales,University; Washington State,University

The preparation of two optically active chromophores, a chiral type and a non-chiral type based on nitrostyryl

phenyl prolinol and nitrostyryl phenyl piperidine respectively is described. The activity of these materials when incorporated into polymethyl methacrylate and polyethyl methacrylate drawn into optical fibres is examined. Strong fluorescence when excited by laser pulse is reported, with efficiency and life equivalent to conventional laser dyes but with the advantage of better polymer compatibility. 19 refs.

AUSTRALIA; USA

Accession no.828808

Item 25

Synthetic Metals 122, No.2, 1st June 2001, p.275-7 OPTICAL PROPERTIES OF DIBLOCK COPOLYMERS

Wei J H; Xie S J; Mei L M Shandong,University

A tight binding model was used to study the electrooptical properties of diblock copolymers. The light-emitting wavelength depended on the proportion and the band structure of the homopolymers. The results were consistent with quantum chemical calculations and experiments. 13 refs. CHINA

Accession no.828720

Item 26

Molecular Crystals & Liquid Crystals Vol.361, 2001, p.257-62 COMPETITIVE OPTICAL NONLINEARITIES AND PHOTOINDUCED TRANSFORMATION OF EPOXY POLYMER BASED ON DIGLICIDYL ETHER OF BISPHENOL A

Gayvoronsky V; Boldovsky D; Borshch A; Brodyn M; Kutsenko A; Voznyy V; Loginenko O Ukraine,National Academy of Sciences

The competitive optical non-linearities (excited state absorption, absorption saturation and two-photon absorption) of DGEBA-based epoxy resin were studied using the picosecond X-scan technique at 532 nm. The complexity of the analysis was dealt with by selection of the part of the Z-scan curve which corresponded to the main contribution of the proper non-linear mechanism in relation to other competitive mechanisms. The two-photon absorption (TPA) coefficient (beta) was 4.0 + or -0.5 cm/ gigawatt for the polymer. At high laser intensities (more than 7 gigawatt/sq cm), photoinduced transformation into some new configuration that was more absorbent at 532 nm (beta 16.7 + or -3 cm/gigawatt for the photoproduct) took place. Up to a pumping irradiance of 20 gigawatt/sq cm, no optical damage of the polymer was observed. 6 refs. (3rd International Conference on Electronic Processes in Organic Materials, Kharkiv, Ukraine, May 2000) UKRAINE

Accession no.827554

Item 27

Molecular Crystals & Liquid Crystals Vol.361, 2001, p.135-42 PHOTOCONDUCTING POLYMER-NEMATIC LIQUID CRYSTAL HYBRID STRUCTURES THE PROMISING CHOICE FOR OPTICAL INFORMATION PROCESSING Bartkiewicz S; Miniewicz A; Kajzar F Wroclaw, Technical University; LETI; CEA

Recent progress in the development of a liquid crystalline optically addressed spatial light modulator is outlined, together with the characterisation and performance of the modulator. The spatial light modulator is based on photoconducting polymer-nematic liquid crystal hybrid structure and is used in various configurations of holographic recording and reconstruction. The refractive index gratings arising in a system with photoconducting electrode layer are tilted and phase shifted with respect to the light intensity pattern, thereby allowing for an extremely efficient energy transfer between the incoming beams. Depending on optical systems used, several useful optical devices can be constructed, including phase conjugate mirrors, Fourier optical correlators for pattern recognition, coherent light amplifiers, incoherent-tocoherent light converters. Their performances are directly linked with physical properties of the materials used and the principal photorefractive mechanism. 15 refs. (3rd International Conference on Electronic Processes in Organic Materials, Kharkiv, Ukraine, May 2000) EASTERN EUROPE; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; POLAND; WESTERN EUROPE

Accession no.827548

Item 28

Macromolecular Chemistry & Physics 202, No.9, 6th July 2001, p.1782-90 ALL ORGANIC NLO SOL-GEL MATERIAL CONTAINING A ONE-DIMENSIONAL CARBAZOLE CHROMOPHORE Wen-Jang Kuo; Ging-Ho Hsiue; Ru-Jong Jeng Taiwan National Tsing Hua University:

Taiwan,National Tsing Hua University; Taiwan,National Chung-Hsing University

A non-linear optical (NLO)-active polymer was developed by combining chromophoric photorefractive characteristics and film optical quality of melamine network. A carbazole-containing NLO-phore was obtained via a facile synthetic route, i.e. Knoevenagel condensation. Guest-host prepolymer was obtained by doping the chromophores into benzoguanamine matrix. After poling and curing process, a NLO-active organic sol-gel material with large second-order non-linearity and good optical quality film was achieved. Thermal stability of the polymer was analysed via DSC and TGA. UVvisible spectra and second harmonic generation measurement were used to characterise the linear and nonlinear optical properties. Reorientation dynamic stability was used to study temp. dependence of NLO signal. The d33 and d31 values for the polymer were 19 pm/V and 9 pm/V, respectively. Long-term NLO stability was investigated by measuring effective second harmonic(SH) coefficient as a function of time. The effective SH coefficient retained 47% of its original value and levelled off after 10 h of thermal ageing at 80C. 69 refs.

TAIWAN

Accession no.827423

Item 29

Journal of Polymer Science: Polymer Chemistry Edition

39, No.8, 15th April 2001, p.1162-8 SYNTHESIS AND ELECTROOPTICAL PROPERTIES OF SIDE-CHAIN METHACRYLATE POLYMERS CONTAINING A NEW AZOPHENYLBENZOXAZOLE CHROMOPHORE

Beltrani T; Bosch M; Centore R; Concilio S; Gunter P; Sirigu A Naples,University; Zurich,Institute of Quantum

Electronics

The synthesis and characterisation of four methacrylate copolymers obtained by radical addition polymerisation of methyl methacrylate as well as a methacrylate azophenylbenzoxazole chromophore are discussed. Molecular structures were identified. Electro-optical properties were examined. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; WESTERN EUROPE

Accession no.826915

Item 30

Glasgow, Blackie & Son Ltd., 1990, pp.xvii, 196, 6E ENGINEERING POLYMERS North London,Polytechnic Edited by: Dyson R W

This book is aimed at those people who wish to gain a general appreciation of some of the polymeric materials currently in use as engineering materials. There are six contributors, all affiliated to the Polytechnic of North London. Main topics Cover Thermoplastic composites; Performance rubbers at high temperatures; Thermoplastic elastomers; Polymer foams; Long fibre reinforced thermoset composites; Co-extruded films and containers; polymers in telecommunications and power transmission. Each chapter is well referenced.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.826534

Item 31

Polymer 42, No.22, 2001, p.9253-9 **SYNTHESIS OF NONLINEAR OPTICAL POLYIMIDES CONTAINING BENZOTHIAZOLE**

MOIETY AND THEIR ELECTRO-OPTICAL AND THERMAL PROPERTIES

Leng W N; Zhou Y M; Xu Q H; Liu J Z Nanjing,Southeast University

The synthesis and characterisation of a series of thermally stable second-order non-linear optical (NLO) polyimides are reported. These polyimides were prepared by the ringopening polyaddition of 4,4'-(hexafluoroisopropylidene)diphthalic anhydride and pyromellitic dianhydride with two aromatic diamines containing, as the chromophore, a benzothiazole moiety, and characterised by FTIR spectroscopy, NMR spectroscopy, elemental analysis, GPC and thermal analysis. A in-situ poling and temperature ramping technique was used to obtain optimal temperatures for corona poling and the largest secondorder NLO response. 23 refs.

CHINA

Accession no.826371

Item 32

Industrial & Engineering Chemistry Research 40, No.17, 22nd Aug.2001, p.3740-8 DIFFUSION-ASSISTED COEXTRUSION PROCESS FOR THE FABRICATION OF GRADED-INDEX PLASTIC OPTICAL FIBERS In-Sung Sohn, Chang-Won Park Florida, University

It is reported that graded-index optical fibres can be fabricated by the coextrusion of two polymer compounds containing different proportions of refractive index modifying additives. The additives diffuse within the interphase region between the two polymers, producing a smooth variation of refractive index. It was determined by a mathematical model described in detail that a near parabolic refractive index profile could not be achieved without excessively long residence times. The optical fibre modelled had a cladding of PMMA without additives and a core of PMMA containing benzyl butyl phthalate, benzyl benzoate and diphenyl phthalate. However, significant changes in the refractive index profile could be achieved by coextruding more than two layers of material. Ray analysis was used to estimate the bandwidth of two- and three-layer coextruded fibres and the results suggested that a small variation of the refractive index profile can give a significant increase in bandwidth. The diffusionassisted coextrusion process could potentially be used to fabricate polymeric optical fibres with a bandwidth of over 400 Mbps per 100 m. 24 refs.

USA

Accession no.826317

Item 33

Reactive & Functional Polymers 48, No.1-3, May 2001, p.113-8 SYNTHESIS OF POLYPHOSPHAZENES AS POTENTIAL PHOTOREFRACTIVE

MATERIALS

Li Z; Li J; Qin J Wuhan,University

A new series of polyorganophosphazenes were designed for potential photorefractive effect and synthesised via a nucleophilic substitution reaction. The component concentration in the polymers was controlled by different feed ratios between hydroxyhexanyl carbazole and hydroxyhexanylnitrophenylazo carbazole. Structural characterisation was undertaken using NMR, FTIR, UV vis spectroscopy, GPC and DSC. 12 refs. CHINA

Accession no.825749

Item 34

Japan Chemical Week 42, No.2128, 28th June 2001, p.6 TAKING LEAP BASED ON CONSOLIDATED MANAGEMENT OF BUS & SUBSIDIARY

Mitsubishi introduced a business unit system into its chemical operation in the spring of 1999. The company's resin business is made up of business units specialising in synthetic resins (general-purpose and engineering plastics), PVC, specialty products (synthetic rubber, elastomers), and paints and housing materials. Most of the commercial rights relevant to domestic sales were transferred to Mitsubishi Shoji Plastic (MSPC). Mitsubishi is consolidating the management of the Synthetic Resin BU and MSPC. In particular, MSPC is steadily expanding its business in engineering plastics for IT-related equipment. For overseas operations, Mitsubishi continues to promote localisation in response to the manufacturing relocation of Japanese companies.

MITSUBISHI CORP. Japan

Accession no.825579

Item 35

Antec 2001.Conference proceedings. Dallas, Texas, 6th-10th May, 2001, paper 1 NEW MANUFACTURING METHOD FOR LIGHT GUIDE OF PMMA

Park S J; Yoon K H; Park C Bestner Inc.; Dankook, University; Fineoptics Inc. (SPE)

The formation of a micro-optical pattern on the surface of a poly(methyl methacrylate) (PMMA) plate, used as a light guide in optical display devices, is described. The pattern was formed by pressing an embossed metal plate into the surface of the pre-heated PMMA. The influence of forming pressure and temperature, and depth of penetration of the tool on the characteristics of the light guide, including dimensional accuracy, was investigated. 3 refs.

KOREA; USA

Accession no.825397

Item 36

Revista de Plasticos Modernos 80, No.533, Nov.2000, p.494/502

Spanish

INNOVATIVE SYSTEM FOR THE EXTRUSION AND COEXTRUSION OF HDPE TUBE ASSEMBLIES FOR TELECOMMUNICATIONS AND OPTIC FIBRES

Fernandez F

Processes and machinery developed and patented by Arvitec of Spain for the extrusion, coextrusion and welding of multiple HDPE tube assemblies for use in the telecommunications and optic fibre sectors are described. Some other developments by the Company in plastics tube and pipe production are also reviewed.

ARVITEC

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE Accession no.825297

Item 37

Polymer Science Series A 43, No.5, May 2001, p.511-8 **ELECTROOPTIC AND HYDRODYNAMIC PROPERTIES OF IONOGENIC LIQUID-CRYSTALLINE COPOLYMERS IN SOLUTIONS AND MELTS**

Polushin S G; Mel'nikov A B; Polushina G E; Barmatov E B; Shibaev V P; Lezov A V; Ryumtsev E I St.Petersburg,State University; Moscow,State University

The hydrodynamic and electrooptical properties of comb-shaped liquid crystalline copolymers containing cyanobiphenyl mesogenic groups and 0.7 to 73 mol % acrylic acid units were studied in THF solutions and in isotropic melts. It was established that the degree of polymerisation of the copolymers was independent of their composition and lay within the range 32 to 93. The degree of folding of the copolymer macromolecules increased with the fraction of acrylic acid units in the copolymer. The electric field birefringence in solutions of the copolymers arose as a result of the orientation of polar cyanobiphenyl groups. The Kerr constant decreased with increasing content of acrylic acid in the copolymers. The temp. dependences of the Kerr constant and the relaxation time of orientational order fluctuations in the vicinity of the isotropic liquid-nematic liquid crystal transition were studied. It was found that the dipole orientation time and the relaxation time of orientational order fluctuations sharply increased with the content of acrylic acid, an observation indicative of an effect of hydrogen bonding on the electrooptical characteristics of the copolymers studied. 15 refs. (Full translation of Vys.Soed.A, 43, No.5, 2001, p.817-25)

RUSSIA

Accession no.825184

Item 38 Composite Interfaces 7, No.4, 2001, p.277-86 **INFLUENCE OF BOUNDARY LAYER ON SOUND PROPAGATION IN OPTICAL FIBERS**

Katok V B; Zabashita Y F; Senchurov S P Ukraine,Scientific Engng.Center of Linear Cable Installations; Kiev,Shevchenko State University

Physical models of two-layered and three-layered optical fibres were constructed. These models were used to calculate acoustic properties of optical fibres. Acoustic properties of fibres with boundary layers and without boundary layer calculated from these models were compared. The propagation of acoustic cylindrical symmetric waves in optical fibres was examined. This problem was treated analytically and numerically in continual approximation. The possibility of simultaneous propagation of two cylindrical symmetric waves in optical fibres with a boundary layer was shown (in a three-layered model). The physical phenomenon of the presence of two waves in the fibre with boundary layer was proposed for study of the boundary layer. Formulae for the calculation of the properties of the boundary layer from the acoustic experiment, verified by numerical calculations, are presented. 5 refs.

UKRAINE

Accession no.825158

Item 39

Chemistry of Materials 13, No.6, June 2001, p.2056-67 **ANTIFERROELECTRIC LIQUID-CRYSTAL GELS**

Artal M C; Ros M B; Serrano J L; de la Fuente M R; Perez-Jubindo M A Zaragoza,University; Pais Vasco,Universidad

The synthesis and characterisation of several mesogenic antiferroelectric gels, obtained by in-situ photopolymerisation of mixtures of a non-chiral diacrylate and a non-reactive compound with an antiferroelectric phase, were studied. Together with kinetic aspects from their photopolymerisation processes, information was obtained relating to the dielectric permittivity, spontaneous polarisation, optical response to an applied electric field and the influence that the photopolymerisation conditions and the structural characteristics of the network had on these properties. It was found that the polymer network not only stabilised the antiferroelectric orientation but also altered the electrooptical properties of the liquid crystal. 30 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.825073

Item 40

Journal of Reinforced Plastics & Composites 20, No.11, 2001, p.971-81

SWELLING INTERACTION, PLASTICIZATION, AND ANTIOXIDANT EXTRACTION BETWEEN FIBER OPTIC CABLE GELS AND POLYOLEFINS

Risch B G

Alcatel Telecommunications Cable

The effects of various water-blocking gels were investigated in relation to swelling behaviour of polyolefins. Gel absorption was studied in PE and propylene/ethylene copolymers as a function of temp. for a density range of 0.868 g/cc to 0.948 g/cc for PE and 0.88 to 0.91 g/cc for propylene/ethylene copolymers. The effect of swelling on antioxidant extraction was also studied as a function of antioxidant molec.wt. and degree of swelling. Both factors showed a strong effect on the amount of antioxidant extracted. A direct correlation was found between antioxidant extraction by gels and reduction in thermooxidative stability. 10 refs. USA

Accession no.824894

Item 41

Molecular Crystals & Liquid Crystals Vol.353, 2000, p.525-37 **ORGANIC-INORGANIC HYBRID MATERIALS FOR NONLINEAR OPTICS APPLICATIONS**

Lee K-S; Kim T-D; Min Y H; Yoon C S; Samoc M; Samoc A

Hannam, University; Korea, Advanced Institute of Science & Technology; Australian National University

Preparation was carried out of three types of organicinorganic hybrid materials by the sol-gel processable monomers derived from 3-isocyanatopropyltriethoxysilane with three different hydroxyfunctionalised non-linear optical chromophores. The measured values of non-linear optical coefficient strongly depended on conditions such as poling temperature, poling time and heating rate. The hybrid films heated at 200 degrees Celsius exhibited d33 = 50-58 pm/V in Maker-fringe measurement. It was discovered that the thermal stabilities of the films were considerably enhanced as poling time increased and a poling temperature became higher. In addition, good waveguiding properties of the films were observed at 810 nm and 1064 nm. The propagation losses of the films for TE mode were about 2 dB/cm at 810 nm and 0.5 dB/cm at 1064 nm. 21 refs.

AUSTRALIA; KOREA Accession no.824187

Item 42

Molecular Crystals & Liquid Crystals Vol.353, 2000, p.451-69 **NOVEL PHOTONICS POLYMERS IN HIGH-SPEED TELECOMMUNICATION** Ishigure T; Koike Y

Keio, University

A review is given of the recent status of the polymer optical fibre (POF) for high speed data communication and telecommunication. The advantage of perfluorinated polymer as the polymer matrix of low-loss and high bandwidth graded index (GI) POF is clarified. The perfluorinated polymer can decrease the intrinsic absorption loss compared with polymethyl methacrylate, which is the conventional material for POF. Moreover, it has been discovered that low material dispersion of the perfluorinated polymer is another advantage to achieve high bandwidth GI POF. For the first time is has been clarified that the power distribution of modes formed by the mode dependent attenuation were the dominant factors of the higher bandwidth of the GI POF than theoretically predicted bandwidth. The effect of the mode coupling, however, was small. 10 refs.

JAPAN

Accession no.824185

Item 43

Molecular Crystals & Liquid Crystals Vol.353, 2000, p.417-26 ELECTROOPTICAL CHARACTERIZATION OF VARIOUS PDLC MATERIALS Grosicka E; Mucha M

Lodz, Technical University

Polymerisation Induced Phase Separation, Solution Induced Phase Separation, and encapsulation techniques were used to prepare polymer dispersed liquid crystal (PDLC) materials. The objective was to compare and optimise the electrooptical and switching properties of the PDLC films, which show a strong dependence on curing time of the polymer matrix. This may be explained by the effective increase of anchoring strength at the interface of the polymer and liquid crystal, depending on the area fraction of the interface, size and shape of liquid crystal droplets, the polymer stiffness and resistivity changing in the course of crosslinking polymerisation. PDLC films prepared from flexible amorphous polyester resin containing dispersed nematic liquid crystal have shown the best electrooptical and switching properties in the case of polyester resin crosslinked with diacrylate and nematic liquid crystal mixture with matched refractive index to polyester matrix. 11 refs.

EASTERN EUROPE; POLAND Accession no.824183

Item 44

Macromolecules 34, No.12, 5th June 2001, p.4244-55 SHG CHARACTERIZATION OF DIFFERENT POLAR MATERIALS OBTAINED BY IN SITU PHOTOPOLYMERIZATION

Artal C; Ros M B; Serrano J L; Pereda N; Etxebarria J; Folcia C L; Ortega J

Zaragoza,University; Bilbao,Universidad del Pais Vasco

The structural, thermal and non-linear optical properties were studied for different polar materials based on monoacrylates and diacrylates. The polymers examined included side chain polymers, crosslinked copolymers, gels and anisotropic networks and they were prepared by in-situ photopolymerisation of their precursors in the ferroelectric smectic C liquid crystal phase. The side chain polymers and low crosslinking polymers were found to be of most interest because of their non-linear optical activity and their ease of synthesis. These materials produced films which were stable at room temperature and which showed second harmonic generation and electrooptical responses without the application of a poling field. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.824152

Item 45

Advanced Materials & Composites News 23, No.11, 4th June 2001, p.7 COMPOSITE MATERIALS MAY AID ELECTRICAL SHORTAGE PROBLEMS California,Energy Commission; Southern California,University

California, Energy Commission is partially funding a project at the University of Southern California to develop a glass fibre-reinforced plastics composite reinforced power cable, which will improve transmission throughputs and simultaneously act as a fibre optic communications cable. The composite material, called Composite Reinforced Aluminum Conductor, may increase transmission rates by 15% and will be tested on a 222,000 volt line.

USA

Accession no.824036

Item 46

Molecular Crystals & Liquid Crystals Vol.354, 2001, p.123-42 **ORMOCER S - INORGANIC-ORGANIC HYBRID MATERIALS FOR E/O-INTERCONNECTION-TECHNOLOGY**

Popall M; Dabek A; Robertson M E; Valizadeh S; Hagel O J; Buestrich R; Nagel R; Cergel L; Lambert D; Schaub M

Fraunhofer-Institut fuer Silicatforschung; Berlin, Technical University; Ericsson Components; IMC Microsystems; Motorola SPS; VLSI Packaging Corp.

Details are given of the development of ORMOCER s hybrid inorganic-organic polymer system for potential application in optical and electrical interconnection technology. The photopatternable materials with negative resist behaviour are composed of inorganic oxide structures crosslinked or substituted by organic groups. Systematic variation of composition combined with adaptation to micro system technology are discussed. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; SCANDINAVIA; SWEDEN; SWITZERLAND; WESTERN EUROPE

Accession no.823840

Item 47

Molecular Crystals & Liquid Crystals Vol.354, 2001, p.49-53 **URETHANE-ACRYLATES AS MAIN COMPONENTS OF LACQUERS FOR PROTECTIVE COATING OF SOME MATERIALS**

Tarasiuk B; Podkoscielny W Lublin,Maria Curie-Sklodowska University

Details are given of the synthesis of urethane-acrylic UVcured resins. Their use as protective soft, hard and intermediate coatings of optical fibres was investigated. 7 refs.

EASTERN EUROPE; POLAND *Accession no.823837*

Item 48

Advanced Materials 13, No.12-13, 4th July 2001, p.1005-7 REWRITABLE 3D BIT OPTICAL DATA STORAGE IN A PMMA-BASED PHOTOREFRACTIVE POLYMER Day D; Gu M; Smallridge A Swinburne, University of Technology;

Victoria, University

Details are given of continuous wave illumination for 3-D bit optical data storage under two-photon excitation in a new PMMA-based photorefractive polymer. The photorefractive mechanism using the diffraction pattern produced from an objective is discussed. 11 refs. AUSTRALIA

Accession no.823618

Item 49

Advanced Materials 13, No.12-13, 4th July 2001, p.927-41 SYSTEMATIC CONDUCTIVITY BEHAVIOUR IN CONDUCTING POLYMERS. EFFECTS OF HETEROGENEOUS DISORDER Kaiser A B

Wellington, Victoria University

A review is given of systematic experimental trends of the conductivity and thermopower of different types of conducting polymers. The patterns were used to infer the conduction mechanisms operating in the polymers and to construct a model that describes the essential features of the conduction process. The conductivity of carbon nanotubes was also examined. 154 refs. NEW ZEALAND

Accession no.823615

Item 50

Polymer 42, No.15, 2001, p.6447-6451 **IMPROVEMENT IN LINEAR AND NONLINEAR OPTICAL-PROPERTIES BY BLENDING POLY(N-VINYL-2-PYRROLIDONE) WITH AN ELECTRO-OPTIC POLYMER** Watanabe O; Tsuchimori M

Toyota

An electro-optic polymer comprising a blend of poly(Nvinyl-2-pyrrolidone) (PVP) and a urethane-urea copolymer (UU) had improved linear and nonlinear optical properties. Mixed solutions of PVP and UU with a wide mixture ratio were used to obtain transparent films without scattering. The absorptions coefficients and refractive indices of the films decreased with the nonlinear optical chromophore concentration. The optical nonlinearity was enhanced by blending 10-20 w/w% PVP with UU in spite of a decrease in the NLC chromophore concentration. There was no noticeable lowering of the temporal stability of the blended film. The improvement resulting from the addition of a small amount of PVP was explained by the interaction between UU and PVP. The blended films containing 10-20 w/w% PVP showed an improvement in temporal stability at 100 degree C by additional heating during corona poling. 20 refs. ΙΔΡΔΝ

Accession no.823566

Item 51

Charlotte, NC., 2000, 19 papers. 29cms. PLASTICS FOR PORTABLE AND WIRELESS ELECTRONICS AND OPTICAL APPLICATIONS. PROCEEDINGS OF A CONFERENCE HELD CHARLOTTE, NC., 23 TH-24TH OCT. 2000 (SPE,Electrical & Electronic Div.; SPE,Carolinas Section)

The proceedings of this fourth conference included nineteen papers on plastics for portable and wireless electronics and optical applications. Topics include technology trends in portable wireless products and wireless networks, thin wall molding of engineering resins, using conductive adhesives for grounding applications, advanced thermoplastic composites for wireless, portable electronics and optical applications and liquid crystal polymer laminates for wireless applications. USA

Accession no.822849

Item 52 Molecular Crystals & Liquid Crystals Vol.357, 2001, p.11-25

SYNTHESIS OF PHOTOCROSSLINKABLE NON-LINEAR OPTIC POLYIMIDES AND ELECTRO-OPTIC PROPERTIES

Park L S; Kim S J; Choi S Y; Kim G H Kyungpook,National University; Tokyo,Institute of Technology

Photocrosslinkable polyimide-type non-linear optical (NLO) polymers are obtained by multi-step reactions. Polyimide substrate polymer (P05) made from 3,3'diamino-4,4'-dihydroxybiphenyl (HAB) and aromatic dianhydride (6FDA) has higher molecular weight than other polyimides due to the high nucleophilicity of the amine group in HAB compared to the one in 2,2'-bis(3-amino-4hydroxyphenyl)hexafluoropropane (Bis-AP-AF) with the electron-withdrawing group. The introduction of DR-1 chromophore into the polyimide substrate polymers depends on the steric factor between the bulky DR-1 chromophore and the substrate polyimide in the polymer reaction via the Mitsunobu reaction. In the DR-1 substituted NLO polyimides, Tg decreases with increasing amount of DR-1 chromophore. Photocrosslinkable (NLO) polyimide (P05-DR-cin) is obtained by the introduction of the photoreactive cinnamoyl group into the DR-1 substituted polyimides. The electro-optic coefficient (r33) of the NLO polymer is determined with an experimental set-up capable of real-time measurement by varying both the poling field and temperature. The electro-optic coefficient (r33) of the linear NLO polymer (P05-DR) starts to show a decrease of the r33 value from about 80 deg.C. The photocrosslinked NLO polymer (P05-DR-cin), however, maintains a high r33 value up to 150 deg.C due to chromophores locked in the polymer matrix with a network structure. 15 refs. JAPAN; KOREA

Accession no.822748

Item 53

Molecular Crystals & Liquid Crystals Vol.359, 2001, p.31-9 FABRICATION AND CHARACTERISATION OF QUASI-PHASEMATCHED NLO-WAVEGUIDES USING LIQUID CRYSTALLINE POLYMERS Priebe G; Kentischer F; Kunze K; Macdonald R; Eichler H J

Berlin, Optisches Institut

Side chain polymers are investigated for realisation of nonlinear film and rib waveguides. Cyanobiphenyl and azochromophores are studied as non-linear optical side groups by measuring the non-linear optical coefficients, the refractive indices and the transparency range. Periodically poled waveguides using electrode and Corona poling in combination with corrugated surfaces are fabricated. First experience and results for the realisation of quasi-phasematched NLO waveguides for second harmonic generation using these polymers are presented. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.822735

Item 54

Molecular Crystals & Liquid Crystals Vol.360, 2001, p.147-60 MESOPHASE STRUCTURE OF CHIRAL LIQUID CRYSTALLINE POLYSILOXANES FOR ELCTRO-OPTICAL APPLICATIONS

Galli G; Cesarino C; Gallot B; Komitov L; Chiellini E Pisa,University; CNRS; Chalmers University of Technology; Chalmers University of Technology

Homopolysiloxanes poly(1) and poly(2) and copolysiloxanes (poly(1-co-3)) are synthesised. Their mesophase structures are investigated by X-ray diffraction, and the electron density profiles along the layer normal are derived. A linear response with the applied electric field is detected in the chiral smectic (C or A) are phases of poly(1) and poly(2). 12 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; ITALY; SCANDINAVIA; SWEDEN; WESTERN EUROPE *Accession no.822714*

Item 55

Macromolecules 34, No.14, 3rd July 2001, p.4774-9 SYNTHESIS AND CHARACTERIZATION OF NONLINEAR OPTICAL SIDE-CHAIN POLYIMIDES CONTAINING THE BENZOTHIAZOLE CHROMOPHORES

Leng W; Zhou Y; Xu Q; Liu J Nanjing,Southeast University

Details are given of the synthesis of a series of polyimidebased second-order non-linear optical materials. Data are presented for the molecular structure, thermal properties, electrooptical properties and other physical properties. 19 refs.

CHINA

Accession no.822210

Item 56

Macromolecules 34, No.14, 3rd July 2001, p.4680-2 SYNTHESES OF CONJUGATED POLYMERS DERIVED FROM ALKYLCARBAZOLES Morin J-F; Leclerc M Quebec,Universite Laval

Details are given of the synthesis of homo- and copolymers derived from alkylcarbazoles. Some preliminary studies of their physical properties are presented. Potential applications in electrical, electrochemical, optical and electrooptical devices are mentioned. 17 refs.

CANADA

Accession no.822195

Item 57 Patent Number: US 6185349 B1 20010206

MULTIMODAL POLYMER COMPOSITION Dammert R; Heino E; Korvenoja T; Martinsson H

Borealis Polymers Oy

A multimodal polymer composition for fibre optical cables and a fibre optical cable comprising the composition are disclosed. The composition is characterised in that it comprises a multimodal polyethylene with a density of 0.920-0.965 g/cm3 and a viscosity at a shear stress of 2.7 kPa (eta2.7kPa) of at least 150 kPa.s, said multimodal polyethylene comprising a low molecular weight (LMW) ethylene homo- or copolymer fraction and a high molecular weight (HMW) ethylene copolymer fraction, said multimodal polymer composition having a weight ratio of the LMW fraction to the HMW fraction of (35-55):(65-45). Preferably, the multimodal polyethylene is a bimodal polyethylene and has a shear thinning index (SHI), defined as the ratio of the viscosities at shear stresses of 2.7 and 210 kPa, respectively, of SHI. sub.2.7/210 =20-150. Also, preferably, the multimodal polyethylene has a MFR.sub.5 of 0.1-2.0 g/10 min and a melt strength at 190 degree C. of at least 4 g. The multimodal polymer composition is particularly useful as a material for slotted core elements of fibre optical cables of the slotted core type.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; USA; WESTERN EUROPE

Accession no.822080

Item 58

Polymer 42, No.18, 2001, p.7749-54 **SYNTHESIS OF NONLINEAR OPTICAL SIDE-CHAIN SOLUBLE POLYIMIDES FOR ELECTRO-OPTIC APPLICATIONS** Leng W L; Zhou Y M; Xu Q H; Liu J Z Nanjing,Southeast University

A new fluorine-containing hydroxyl polyimide, soluble in common organic solvents, was synthesised. A nonlinear optical chromophore was covalently bonded on to the backbone of the polyimide using a mild Mitsunobu condensation reaction. A series of polyimides was prepared by controlling the chromophore loading level. The resulting non-linear optical polyimides had relatively high glass transition temperatures (greater than 180C) and thermal stability up to 280C. Films of high optical quality were prepared and their electrooptical properties were studied. Large electrooptical coefficients of up to 25 pm/ V at 0.83 micrometres were observed, together with high thermal stability of the poled films at 120C. 16 refs. CHINA

Accession no.822055

Item 59

Synthetic Metals 121, Nos.1-3, 15th March 2001, p.1495-6 SECOND AND THIRD ORDER OPTICAL

PROCESSES IN ANISOTROPIC POLYMER WAVEGUIDES

Schrader S; Flueraru C; Dietzel B; Motschmann H; Brehmer L

Potsdam, Universitat; Teltow, Institute of Thin Film Technology & Microsensorics; Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Second harmonic generation and linear optical properties of thin layer and optical waveguides obtained by a Langmuir-Blodgett method or by spin-coating corona poling from maleic anhydride polymers carrying nonlinear side chain optical (NLO) chromophores, from polymethyl methacrylate/disperse red host-guest systems, and from 2-docosylamino-5-nitropyridine (DEANP) amphiphiles were studied. It was found that all these materials could be used to obtain high quality waveguides with high non-linear optical coefficients. Phase matching was achieved for special waveguide structures. The intensity distribution within the waveguides was assessed by computer simulation for the second and third harmonic waves, based on "coupled amplitude equations". 6 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.821996

Item 60

Macromolecular Rapid Communications 22, No.8, 15th June 2001, p.601-6 ENHANCED TEMPORAL STABILITY OF AN NLO POLYURETHANE VIA A TWO-DIMENSIONAL CHROMOPHORE Kuo W-J; Hsiue G-H; Jeng R-J

Taiwan, National Tsing Hua University

A new non-linear optical-active PU, based on a twodimensional non-linear optical chromophore was investigated. After poling, fast relaxation of the effective second harmonic coefficient was observed. Characterisation was undertaken using FTIR, proton NMR, GPC, DSC, TGA and UV vis spectroscopy. 36 refs. CHINA

Accession no.820201

Item 61 Polimery 46, No.1, 2001, p.53-9 Polish **METHOD FOR ESTIMATING THE EFFICIENCY OF QUASI-CUTTING OF RECYCLED OPTICAL- TELECOMMUNICATION PIPES** Flizikowski J; Mlacko M

An original method for investigation of the efficiency of quasi-cutting of thermoplastics pipe materials, especially recycled materials from optical-telecommunication pipes, is presented. The efficiency of the grinding process and the suitability of the product for further processing have been significantly increased. 15 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

Accession no.819990

Item 62

Synthetic Metals 122, No.1, 1st May 2001, p.123-6 ORGANIC LIGHT-EMITTING DEVICES OF THIOPHENE VINYLIC DERIVATIVES

Brovelli F; Diaz F R; del Valle M A; Bernede J C; Molinie P

Pontificia,Universidad Catolica de Chile; EPSE; Nantes,Institut des Materiaux

Electropolymerisation in non-aqueous media and subsequent electrical deposition on indium tin oxide glass electrodes of different thiophene derivatives was carried out, followed by evaluation of voltage-current curves and electroluminescent response of the polymers. Electroluminescence response was found to occur at 2 to 3 volts, but current injection depended on the polymermetal interface, itself affected by film thickness. Some anomalous behaviour was noted when a reverse bias was applied. 12 refs

CHILE; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.818478

Item 63

Synthetic Metals 122, No.1, 1st May 2001, p.119-21 ALTERATION OF THE PHOTO AND ELECTROLUMINESCENT PROPERTIES OF POLY(P-PHENYLENE VINYLENE) UPON ADDITION OF INDIUM CHLORIDE Margada J: Thomas D.S: Friand P.H: Casialli F.

Morgado J; Thomas D S; Friend R H; Cacialli F Lisbon,Instituto Superior Tecnico; Cavendish Laboratory

Modifications to optical properties caused by addition of different molar ratios of indium chloride to the precursor solution of poly(p-phenylene vinylene) (PPV) were studied. It was found that there were increases in electroluminescence efficiency, but photoluminescence efficiency changes depend very much on conversion conditions.Spectroscopic studies give no evidence of charge transfer doping of the PPV-indium chloride blends. Compared to the influence of indium-tin-oxide coatings on transport and luminescence properties, influences of the indium chloride appear additional. 11 refs

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; UK; WESTERN EUROPE

Accession no.818477

Item 64 Synthetic Metals 122, No.1, 1st May 2001, p.115-8

OLEDS BASED ON NEW OXADIAZOLE DERIVATIVES

Kaminorz Y; Schulz B; Schrader S; Brehmer L Potsdam,Universitat

Methods of improving the solubility of polymers and chemicals having electrooptical properties to allow better and easier film forming characteristics were examined. These included modification of poly(1,3,4-oxadiazole)s by introduction of pendant alkyl side chains and tetraphenylsilane or hexafluoroisopropylidene groups into the main chain. A further option explored was to optimise a low molar mass oxadiazole compound and link it as a side chain on a polymethyl methacrylate main chain. Photooptical and electrooptical characteristics were examined and the feasibility of both methods of preparation of optically active materials was verified, providing the correct molecular structures were maintained. 15 refs

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.818476

Item 65

Synthetic Metals 122, No.1, 1st May 2001, p.111-3 LIGHT EMITTING ELECTROCHEMICAL CELLS BASED ON POLY(P-PHENYLENE VINYLENE) COPOLYMERS WITH ION-TRANSPORTING SIDE GROUPS

Morgado J; Friend R H; Cacialli F; Chuah B S; Rost H; Moratti S C; Holmes A B

Lisbon,Instituto Superior Tecnico; Cavendish Laboratory; Melville Laboratory

Comparison of the electrooptical characteristics of two copolymers of polyphenylene vinylene, an alternating copolymer poly(2,3-dibutoxy-1,4-phenylene vinylene-alt-2,5-bis(triethoxymethoxy)-1,4-phenylene vinylene) (DBalt-BTEM-PPV) and a statistical copolymer poly(2,5bis(dimethyloctylsilyl)-1,4-phenylene vinylene)-co-(2,5bistriethoxymethoxy)-1,4-phenylene vinylene) (BDMOSco-BTEM-PPV), was determined using spin coating from solution and addition of lithium triflate. The effect of polyethylene oxide (PEO) addition was also examined and the PEO was found to improve the electroluminescence efficiency, but increase the response time. PEO phase induced separation was considered to be the cause of this behaviour. 10 refs

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; UK; WESTERN EUROPE

Accession no.818475

Item 66

Synthetic Metals 122, No.1, 1st May 2001, p.105-10 ADVANCES IN POLYMERS FOR PLEDS: FROM A POLYMERIZATION MECHANISM TO INDUSTRIAL MANUFACTURING Becker H; Spreitzer H; Kreuder W; Kluge E; Vestweber H; Schenk H; Treacher K Covion Organic Semiconductors

Industrialisation of manufacture of poly(p-phenylene vinylene)s (PPV) for use in polymer light emitting diodes (PLED) is described using a glass lined vessel cascade and dehydrohalogenisation polymerisation. A defect in this particular type of polymerisation identified by nuclear magnetic resonance spectroscopy, where head to head reactions occur in competition with the predominant head to tail reactions, results in tolane-bisbenzyl moieties (TBB). The presence of TBB in PPV will result in a reduced service life of the PLED, an example being given of a 30 times shorter life for 6 percent TBB content compared to 3 percent. Identification of this potential defect allows its control during industrial scale polymerisation. Electrooptical performance and performance in PLEDs of the PPVs are discussed. 9 refs EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.818474

Item 67

Chemistry of Materials 13, No.4, April 2001, p.1230-7 LARGE DYNAMIC RANGES IN PHOTOREFRACTIVE NLO POLYMERS AND NLO-POLYMER-DISPERSED LIQUID CRYSTALS USING A BIFUNCTIONAL CHROMOPHORE AS A CHARGE TRANSPORTER

Van Steenwinkel D; Hendrickx E; Persoons A; Samyn C Leuven,University

The synthesis and characterisation of two photorefractive side-chain polymethacrylates, functionalised with aminodonor-containing chromophores are reported. Carbazole units are neither copolymerised nor added to the polymers as separate components, and charge transport is provided by the chromophores. The polymer glass transition temperature is lowered to room temperature with appropriate plasticisers. After the addition of a sensitiser, (2,4,7-trinitro-9-fluorenylidene)malononitrile (TNFM) or C60, a charge-transfer (CT) complex is formed between the chromophore and sensitiser, and photoconductivity can be observed upon excitation of the CT complex at 680 and 780 nm. The excellent photorefractive properties at both wavelengths are probed using the techniques of four-wave mixing and two-beam coupling. 33 refs. BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.818022

Item 68

Journal of Polymer Science: Polymer Physics Edition 39, No.9, 1st May 2001, p.895-900

EFFECT OF PRESSURE AND TEMPERATURE ON CHROMOPHORE REORIENTATION IN A NEW SYNDIOREGIC MAIN-CHAIN HYDRAZONE NONLINEAR OPTICAL POLYMER

Hayden L M; Won-Kook Kim; Chafin A P; Lindsay G A Maryland,University; US,Naval Air Warfare Center Weapons Div.

The temp. dependence of the reorientation activation volume of a syndioregic main-chain hydrazone(SMCH) non-linear optical polymer was measured using second harmonic generation(SHG). The decay of the SHG signal from poled films of SMCH was recorded at hydrostatic pressures up to 2924 atm and at temps. between 25C below the Tg to 20C above it. The reorientation activation volume for pressures less than 500 to 1000 atm and temps. above Tg decreased as the temp. was increased. For pressures greater than 1000 atm, reorientation activation volume was essentially constant for all temps. In addition, the size of reorientation activation volume indicated that the chromophore in this main chain was internally flexible. 17 refs.

USA

Accession no.817792

Item 69

Patent Number: US 6181859 B1 20010130 COATED OPTICAL FIBER AND METHOD OF MAKING THE SAME

Suzuki A; Akasaka N; Matsuda Y Sumitomo Electric Industries Ltd.

A coated optical fibre comprising a drawn glass fibre, and a primary coating and a secondary coating which are formed by photo-curing primary and secondary coating resins simultaneously applied to an outer periphery of the glass fiber, wherein an adhesion force S (g/cm) at an interface between the primary coating resin after curing and the glass fibre is at least 1/13 ((g/cm)/degree C.) with respect to a glass transition temperature Tg (degree C.) of the secondary coating resin after curing.

JAPAN; USA

Accession no.817372

Item 70

Molecular Crystals & Liquid Crystals Vol.356, 2001, p.175-83 **HYPERBRANCHED ARCHITECTURES FOR NLO POLYMERS**

Tajbakhsh A; Moratti S C; Koch A; Warner M Cambridge, University

A new approach to nonlinear optical polymer architecture was investigated. A hyperbranched polymer containing non-linear optical chromophores was synthesised in three steps. Characterisation was undertaken using FTIR, NMR, and GPC. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.817229

Item 71

Molecular Crystals & Liquid Crystals Vol.358, 2001, p.251-62 **STUDIES OF THE POLYMER-STABILIZED CHOLESTERIC TEXTURE FILMS DOPED WITH SMC**

Fuh A Y-G; Huang C-Y; Lin J-C; Lin C-H; Ko T-C Taiwan, National Cheng Kung University

Cells of polymer-stabilised cholesteric texture were fabricated by adding various ferroelectric liquid crystal dopant concentrations. The effect of adding ferroelectric liquid crystals on the electrooptical characteristics of the cells is discussed. 15 refs.

Accession no.817211

Item 72

Molecular Crystals & Liquid Crystals Vol.358, 2001, p.23-35 **PERIODIC POLYMER-DISPERSED LIQUID CRYSTAL STRUCTURES**

Sutherland R L; Natarajan L V; Tondiglia V P; Bunning T J

US, Air Force, Wright-Patterson Base

The physics of formation of periodic structures in polymer-dispersed liquid crystals were analysed. Optical properties are discussed. Experimental confirmation of the concepts is presented. Possible electro-optical applications in devices are given. 11 refs. USA

Accession no.817207

Item 73

Synthetic Metals 119, Nos.1-3, 15th March 2001, p.639-40 STUDY OF THE HIGH MOLECULAR WEIGHT MEH-PPV NLO PROPERTIES IN THE-INFRARED RANGE

Zaopo A; Dubitsky Yu; Khudyakov D; Nadtochenko V Pirelli Cavi e Sistemi SpA; Moscow,Institute of Chemical Physics

High molecular weight poly(2-(2'-ethylhexyloxy)-5methoxy-1,4-phenylene vinylene) films were prepared by spin casting onto glass substrates and the nonlinear optical properties determined using the conventional Z-scan technique over the range 1100-1700 nm. It was concluded that the polymers had applications in telecommunications devices. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; RUSSIA; WESTERN EUROPE Accession no.816577

Item 74

Synthetic Metals 119, Nos.1-3, 15th March 2001, p.579-80

PM3/FF STUDIES ON NONLINEAR OPTICAL PROPERTIES OF POLYACENE AND ITS DERIVATIVES

Hu L H; Su Z M; Wang X J; Wang C G; Wang R S; Feng J K Changchun,Northeast Normal University; Jilin,University

The nonlinear optical properties of polyacenic semiconductor materials were studied theoretically and experimentally. The influence of the substituents -NO2 and -NH2 was significant. The first-order hyperpolarisability and the second-order hyperpolarisability were determined and compared for three stable structures: equal bond length; cis-structure; and the trans-structure. The NO2 and NH2 substituted polymers were typical donor-acceptor materials, exhibiting large first-order hyperpolarisability, indicating that the ladder-type polyacene was a candidate material for nonlinear optical applications. 11 refs. CHINA

Accession no.816554

Item 75

Synthetic Metals 119, Nos.1-3, 15th March 2001, p.577-8 THEORETICAL CHEMICAL STUDY ON NLO PROPERTIES OF POLYPYRIDINOPYRIDINE AND ITS DERIVATIVES

Su Z M; Hu L H; Qiu Y Q; Sun S L; Duan H X; Feng J K

Changchun,Northeast Normal University; Jilin,University

Quantum chemical calculations were used to determine the influence of structure and the substituents -NO2 and -NH2 on the nonlinear optical properties of polypyridinopyridine. The first-order hyperpolarisability and the second-order hyperpolarisability were determined and compared for three stable structures: equal bond length; cis-structure; and the trans-structure. The introduction of NO2 and NH2 increased the effect of pullpush electron and pi-electron delocalisation, increasing the first-order hyperpolarisability. It is proposed that PPY is a promising candidate material for nonlinear optical applications. 9 refs.

CHINA

Accession no.816553

Item 76

Synthetic Metals 119, Nos.1-3, 15th March 2001, p.565-6 OPTICAL AND ELECTRONIC PROPERTIES OF THIN PDAS FILMS WITH VERY NARROW EXCITONIC BANDWIDTH

Piccardo R; Alloisio M; Moggio I; Dell'Erba C; Comoretto D; Cuniberti C; Dellepiane G Genova,Universita Soluble polycarbazolyldiacetylenes were synthesised with long alkyl chains on the carbazolyl substituents. In the solid state the chains assembled in hexagonal columnar structures, and thin films exhibited very high third order susceptibilities. The influence of the substituents on the electronic properties were studied by inserting -CO(CH2)nCH3 groups on the carbazolyl rings, so decreasing the electron-donor effect of the carbazole. The optical and electronic properties of the resulting nonbirefringent thin films were determined. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.816547

Item 77

Synthetic Metals

119, Nos.1-3, 15th March 2001, p.545-6 INVESTIGATION OF THE THIRD ORDER NON-LINEAR OPTICAL COEFFICIENTS OF A NEW POLY(HETERO-ARYLENE-ETHYNYLENE) AND ITS DERIVATIVE

Hotzel M; Rentsch S; Egbe D A M; Pautzsch T; Klemm E

Jena, Friedrich-Schiller-Universitat

Z-scan measurements on solutions of poly(2,2'bipyridine-5,5'-diylethynylene-(2,5-dioctadecyloxy-1,4phenylene)ethynylene), and a derivative of the polymer with an added ruthenium complex, were made using 130 fs pulses at 800 nm, to obtain the non-linear refractive index and the non-linear absorption coefficient. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.816542

Item 78

Patent Number: US 6180050 B1 20010130 OPTICAL FORMATION DEVICE AND METHOD Arai M; Niino T; Nakagawa T

Japan,Institute of Physical & Chemical Research; NTT Data Corp.

Disclosed is a solid model creation apparatus, which is small in size and inexpensive. A multiplicity of blue LEDs are prepared, optical fibres are connected thereto and GRIN lenses are arranged at the ends of the tips of the respective optical fibres to constitute an exposing head. The exposing head forms images of the end faces of the respective optical fibres in a photocurable resin exposure region as light spots. The diameter of a light spot is, for example, 0.5 mm, but the size of a pixel within the exposure region is much smaller, e.g. 62.5 micrometers. The multiplicity of optical fibres at the exposing head are arrayed in a matrix such that they are displaced in staggered fashion so that respective light spots are lined up at the pitch 62.5 micrometers of the pixels in the primary scan (Y-axis) direction. As the exposing head scans the exposure region in the secondary scan (X-axis)

direction, all of the light spots capable of directing light onto appropriate pixels, these being the respective pixels to be cured within the exposure region, are turned on and multiple exposure is carried out.

JAPAN; USA

Accession no.816317

Item 79

Macromolecular Rapid Communications 22, No.5, 26th March 2001, p.358-62 POLYDIETHYNYLBENZENE DERIVATIVES FOR NONLINEAR OPTICS

Zhan X; Yang M; Xu G; Liu X; Ye P Hangzhou,Zhejiang University; Chinese Academy of Sciences

Details are given of the synthesis of a new series of polydiethynyl benzene derivatives with trans structure and long conjugation side chains. Data for solubility and thermal stability are presented. Third-order nonlinear optical properties were characterised. 16 refs. CHINA

Accession no.816191

Item 80

Chemistry of Materials 13, No.3, March 2001, p.927-31 POST-FUNCTIONALISATION STRATEGY TO DEVELOP PVK-BASED NONLINEAR OPTICAL POLYMERS WITH A HIGH DENSITY OF CHROMOPHORES AND IMPROVED PROCESSABILITY

Luo J; Qin J; Kang H; Ye C Wuhan,University; Chinese Academy of Sciences

A new strategy for post-functionalisation performed on poly(N-vinylcarbazole) (PVK) is explored to develop PVK-based nonlinear optical (NLO) polymers with a high density of chromophores and improved comprehensive properties. Thus, under the standard Vilsmeier reaction conditions, PVK is partially formulated to a high degree (up to 52% molar ratio), and these formyl groups of high reactivity are condensed with cyanoacetylated DR-1 to afford a DR-1 functionalised PVK in almost complete conversion. The Tg of the resulting polymer is 185 deg.C, and the orientation behaviour of its poled film is studied by UV-visible spectroscopy. The NLO activity, estimated to be 20 pm/V by in situ second harmonic generation measurement, remains unchanged at 120 deg.C for over 1000 h after a minor initial drop. 22 refs. CHINA

Accession no.816129

Item 81

Molecular Crystals & Liquid Crystals Vol.352, 2000, p.379-88 **ELECTRO-OPTIC MODULATION OF LIGHT BY**

A PLANAR WAVEGUIDE BASED ON FERROELECTRIC LIQUID CRYSTALS

Hermann D S; De Marco F; Scalia G; Sirleto L; Righini G; Lindgren M; Abbate G Napoli,Universita Federico II; Chalmers University of Technology; CNR,Istituto di Ricerca sulle Onde Elettromagnetiche; Sweden,Defence Research Establishment; Linkoping,University

Electrooptical switching from a planar waveguide with a ferroelectric liquid crystal overlayer is presented, together with the operating principle and the parameters significant for the operation of the device. Electrooptical response times of 20 mu.us are found at best as well as a high transmittance in the ON-state of the device. The contrast ratio is 4:1 ON to OFF state. 19 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SCANDINAVIA; SWEDEN; WESTERN EUROPE Accession no.816102

Item 82

Journal of Polymer Science: Polymer Chemistry Edition

39, No.10, 15th May 2001, p.1589-95 CROSSLINKABLE MALEIMIDE COPOLYMERS FOR STABLE NLO PROPERTIES

Serhatli I E; Yagci Y; Hattemer E; Zentel R; Schmaelzlin E; Hohenadl S; Braeuchle C; Meerholz K Istanbul,Technical University; Wuppertal,Bergische Universitaet; Munchen,Ludwig-Maximilians-Universitat

Second-order non-linear optical (NLO) polymers based on epoxy-substituted methyl vinyl isocyanates and Nsubstituted maleimides were synthesised and characterised. The photocrosslinking and thermal crosslinking reactions of copolymers with different chromophore contents were studied. The electrooptical coefficients for crosslinked and non-crosslinked systems had similar absolute values and relaxation dynamics. The results were discussed. 28 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; TURKEY; WESTERN EUROPE

Accession no.815987

Item 83

Shawbury, Rapra Technology Ltd., 2000, pp.112. 30 cms., 1/6/01. Rapra Industry Analysis Series **POLYMERS FOR WIRE AND CABLE. CHANGES WITHIN AN INDUSTRY** Cousins K

Rapra Technology Ltd.

A European overview of polymer usage in the wire and cable industry is presented, which considers end-use sectors of automotive, rail transport, aerospace, building and construction, business machines and computer networks, telecommunications, power generation and distribution, electrical appliances and consumer electronics, marine, offshore and undersea cables and general engineering. Key market trends are analysed with respect to new products, processes and machinery developments. Current and anticipated effects of European legislation are also considered, including fire hazards, recycling and waste recovery issues. A section on harmonisation of cable standards and specifications is included. Recent merger and acquisition activity in the polymer manufacturing and cable making industries is analysed, and a collection of profiles of the leading companies these business sectors is given. New technology such as multilayer extrusion, new cable designs, and R & D, and the threat from wireless communication, are discussed.

EUROPE-GENERAL

Accession no.815480

Item 84

Kautchuk und Gummi Kunststoffe 54, No.3, 2001, p.106/13 DYNAMIC STIFFNESS OF NATURAL RUBBER CYLINDERS IN THE AUDIBLE FREQUENCY RANGE USING WAVE GUIDES Kari L; Eriksson P; Stenberg B Wallenberg M.,Laboratory for Sound & Vibration

Research; Sweden,Royal Institute of Technology

A waveguide model is applied in order to analyse the temperature influence on the dynamic stiffness of a cylindrical vibration isolator of natural rubber in the audible frequency rate covering 20 to 20,000 Hz and -60 to +60 degrees C. A nearly incompressible material model is applied with shear modulus based on a fractional derivative model, thereby reducing the parameter number needed to accurately fit measurement results. Employing the method of reduced variables enlarges the frequency range available from measurements. Of particular interest, are the stiffness peaks and troughs, the low-frequency stiffness, the propagating and non-propagating modes, and their dependence on temperature. 23 refs.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.815290

Item 85

Patent Number: US 6169126 B1 20010102 RADIATION-CURABLE OPTICAL FIBER PRIMARY COATING SYSTEM Szum D.M: Chawla C.P: Petisce J.P.: Pasternack

Szum D M; Chawla C P; Petisce J R; Pasternack G; Bishop T E; Snowwhite P E; Zahora E P DSM NV

Optical fibre primary coating systems are disclosed having excellent ribbon stripping and adhesion behaviour. The coatings are radiation-curable. The excellent stripping and adhesion behaviour can be inner primary coating composition having a slip enhancing component and a high modulus outer primary coating composition. Combination of means can be employed. Stripping behaviour can be measured by crack propagation and fibre friction measurements.

USA

Accession no.815112

Item 86

Synthetic Metals 119, Nos.1-3, 15th March 2001, p.43-4 EFFICIENT ELECTROLUMINESCENT POLY(P-PHENYLENE VINYLENE) COPOLYMERS FOR APPLICATION IN LEDS

Martin R E; Geneste F; Riehn R; Chuah B S; Cacialli F; Holmes A B; Friend R H Cambridge,University

Poly(p-phenylene vinylene)s containing dialkoxy substituents at the 2,3-positions of the phenylene rings were synthesised, which exhibited significantly blueshifted longest-wavelength absorption and emission bands compared with 2,3-substituted polymers. Statistical copolymers, poly(2-dimethyloctylsilyl-stat-(2,3dibutoxy-p-phenylene vinylene)) and poly(bis(2,5dimethyloctylsilyl)-stat-(2,3-dibutoxy-p-phenylene vinylene)), were synthesised by the Gilch dehydrohalogenation route. Double layer light emitting devices, consisting of indium tin oxide/polyethylene dioxythiophene/polymer/Ca, exhibited high electroefficiencies with low turn-on voltages. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.814383

Item 87

Patent Number: US 6174987 B1 20010116 POLYCARBONATES DERIVED FROM SPIROBIINDANOLS AND DIHYDROXYAROMATIC COMPOUNDS Gordon J L; Stewart K R

Molecular OptoElectronics Corp.

Disclosed are linear polycarbonates, which contain spirobiindanol derivatives regularly alternating in the polymeric chain with derivatives of dihydroxyaromatic compounds, such as biphenols and bisphenols. These clear spirobiindane-dihydroxyaromatic polycarbonates exhibit high glass transition temperatures and good mechanical and optical properties. The alternating polycarbonates are thermally stable and remain ductile even at temperatures greater than 150C. They are useful in high temperature processing and optical applications and exhibit indices of refraction that differ sufficiently from those of randomly distributed SBI/BPA polycarbonates to make them useful in the manufacture of optical waveguides.

USA

Accession no.814185

Item 88

Patent Number: US 6174961 B1 20010116 NONLINEAR-OPTICALLY ACTIVE COPOLYMERS, POLYADDUCTS PRODUCED FROM THEM, AND THEIR USE FOR NONLINEAR-OPTICAL MEDIA Kanitz A; Hartmann H; Fricke C; Kuhne K Siemens AG

The non-linear, optically active copolymers are composed of a chromophore acrylate, a glycidyl-functional acrylate and an acrylate unit. The polyadducts are produced by crosslinking these copolymers with a carboxyl-functional polyester. Both the copolymers and polyadducts possess an orientation stability in the crosslinked state and heat stability, which makes them highly suitable for producing electrooptical and photonic components.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.814163

Item 89

Revista de Plasticos Modernos 80, No.529, July 2000, p.35/7 Spanish **OPTIC FIBRES R & D CENTRE** Latti M Nextrom

An account is given of the activities of a centre established by Nextrom in Vantaa, Finland, for research and development in optic fibres and optic fibre cables. EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND; ITALY; SCANDINAVIA; WESTERN EUROPE Accession no.812732

Item 90

Patent Number: US 6162494 A1 20001219 **METHOD FOR MAKING AN OPTICAL SENSOR HAVING IMPROVED BARRIER PROPERTIES** Kimball L M; Bauer L J; Fowler W V; Lynch L E Optical Sensors Inc.

A method of making a optical sensor for measuring the pH of a fluid includes the steps of applying a solution containing (a) a cellulose acrylamide, (b) an acrylamide, and (c) a copolymerisable monomeric fluorescent indicator species to the distal end of an optical fibre and polymerising the solution to form a pH sensor means. USA

Accession no.812616

Item 91

Patent Number: US 6165394 A1 20001226 METHOD OF FABRICATING A MOLD FOR FABRICATING OPTICAL FIBER GUIDE BLOCKS

Shibata G; Yamashita T; Yoshida M

Hoya Corp.

In a grindstone for fabricating a mould which has optical fibre engagement portions of an optical fibre guide block used for aligning optical fibres, two main grinding surfaces are provided to form the optical fibre engagement portions contacted with the sides of the optical fibres and a tip end portion which is contiguous to the two main grinding surfaces and which has a contour contained within a predetermined area. The predetermined area has a triangle shape which is defined by two tangent lines along the two main grinding surfaces and a preselected line drawn between two points determined on the two main grinding surfaces. The two points are decided in accordance with a predetermined formula.

JAPAN; USA

Accession no.812575

Item 92

Patent Number: US 6171698 B1 20010109 **RADIATION CURABLE COATING COMPOSITION FOR OPTICAL FIBERS AND OPTICAL FIBERS COATED THEREBY** Khudyakov I V; Overton B J; Purvis M

Alcatel

A radiation curable coating composition for forming a primary polymeric coating having good adhesion to a glass optical fibre is disclosed. The coating composition is formed from a mixture of a base radiation curable liquid composition capable of forming a polymeric coating and a hydrolysed coupling agent mixture comprising N-beta (amin o e th y l) - g a m m a - a m i n o p r o p y l m e th y l - dimethoxysilane, N-beta (aminoethyl)-gamma-amino-propyltrimethoxysilane, isocyanatopropyltriethoxysilane and gamma-(trimethoxylsilyl)propyl acrylate.

USA

Accession no.812441

Item 93

Journal of Polymer Science: Polymer Chemistry Edition

39, No.9, 1st May 2001, p.1419-25 STUDY ON SIDE-CHAIN SECOND-ORDER NONLINEAR OPTICAL POLYIMIDES BASED ON NOVEL CHROMOPHORE-CONTAINING DIAMINES. II. COPOLYIMIDES POSSESSING DIRECT PHOTOLITHOGRAPHIC FEATURES Sui Y; Lu J-X; Yin J; Liu Y-G; Zhu Z-K; Wang Z-G

Shanghai, Jiao Tong University

Second-order nonlinear optical copolyimides were prepared by a traditional two-step process which includes a solution polycondensation followed by a chemical imidisation. Photolithographic features of the polyimides are discussed. Data concerning Tg, thermal degradation and solubilities are presented. 41 refs. CHINA

Accession no.812354

Item 94

Journal of Applied Polymer Science 80, No.9, 31st May 2001, p.1374-82 **NOVEL OPTICAL MATERIAL. POLYARYLATES WITH AZOMETHINE SIDE-CHAIN GROUPS** Zadrozna I; Myslek M

Warsaw, University of Technology

Details are given of the preparation of nonlinear optical polymers in which an aromatic polyester is a matrix and chromophores are incorporated into the form of a side chain. Monomers were based on bisaminohydroxyphenylpropane containing azomethine bond and various electron-acceptor groups as substituents in the side-chain aromatic ring. The effect of the type of the electronacceptor substituent, its substitution position in the aromatic ring with respect to the azomethine bond, and special monomer concentration on the optical, mechanical and thermal properties of the whole system was studied. 28 refs.

EASTERN EUROPE; POLAND *Accession no.812314*

Item 95

Polymer 42,No.9,p.4025-9 NONLINEAR OPTICAL PROPERTIES OF POLYMERS CONTAINING A NEW AZOPHENYLBENZOXAZOLE CHROMOPHORE

Beltrani T; Bosch M; Centore R; Concilio S; Gunter P; Sirigu A

Naples, University; ETH Zurich

Synthesis of the new highly extended chromophore 2-(4-(N,N-dihydroxyethylaminophenylazo)-phenyl)benzoxazole (I) is described. This compound is used to obtain and characterise two polyurethane polymers, by polycondensation with propyloxyterephthalic acid and 2,4-tolylene diisocyanate(II), and one obtained by polycondensation of 2-(4-N,N-bis(2-hydroxyethyl) aminophenyl)-6-nitro-benzoxazole with II. The polymers were amorphous, had good optical clarity, adequate thermal stability above the glass transition temperature, and were soluble in common organic solvents. The second order nonlinear optical behaviour of the polymers was studied by measurement of the electrooptic coefficient of films poled between parallel electrodes. The maximum measured value of this coefficient was 6.5 pm/N for a 1.552 micron incident laser wavelength. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; WESTERN EUROPE

Accession no.811087

Item 96

Macromolecules 34, No.6, 13th March 2001, p.2002-7 **NONLINEAR OPTICAL PROPERTIES AND**

CHROMOPHORE ELECTROSTATIC INTERACTIONS FOR THE POLY(ETHER KETONE) GUEST-HOST POLYMER FILMS

Shi Wei; Zhang Zhenyu; Pan Qiwei; Gu Qingtian; Ye Lina; Fang Changshui; Xu Dong; Wei Hongzhen; Yu Jinzhong

Shandong, University; Chinese Academy of Sciences

Poly(ether ketone)-chromophore 3-(1,1-dicyanothenyl)-1-phenyl-4,5-dihydro-1H-pyrazole (DCNP) guest-host system polymer films, doped with different amounts of the chromophore, were prepared. The attenuation of the macroscopic optical non-linearities at high chromophore loading was discussed. This was demonstrated by the role of chromophore electrostatic interactions at high chromophore loading in the guest-host polymer systems. 28 refs.

CHINA

Accession no.811076

Item 97

Macromolecular Rapid Communications 22, No.3, 23rd Feb.2001, p.185-8 LARGE PHOTOINDUCED REFRACTIVE INDEX CHANGE IN A POLYIMIDE FILM BY CHARGE-TRANSFER COMPLEX FORMATION WITH A POLYMER-BOUND PHENYLAZIDE FRAGMENT

Kashiyama Y; Jionghao He; Machida S; Horie K Tokyo,University

A large photoinduced change in the refractive index was observed for thermally stable transparent precursor films containing phenylazide upon imidisation. The phenylazide fragment formed a charge-transfer complex with the imide group. In contrast to conventional polyimide films, the samples examined maintained high transparency in the visible range of the spectrum. This value of refractive index change was adequate for the manufacture of thermally stable channel waveguides and other optical devices. 27 refs.

JAPAN

Accession no.810868

Item 98

Macromolecules 34, No.5, 27th Feb.2001, p.1493-5 SYNTHESIS AND NONLINEAR OPTICAL PROPERTIES OF A NEW SYNDIOREGIC MAIN-CHAIN HYDRAZONE POLYMER

Hayden L M; Kim W-K; Chafin A P; Lindsay G A Maryland, University; US, Navy

A syndioregic main chain hydrazone polymer was synthesised and the nonlinear optical properties of films, prepared by solution casting followed by corona polling, were studied. The thermal stability of the second-order optical susceptibility was determined by measuring the second harmonic generation whilst heating the sample at a rate of 10 C/min. The nonlinearity was stable up to 140 C, and retained 90% of the original value following storage at 100 C for 100 h. The relatively low nonlinearity of the polymer was attributed to the incorporation of a low beta chromophore. 17 refs.

USA

Accession no.810723

Item 99

Patent Number: US 6166156 A1 20001226 METHOD FOR MAKING PHOTOCURABLE HALOFLUORINATED ACRYLATES Wu C; Xu B; Yardley J T

Halofluorinated alkylene monomers are made by a method comprising the steps of: (a) subjecting a first polymer which is the reaction product of a fluorinated vinyl monomer and a vinyl comonomer to dehydrohalogenation to form a second polymer; (b) treating the second polymer with an oxidising agent to form an oxidation product consisting of a alpha, omega-dicarboxylic acid or an ester derivative thereof; and (c) treating said oxidation product with a reducing agent to form a reduction product consisting of a alpha, omega-diol. Preferably, the first polymer has a structure of -(CH2 CYZ(CF2 CFX)n)m wherein X and Y=F, Cl or Br; X and Y may be the same or different; Z=H, F, Cl, Br, alkyl or perfluoroalkyl containing from about 1 to about 10 carbon atoms; n=an integer larger than about 1; and m is an integer between about 2 and about 10.sub.5. The alpha, omegadicarboxylic acids and alpha, omega-diols produced herein can be directly used as polycondensation monomers. Alternatively, the alpha, omega-dicarboxylic acids and alpha, omega-diols can be further derivitised to tri-, tetra- or other multifunctional alcohols which may be directly used as condensation monomers or they may be converted to acrylates which may be photocured in the presence of a radical photoinitiator into transparent polymers which are useful as optical waveguiding materials.

USA

Accession no.810268

Item 100

Polymers for Advanced Technologies 12, Nos.3-4, March-April 2001, p.231-6 **BRANCHED EPOXY COPOLYMERS WITH OLIGO(BENZOATE) SIDE CHAINS CARRYING DONOR AND ACCEPTOR FUNCTIONS IN EACH END**

Kimura T; Fukuda T; Matsuda H; Komoriya A; Kazama M; Kato M; Okada S; Nakanishi H Japan,National Institute of Materials & Chemical Research; Tokyo,Science University; Tohoku,University

Branched epoxy copolymers are synthesised with oligobenzoate to create unique second-order non-linear

optical (NLO) active polymers (PEA3-C3, PEA3-C3F6 and PEA3-K) on the basis of new architecture. The cutoff wavelength of these polymers is satisfactorily shorter than the visible region. Second-order NLO properties for poled polymer films thus synthesised are investigated. These polymer films, after poling treatment, exhibit good transparency in visible region and the second-order nonlinear optical coefficient. 14 refs.

JAPAN

Accession no.810202

Item 101

Synthetic Metals 117, Nos.1-3, 15th Feb.2001, p.237-9 SYNTHESIS OF POLY(ALKOXYPHENYLENE VINYLENE-CO-PHENYLENE VINYLENE) TYPE COPOLYMERS AND ELECTRO-OPTIC PROPERTIES

Lee Soon Park; Yoon Soo Han; Sang Dae Kim; Dong Uk Kim

Kyungpook, National University; Taegu, University

Poly(2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylene vinylene-co-1,4-phenylene vinylene) (poly(MEHPV-co-PV) copolymers, synthesised by dehydrohalogenation with potassium t-butoxide, showed random copolymer behaviour. Poly(MEHPV-alt-PV) copolymers were synthesised by the Horner-Emmons condensation reaction. Single layer light-emitting diodes were fabricated using poly(1,4-phenylene vinylene) (PPV), MEH-PPV, poly((MEHPV-co-PV)S and poly(MEHPV-alt-PV) as emitting materials. The maximum wavelength of electroluminescence for the poly(MEHPV-co-PV) with a MEHPV content of 61 mol% was closer to that of PPV than was that of poly(MEHPV-alt-PV). Reasons for this were discussed. 6 refs.

SOUTH KOREA

Accession no.809683

Item 102

Patent Number: US 6140404 A1 20001031 NON-LINEAR OPTICAL MATERIAL AND PROCESS FOR THE PREPARATION THEREOF Ono Y; Sato K Fuji Xerox Co.Ltd.

This non-linear optical material, which is not susceptible to modification by a cuprous halide incorporated therein, is produced at a low temperature by means of a simple apparatus. It exhibits a non-linear response to incident light and comprises a particulate cuprous halide dispersed in a matrix, the cuprous halide having been separated out with the reaction of a functional group contained in a matrix-forming substance having a functional group. The matrix contains a compound for inhibiting the modification of the cuprous halide. The non-linear optical material may be produced by mixing a mixture of a matrix-forming substance having a functional group and a compound for inhibiting the modification of a cuprous halide with a cuprous halide to form a uniform solution, and then allowing the functional group to undergo reaction to form a matrix while causing a particulate cuprous halide to separate out in the matrix.

JAPAN; USA

Accession no.809200

Item 103

Patent Number: US 6136880 A1 20001024 RADIATION-CURABLE LIQUID RESIN COMPOSITION FOR COATING OPTICAL FIBERS

Snowwhite P E; Bishop T E; Szum D M; Komiya Z; Ishikawa M; Ukachi T DSM NV; JSR Corp.

A radiation-curable composition for optical fibre coatings comprising about 10 wt.% to about 90 wt.% of at least one radiation-curable oligomer (A), about 10 wt.% to about 90 wt.% of at least one radiation-curable monomer diluent (B), and an effective amount of at least one photoinitiator (C) represented by a given formula wherein Ar1 to Ar3 are aromatic groups which may have one or more substitution groups.

JAPAN; USA

Accession no.808955

Item 104

Patent Number: US 6137935 A1 20001024 METHOD FOR FABRICATING AN OPTICAL CABLE

Bohme R; Wichura D; Nothofer K Alcatel

At least one optical fibre is surrounded by an extruded tubular sheath, which comprises an inner layer and an outer layer and is produced in a single operational step. Tension elements are embedded in the tubular sheath for increasing the tensile strength of the tubular sheath. The optical cable is particularly suited as an indoor cable or as a non-self-supporting cable for installation on ground wires or phase wires of high voltage transmission lines. EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.808501

Item 105

Journal of Materials Science Letters 20, No.1, 1st Jan.2001, p.55-6 DETECTION OF SIMULATED ACOUSTIC EMISSION WITH MICHELSON INTERFEROMETRIC FIBER-OPTIC SENSORS Tsuda H; Koo J-H; Kishi T AIST

Details are given of the response of Michelson interferometric fibre-optic sensors to acoustic emission

simulated by pencil lead break. Two types of simulated acoustic emission sources with different directionality of the source motion were given to a thin CFRP plate. Response of the fibre-optic sensor to acoustic emission was compared with that of a conventional acoustic emission sensor. 7 refs.

JAPAN

Accession no.808089

Item 106

Macromolecules 34, No.2, 16th Jan.2001, p.253-61 PROGRESS TOWARD DEVICE-QUALITY SECOND-ORDER NONLINEAR OPTICAL MATERIALS. 4. A TRILINK HIGH MU BETA NLO CHROMOPHORE IN THERMOSET POLYURETHANE: A "GUEST-HOST" APPROACH TO LARGER ELECTROOPTIC COEFFICIENTS

Cheng Zhang; Chuanguang Wang; Dalton L R; Hua Zhang; Steier W H Southern California,University

A trilinkable thiophene-containing second-order nonlinear optical chromophore was synthesised from a trilinkable donor bridge and a tricyanofuran electron acceptor. A thermal stability study of this chromophore indicated that the free hydroxyl group located close to the cyano acceptor resulted in the chromophore decomposing at a much lower temperature than such chromophores with no hydroxyl groups. The thermal stability of the chromophore in PU film was significantly improved by masking the free hydroxyl groups with TDI. An enhancement of over 150% in poling efficiency could be achieved by reducing the degree of chromophore attachment to the polymer backbone before applying an electric poling field through a "guest-host" approach. Anchoring the chromophores to a three-dimensional crosslinked PU network at three points enhanced the thermal stability of poling induced electrooptical activity by 33C. 14 refs.

USA

Accession no.807925

Item 107

Macromolecules

34, No.2, 16th Jan.2001, p.235-43 ELECTRIC POLING AND RELAXATION OF THERMOSET POLYURETHANE SECOND-ORDER NONLINEAR OPTICAL MATERIALS: ROLE OF CROSS-LINKING AND MONOMER RIGIDITY

Cheng Zhang; Chuanguang Wang; Jinglin Yang; Dalton L R; Guilin Sun; Hua Zhang; Steier W H Southern California,University

A high mu beta isophorone-derived phenyltetraene chromophore (CLD-5) was prepared. This was modified

with a hexyl group in the middle of the pi-conjugated bridge to improve solubility and processability and was dihydroxy-functionalised for covalent incorporation into crosslinked PU polymer systems. When the chromophore was incorporated into a TDI/triethanolamine (TEA) system, the electrooptical coefficient was 57.6 pm/V at 1.06 micrometres. This was 28% higher than that obtained with the nonhexylated chromophore in this system. Two new PU systems, poly((phenyl isocyanate)-coformaldehyde) (PPIF)/TEA and PPIF/bisphenyl-1,1'dimethanol (BPDM) were used to study the effect of crosslink density and monomer rigidity on electrical field poling of chromophore dipoles and relaxation behaviour of poling-induced chromophore alignment. CLD-5/PPIF/ TEA had the highest crosslink density (3.07 mmol/g) of the PU systems studied. It gained 38C in thermal stability but lost 50% of electrooptical activity compared with the CLD-5?TDI/TEA system, which had a crosslink density of 1.19 mmol/g. A higher electrooptical coefficient, lower optical loss and the highest dynamic stability were obtained for the CLD-5/PPIF/BFDM system. This had the lowest crosslink density and the most rigid monomers. Thus, excessive crosslinking had an adverse effect on electrical poling of PU systems and crosslinking alone was not enough to provide very high thermal stability of electric field-induced chromophore alignment. Using a rigid monomer was important to obtain both good thermal stability and high poling efficiency. 11 refs.

USA

Accession no.807924

Item 108

Polymer 42, No.7, 2001, p.3023-31 **SYNTHESIS AND CHARACTERIZATION OF PHOTOCONDUCTING NON-LINEAR OPTICAL POLYMERS CONTAINING INDOLE-BENZOXAZOLE MOIETY**

Hwang J; Moon H; Seo J; Park S Y; Aoyama T; Wada T; Sasabe H Seoul,National University; Japan,Institute of Physical & Chemical Research

2-(3-(6-Nitro-benzoxazol-2-yl)-indol-1-yl)ethanol(I) was synthesised for use as a photoconducting non-linear optical(NLO) chromophore with thermal and photochemical stabilities and broad transparency in the visible region. Methacrylate and acrylate esters of I were synthesised and subsequently copolymerised with methyl methacrylate and methyl acrylate, respectively, to give photoconducting NLO polymers. In order further to enhance the photoconductive sensitivity, hydrazonecontaining methacrylate monomer was also copolymerised with I. In addition, studies were conducted of the use of the photoconducting plasticiser N'-(9-(2ethylhexyl)-9H-carbazol-3-ylmethylene)-N,Ndiphenylhydrazone was mixed with simple copolymer to give polymer composites with enhanced photoconductivity and reduced Tg. Photorefractivity was demonstrated for the 70:30 copolymer/plasticiser composite doped with 0.2% thiapyrilium salt through twobeam coupling and four-wave mixing. 20 refs.

JAPAN; SOUTH KOREA *Accession no.807203*

Item 109

Journal of Materials Chemistry 11, No.2, Feb.2001, p.312-20 SYNTHESIS AND THIRD ORDER NONLINEAR OPTICS OF A NEW SOLUBLE CONJUGATED PORPHYRIN POLYMER

Screen T E O; Lawton K B; Wilson G S; Dolney N; Ispasoiu R; Goodson T; Martin S J; Bradley D D C; Anderson H L

Oxford,University; Wayne State,University; Sheffield,University

A soluble conjugated porphyrin polymer was prepared. MALDI-TOF mass spectra showed the presence of oligomers with up to 13 repeat units and GPC gave a Mn of 53 kDa. The electronic absorption spectra of this polymer exhibited an intense Q band at 800 nm in solution and 853 nm in the solid state, demonstrating a high degree of conjugation. Electroabsorption spectroscopy showed that thin films of the porphyrin polymer had lower resonant third-order non-linear optical susceptibility than the authors' previously-prepared conjugated porphyrin polymer, whereas closed z-scan measurements indicated that the off-resonance real susceptibility, at 1064 nm, was very large for both polymers. Open z-scan measurements were also made at 1064 nm, demonstrating that the two polymers exhibited similar non-linear absorption at this wavelength. 32 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.807146

Item 110

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.467-70 LIGHT-EMITTING ELECTROCHEMICAL CELL (LEC) USING POLYTHIOPHENE DERIVATIVE Han E-M; Gu H-B; Jin S-H; Lee S-H; Moon S-B; Kim

W-H; Lee K-S Chonnam,National University; Pusan,National University; Samsung Advanced Institute of Technology

Solid-state polymer light-emitting electrochemical cells are fabricated using thin films of blends of polymer electrolytes and urethane-containing polythiophene (PURET) material. Various types of polymer electrolytes, such as polyacrylates and polyether esters, are prepared. The devices emit orange-red light with the maximum intensity at 590 nm at room temperature. The typical voltage (V) - current density (I) - luminance characteristics of an ITO/PURET+ polymer electrolyte complexed with LiClO4/Al cell under forward and reverse bias conditions are measured. The I-V curve is symmetric at zero bias. The apparent threshold voltages for current injection and visible light emission are around 2~3V. 5 refs. KOREA

Accession no.806512

Item 111

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.455-8 IMPROVED QUANTUM EFFICIENCY BY OVERNEUTRALISATION OF IONOMERS USED IN POLYMER LIGHT-EMITTING DIODES Lee T-W; Park O O; Do L-M; Zyung T Korea,Advanced Institute of Science & Technology; Korea,Electronics & Telecommunications Research Institute

Polymer light-emitting diodes are fabricated using poly(2methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene) as an emissive material, and sodium sulphonated PS (SSPS) ionomers with several different neutralisation levels as an electron injecting and hole blocking layer. The SSPS with higher neutralisation level makes the EL device more efficient. Highest efficiency is found at 200% overneutralisation of the ionomer. The main reason for this is that overneutralisation in the ionomer helps to form a more favourable morphology to block holes better by tightening the cluster. 4 refs.

KOREA

Accession no.806509

Item 112

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.431-4 SYNTHESIS OF CONJUGATED POLYMERS CONTAINING BIPHENYL GROUP AND THEIR ELECTRO-OPTICAL PROPERTIES Park L S; Han Y S; Kim S D

Korea, Kyungpook National University

Two types of conjugated polymer, poly(MEHPV-co-BPV)s and poly(MEHPV-alt-BPV), are synthesised by dehydrohalogenation and Horner-Emmons condensation, respectively. Single layer type lightemitting diodes are fabricated utilising synthesised polymers and their electro-optical properties are examined. Emission spectrum of poly(MEHPV-co-BPV)s have two peaks in the blue and orange region which originate from BPV and MEHPV moiety respectively. This may be due to the mixture of two homopolymers or the macroblock nature of the BPV and MEHPV unit in the poly(MEHPV-co-BPV)s. However, LED made from poly(MEHPV-alt-BPV)s shows a relatively sharp single peak at the yellow-green region due to the alternating nature of the repeat units. 4 refs. KOREA

Accession no.806503

Item 113

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.111-4 **HIGH TG POLYARYLATE THIN FILMS FOR PHOTONIC DEVICE APPLICATIONS**

Sugihara O; Tomiki M; Fujimura H; Egami C; Okamoto N; Fujiwara M; Yasue K Shizuoka,University; Unitika Ltd.

Polyarylates (PARs) with high glass transition temperature are used for photonic devices. Optical properties are investigated. PARs show high thermal stability as well as high optical transparency. Electron-beam lithography can be performed using PAR thin films and high-resolution surface relief gratings are fabricated by direct electron-beam writing technique together with thermal development. 3 refs. JAPAN

Accession no.806471

Item 114

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.99-102 **RIGIDITY DEPENDENCE OF ALIGNMENT AND RELAXATION IN MAIN-CHAIN NONLINEAR OPTICAL POLYMERS MEASURED BY OPTICAL AND ELECTRICAL METHOD** Choi H-J; Lim T K; Keong M-J; Wu J W; Lee K-S; Lee S-M; So B-K

Korea, University; Ewha Womens University

The dynamics of two main-chain non-linear optical polymers, PA-PS and PA-MS, are studied at various temperatures below Tg. In the characterisation, both photo-induced isomerisation method and second harmonic generation are employed. In the case of non-polar alignment by the linearly polarised UV light, the main-chain of PA-PS polymer is found well re-aligned but the main-chain of PA-MS polymer is not, because of the high rigidity. In the case of polar alignment by in-situ corona poling technique, double exponential functions fit well to the data of both PA-PS and PA-MS polymer relaxation data at all the temperature range. 5 refs. KOREA

Accession no.806469

Item 115

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.71-4 **POLYMERIC OPTICAL WAVEGUIDES USING FLUORINATED POLYIMIDES**

Han K; You K; Kim E; Kim J; Jang W-H; Rhee T H Samsung Electronics Co.Ltd.

Fluorinated polyimides with high thermal stability and low optical absorption loss are investigated for waveguide application. Rib-type optical waveguides are fabricated using these fluorinated polyimides. 5 refs. KOREA

Accession no.806463

Item 116

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.67-70 SECOND-ORDER NONLINEAR OPTICAL ACTIVE POLYMETHACRYLATE AND POLYESTER CONTAINING A METHLSULPHONYLBENZOTHIAZOLE AZO CHROMOPHORE

Kang J S; Kim J H; Lee C J; Choi D H Kyung Hee,University; Korea,Institute of Science & Technology

Second-order non-linear optical copolymers are synthesised to study effect of temperature on the temporal stability of the electro-optic effect. Heterocyclic azo chromophore is synthesised to be anchored to methacrylate and naphthalate polymer backbone. The decaying behaviour of the electro-optic response is traced at different temperatures. The rates of relaxation are considered based on the difference in the polymer structure. 3 refs.

KOREA

Accession no.806462

Item 117

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.63-6 ORIENTATIONAL RELAXATION DYNAMICS IN METHACRYLATE POLYMERS BY MEANS OF IN-SITU MEASUREMENT OF THE ELECTRO-OPTIC PROPERTY

Hong H T; Cho K Jchoi D H Kyung Hee,University

Side chain second-order non-linear optical (NLO) polymers are synthesised to study the relaxation dynamics of the electro-optic effect. 2-(Methyl-(4-(2-(4-nitrophenyl)-vinyl)-phenyl)-amino)-ethanol is synthesised to be bound to methacrylate repeating unit. Homopolymer and copolymer are synthesised to compare the temporal relaxation behaviour of second-order NLO properties. A real time poled and probe technique is employed to investigate the relationship between measurement temperature and electro-optic (EO) properties. The relaxation behaviour of the EO effect is analysed below and above the glass transition temperature. 4 refs.

KOREA

Accession no.806461

Item 118

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.31-4 PHOTOREFRACTIVE PROPERTIES IN A LIQUID CRYSTAL PANEL WITH PORPHYRIN DISPERSED PVK LAYERS

Kim H-S; Kyong C-S; Sung G-Y; Kim M-R; Kim T-G; Ha C-S; Kwak C-H; Lee J-K Pusan, National University; Yeungnam, University

Orientational photorefractive in nematic liquid crystals (NLC) on a poly(N-vinyl carbazole) film dispersed with 5, 10, 15, 20-tetra-phenylporphyrinatozinc across polyvinyl alcohol film are observed. The maximum diffraction efficiency of 0.3-0.5% is measured. 3 refs. KOREA

Accession no.806453

Item 119

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.23-6 SPONTANEOUS ORDERING OF NONLINEAR OPTICAL GROUPS IN A POLYMER THIN FILM THROUGH CROSS-LINKING

Jung C; Lee C H; Ko J E; Lee H; Kim D; Rhee B K Sogang,University

Polymer thin films with non-linear optical groups are prepared by spin-coating Poly-DR1-(anthranilic acid) on glass substrates. The films are heated to different temperatures and cooled down to obtain samples with various degrees of crosslinking. The visible absorption decreases for samples annealed at high temperatures. Strong second-harmonic signal generated from the polymer film indicates that the non-linear side chains of the polymer are macroscopically aligned through the heat treatment without external field. 4 refs.

KOREA

Accession no.806451

Item 120

Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.15-8 SIMPLE FABRICATION OF NONLINEAR GRATINGS IN POLYMER FILM USING SIMULTANEOUS PROCESS OF EMBOSS HEATING AND THERMAL POLING

Nakanishi M; Yamaji H; Sugihara O; Fujimura H; Egami C; Okamoto N Shizuoka,University

A simple fabrication technique of nonlinear polymeric optical waveguide patterns based on the simultaneous process of emboss heating and poling is introduced. The polyimide film on the nickel plate is used as master grating. The condition of the fabricated pattern depends on removal temperature and the stability of the master grating is investigated. The submicron surface relief grating with X is realised in the NLO polymer film. 5 refs.

JAPAN

Accession no.806449

Item 121 Molecular Crystals & Liquid Crystals Vol.349, Sept.2000, p.1-4

NOVEL CHROMOPHORES FOR HIGHLY EFFICIENT PHOTOREFRACTIVE MATERIALS

Jahng W S; Yoo D; Moon H; Moon I JK; Shin D-H; Joo M; Lee E; Kim N Seoul,National University

Barbituric acid derivatives are synthesised as electro-optic chromophores for photorefractive application. When doped with new chromophores the photorefractive composites, which consist of polysiloxane with pendant carbazole as photoconducting host, show very large gain coefficient. 5 refs.

KOREA

Accession no.806446

Item 122

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.497-500 CAVITY MODE POLARISATION SPLITTING IN ORGANIC SEMICONDUCTOR MICROCAVITIES

Virgili T; Lidzey D G; Bradley D D C; Walker S Sheffield,University

Angular-dependent reflectivity techniques are used to probe the optical structure of microcavities containing a passive spacer layer, and also a fluorescent polymer, poly(9,9-dioctylfluorene) (PFO), which was deposited between a dielectric and an aluminium mirror. The reflectivity spectra exhibit a strong polarisation dependence with the cavity mode energy and photon linewidths of the cavity mode different for the TE (transverse electric) and TM (transverse magnetic) polarisations. It was found that as the cavity mode is moved away from the centre of the dielectric mirror stopband, the difference between the energy of the TE and TM mode increases. This results in a significant splitting of up to 110 meV between the TE and TM polarisations detected at large angle. This effect was investigated by varying the energy of the cavity mode with respect to the centre of the mirror stop-band. Results are analysed using a transfer-matrix model. Photoluminescence emission from the PFO-containing microcavity was also measured. A splitting between TE and TM modes was found, which is also manifested in the photoluminescence (PL) emission. This allows control of polarisation from an isotropic film, presenting a new method to control exciton emission. 14 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.806444

Item 123 Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.445-8 SYNTHESIS OF THIN FILM PHOTONIC CRYSTALS

Subramania G; Constant K; Biswas R; Sigalas M M; Ho K-M Iowa State University

A procedure is described for fabricating thin film photonic crystals at optical length scales from a ceramic slurry of nanocrystalline titania and polystyrene spheres. Selfassembly of the spheres is performed simultaneously with the introduction of the dielectric background. Thin film photonic crystals are grown on glass or semiconductor substrates. The photonic crystals are characterised with both surface and cross-sectional scanning electron microscope images. The photonic crystals exhibit a reflection peak and transmission dip at the wavelength of the first stop band. 13 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806442

Item 124

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.439-43 SITE-SPECIFIC SELF-ASSEMBLY OF SI/SIOX NANOPARTICLES ON MICROPATTERNED POLY(DIMETHYLSILOXANE) THIN FILMS Phely-Bobin T S; Muisener R J; Koberstein J T; Papadimitrakopoulos F Connecticut,University; Columbia University;

ESSILOR

Recent efforts have focused on the design of 2D and 3D assemblies with the goal of creating highly ordered supramolecular structures. Ultrathin films patterned with topologically different surface chemical functionality may be used as a template for such elaborate architectures. Surface functionalisation can be used to impose site-specific assembly and can further lead to the fabrication of highly ordered structures, of great importance in the microelectronic and optoelectronic industries. The fabrication of surface modified Si/SiOx nanoparticles and their self-assembly on various surfaces have recently been demonstrated, and this paper reports the specific self-assembly of Si/SiOx nanoparticles on poly(dimethylsiloxane) (PDMS) spin-cast films. The desire to create regions of SiOx, which coexist with silicones in a two-dimensional film, is motivated by the difference in surface energies and affinity contrast between SiOx and PDMS. As presently reported, the selectivity of the deposition of Si/SiOx nanoparticles on PDMS versus UV/ozone converted SiOx offers a great opportunity for the fabrication of periodic structures with large modulation in refractive index. 29 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806441

Item 125 Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.389-91 **MOBILITY VARIATION WITH FIELD IN CONDUCTING POLYMER FILMS** Rakhmanova S V; Conwell E M Rochester,University

Poole-Frenkel (P-F) behaviour, i.e. the exponential dependence of the mobility on the square root of the electric field intensity, has been found for many conducting polymer films. It has been suggested that, as in molecularly doped polymers, this dependence is due to the interaction between the charge carriers and randomly distributed permanent dipoles. However, the dipole concentration in the polymers is much too small. Monte Carlo simulations show that introduction of short-range correlation between the energies of the hopping sites, on the scale of the coherence length measured by X-rays, can account for the measured field and temperature dependence of MEH-PPV films. It is also shown that homogeneity, while still permitting P-F behaviour, has important effects on the size, field dependence and temperature dependence of the mobility. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806440

Item 126 Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.385-8 **HIGH HOLE MOBILITY IN THE MOLECULARLY ORDERED OLIGOSILANES** Okumoto H; Yatabe T; Shimomura M; Kaito A; Minami N; Tanabe Y

Japan, National Institute of Materials & Chemical Research

A single-dispersed oligosilane with a mesophase (smectic B) was used to fabricate molecularly ordered films. Their carrier transport properties were examined by the time-offlight (TOF) transient photocurrent technique. In polycrystalline films of permethyldecasilane, molecular orientation almost parallel to bias electric field and a multilayered structure were found, possessing large domain size (greater than 20 microns). This unique molecular order resulted in non-dispersive TOF photocurrent with a clear plateau, whose hole mobility exceeded 0.001 sq. cm/V s at 293 K. The high carrier mobility with small distribution can be ascribed to their well-ordered hopping sites. The unprecedented structure together with possible control of hopping sites makes oligosilanes a new class of hole transport materials. 11 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

JAPAN

Accession no.806439

Item 127

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.373-7 ELECTROSTATIC SELF-ASSEMBLY AS A MEANS TO CREATE ORGANIC PHOTOVOLTAIC DEVICES

Durstock M F; Taylor B; Spry R J; Chiang L; Reulbach S; Heitfeld K; Baur J W Wright-Patterson Air Force Base; Dayton,University,Research Institute; Taipei,National Taiwan University

Much work has recently been done on making photovoltaic devices (solar cells) from thin films of conjugated polymers and other organic systems. The advantages over conventional inorganic systems include the potential to create lightweight, flexible and inexpensive structures, but the challenge has been to create more highly efficient devices. To date, the primary photovoltaic device mechanism used is that of photoinduced charge transfer between an electron donor and acceptor. In this study, similar photovoltaic devices are fabricated using a water-based electrostatic selfassembly procedure, as opposed to the more conventional spin-coating and/or vacuum evaporation techniques. In this process, layers of oppositely charged species are sequentially adsorbed onto a substrate from an aqueous solution and a film is built up due to the electrostatic attraction between the layers. The technique affords molecular level control over the architecture and gives bilayer thickness values of the order of tens of angstroms. By repeating this process a desired number of times and using different cations and anions, complex architectures can be created with very accurate control over the thickness and the interfaces. A number of systems are examined, built from a variety of components including a cationic PPV precursor, functionalised C60, and numerous other polyelectrolytes. The device characteristics of these films are reported as well as the overall applicability of this technique to the fabrication of photovoltaic devices. 19 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

TAIWAN; USA

Accession no.806437

Item 128

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.369-72 ORGANIC LIGHT EMITTING DIODES FABRICATED WITH SINGLE WALL CARBON NANOTUBES DISPERSED IN A HOLE CONDUCTING BUFFER: THE ROLE OF CARBON NANOTUBES IN A HOLE CONDUCTING POLYMER

Woo H S; Czerw R; Webster S; Carroll D L; Park J W; Lee J H

Clemson,University; Chungju,National University; Samsung Advanced Institute of Technology

In order to investigate the role of single wall carbon nanotubes (SWNTs) in a hole conducting polymer, organic light emitting diodes (OLEDs) were fabricated with a conjugated emissive copolymer, poly(3,6-N-2ethylhexyl carbazolyl cyanoterephthalidene) (PECCP) and SWNTs dispersed in a hole conducting buffer polymer, polyethylene dioxythiophene (PEDOT). Devices made with SWNTs dispersed in PEDOT and devices made without SWNTs in the PEDOT emit green light at 2.37 eV, as expected for PECCP. However, it was observed that the device made with SWNTs in the buffer layer shows a significant decrease in the electroluminescence (EL) compared to that of the device without the SWNTs. In contrast, the photoluminescence (PL) from the same organic layer combination, excited from the PECCP side and measured through the PEDOT and the indium tin oxide glass, shows very little difference between the films with and without the SWNTs. The current-voltage characteristics of OLEDs with SWNTs show a lower current-voltage power dependence near 1-2 V than that of the device without SWNTs. The EL and the currentvoltage data, together with the PL, suggest an electronic interaction between the SWNTs and the host polymeric material, PEDOT. It is proposed that this electronic interaction originates from the hole trapping nature of SWNTs in a hole conducting polymer. 14 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

SOUTH KOREA; USA *Accession no.806436*

Item 129

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.363-7 **MODE CHARACTERIZATION OF MICRORING POLYMER LASERS** Polson R C; Levina G; Vardeny Z V Utah,University

Conducting polymer films coated on circular glass fibres offer a low loss, high Q resonance structure for investigating photopumped lasers. The high Q structure allows simplification of the boundary conditions, that the field goes to zero at the boundary. Solutions of the wave equation are then simply integer Bessel functions of high order. The product of the refraction index and the microring radius is needed to several decimal places to successfully assign spectral emission lines to the appropriate Bessel function. A Fourier transform of the emission spectra consists of a series of diminishing peaks with a spacing given by the product of the refraction index and the microring radius. This evaluated product can then be used to calculate the laser emission. 6 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. USA

Accession no.806435

Item 130

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.357-62 NANOENGINEERING OF ORGANIC SEMICONDUCTORS FOR LIGHT-EMITTING DIODES: CONTROL OF CHARGE TRANSPORT Lupton J M; Samuel I D W; Beavington R; Burn P L;

Baessler H Durham,University; Oxford,University;

Marburg, Universitat

The effect of intermolecular interactions on the properties of organic semiconductors was investigated using a family of conjugated dendrimers as model systems. Increasing the amount of branching, or generation number, of these molecules reduces the degree of interaction between the chromophores. The effect of this on both photophysical and charge transporting properties is reported. It is found that an increase in generation gives rise to a reduction in the red tail emission of the dendrimer. Time of flight measurements show a slowing of charge transport with increasing generation, which is found to be related to the films becoming more insulating. The results show that dendrimer generation provides an elegant way of controlling intermolecular interactions. 20 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.806434

Item 131

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.353-6 SPECTROSCOPY OF CONDUCTING AND INSULATING LADDER-TYPE POLY(PARA-PHENYLENE) DEVICE STRUCTURES

Wohlgenannt M; List E J W; Zenz C; Leising G; Graupner W; Vardeny Z V Utah, University; Graz, Technische Universitat; Virginia, Tech

Electroabsorption (EA) and charge-induced absorption (CIA) spectroscopic techniques were applied to methylsubstituted ladder-type poly(para-phenylene) (m-LPPP) sandwich device structures. The device structures were either of conducting (ITO/m-LPPP/Al) or insulating ((ITO/SiO/m-LPPP/Al) type. For both devices a CIA band with its 0-0 transition at 1.95 eV was observed. From a comparison with doping induced and photoinduced absorption spectra this band was assigned to polarons. In addition, in the insulating device a derivative-like band with zero crossing was observed at 1.15 eV. In the conducting device two derivative bands were observed with zero crossing at approx. 0.8 and 1.2 eV, respectively. Their intensity increased linearly with the modulus of the applied electric field and the features were independent of the modulation frequency. These derivative-like bands were tentatively assigned to a Stark-effect related to charge transitions at the ITO and Al electrodes. At high currents in the conducting device a relatively broad, structureless CIA band peaking at 1.3 eV was also observed, which was assigned to bipolarons. 10 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE Accession no.806433

Item 132

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.343-7 PHOTOVOLTAIC CELLS BASED ON IONICALLY SELF-ASSEMBLED NANOSTRUCTURES

Piok T; Brands C; Neyman P J; Erlacher A; Soman C; Murray M A; Schroeder R; Graupner W; Heflin J R; Marciu D; Drake A; Miller M B; Wang H; Gibson H; Dorn H C; Leising G; Guzy M; Davis R M Virginia,Tech; Graz,Technische Universitat

The technique of ionically self-assembled monolayers (ISAMs) was used to produce photovoltaic devices of well-controlled thickness and composition. The ISAM nanostructure fabrication method simply involves the alternate dipping of a charge substrate into aqueous cationic and anionic solutions at room temperature. Several approaches were employed to combine the tetrahydrothiophenium precursor of poly(para-phenylenevinylene) (PPV) with fullerenes and other organic materials. Modulation spectroscopy was used for the electrooptical characterisation of the ISAM devices. The modulation frequency dependence of the photocurrent can be assigned to the influence of trapped charges taking part in the photovoltaic process. 25 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE Accession no.806432

Item 133

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.333-7 AGGREGATION QUENCHING IN THIN FILMS OF MEH-PPV STUDIED BY NEAR-FIELD SCANNING OPTICAL MICROSCOPY AND SPECTROSCOPY Huser T; Yan M Lawrence Livermore National Laboratory

Aggregates in thin films of conjugated polymers form excimer states and significantly reduce the photo- and electroluminescence efficiency in devices produced from these materials. Aggregate formation in thin films of poly(2-methoxy,5-(2'-ethyl-hexyloxy)-p-phenylene vinylene) (MEH-PPV) was studied using near-field scanning optical microscopy and spectroscopy. Local photoluminescence spectroscopy and photobleaching experiments were used to show that thin films of MEH-PPV are homogeneously aggregated and do not form aggregated domains. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806431

Item 134

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.317-20 DELOCALIZED POLARONS IN SELF-ASSEMBLED POLY(3-HEXYL THIOPHENE) NANOCRYSTALS

Oesterbacka R; An C P; Jiang X M; Vardeny Z V

The characteristic properties of charged excitations (polarons) in thin films of regioregular poly(3hexylthiophene) (RRPHT) are studied using optical spectroscopy. It was found that the increased interchain coupling that exists in self-assembled lamellae in these films drastically changes the properties of the polaron excitations. The traditional self-localised polaron in one dimension delocalises in two dimensions, resulting in a much reduced relaxation energy and multiple absorption bands, the most dominant being in the mid-infrared (IR) spectral range. Also it has associated IR and Raman active vibrations with reverse absorption bands (anti-resonances, AR) compared with the continuum electron band. The AR are attributed to the electron-phonon interaction. 18 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

Accession no.806430

Item 135 Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.289-91 **TRIPLET EXCITONS IN BBL** Yeates A T; Dudis D S; Connolly J W US,Air Force, Wright-Patterson Base; Missouri-Kansas City,University

Electronic transitions in poly-benzimidazobenzophenanthroline (BBL) were modelled by applying ab initio Hartree-Fock techniques to the ground and triplet states of various molecular analogues. It was found that the triplet states were strongly localized to a single unit cell, leading to a Frenkel exciton picture of the excited state. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806428

Item 136

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.259-62 ELECTRONIC DEFECTS AND CONJUGATION LENGTH IN MESOSCOPIC PI-SYSTEMS Del Freo L; Painelli A; Girlando A; Soos Z G Parma,University; Princeton,University

The intrinsic non-linearity of pi-conjugated materials shows up clearly in the non-additivity of their physical properties. This offers unique opportunities for studying defects that limit the conjugation length in polymers whose linear absorption and emission is generally discussed in terms of finite segments. A simple Huckel approach is applied to the electronic and vibrational properties of polyenic chains and the following are considered: (a) a weak central bond due, for example, to chain torsion and (b) the more complex "defect" due to a central para-conjugated phenyl. The phenyl generates local and extended states that are shown to break conjugation much as a weak bond. Defects alter the length dependence of polyene properties and lead to the concept of mesoscopic chain lengths. Comparable vibrational and electronic contributions to the static second hyperpolarisability are found. 10 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.806426

Item 137

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.255-8 SUBGAP ABSORPTION AND QUANTUM LATTICE FLUCTUATION IN POLYMERS: EFFECTS OF THE GROUND-STATE DEGENERACY

Zhang J; Wu C Q; Lin H Q Shanghai,Fudan University; Hong Kong,Chinese University

By using a simple model of soliton-antisoliton pairs to simulate the quantum lattice fluctuations in onedimensional conjugated polymers, subgap optical absorption results from the transition between the lowest unoccupied and the highest occupied levels of the conduction and valence bands, respectively, in the solitonantisoliton excitations. There is no gap in the absorption induced by the quantum fluctuation. It is shown that the ground state non-degeneracy suppresses the quantum fluctuations, so that the subgap absorption is reduced and then there appears a clear onset in the absorption spectrum of non-degenerate polymers. The result is in good agreement with experiments. 10 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. CHINA

Accession no.806425

Item 138

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.241-5 MULTIPLE REDUCTION STATES WITH DIFFERENT CONDUCTIVITIES OF POLYBENZIMIDAZOBENZOPHENANTHROLINE (BBL) STUDIED WITH INFRARED SPECTROELECTROCHEMISTRY

Yohannes T; Neugebauer H; Jenekhe S A; Sariciftci N S Johannes-Kepler-University; Rochester, University

Polybenzimidazobenzophenanthroline (BBL), a conjugated ladder polymer, has interesting features such as n-type conductivity, good photoconductivity, large nonlinear optical properties and the highest electron affinity among known n-type semiconducting polymers, which makes the material an interesting candidate for optoelectronic applications. BBL can be reduced (ndoped) electrochemically and shows various reduction states. Results are reported of FTIR spectroelectrochemical studies of the reduction reactions using ATR-FTIR spectroscopy. The spectra were recorded in a three electrode spectroelectrochemical cell in situ during continuous potential cycling of a BBL coated germanium reflection element in contact with the electrolyte solution under applied potential. In contrast to most of the other conjugated polymers, BBL shows four reversible redox reactions during n-doping, corresponding to five different forms of the polymer. From the spectral response, a reduction scheme insulator to conductor to insulator to conductor to insulator was found. 9 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE

Accession no.806424

Item 139

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.229-34 EFFECTS OF CHEMICAL MODIFICATIONS ON PHOTOPHYSICS AND EXCITON DYNAMICS OF PI-CONJUGATION ATTENUATED AND

METAL-CHELATED PHOTOCONDUCTING POLYMERS

Chen L X; Jaeger W J H; Gosztola D J; Niemczyk M P; Wasielewski M R

Argonne National Laboratory; Evanston, Northwestern University

Effects of two types of chemical modifications on photoconducting polymers consisting of polyphenylene vinylene (PPV) derivatives were studied by static and ultrafast transient optical microscopy as well as semiempirical ZINDO calculations. The first type of modification inserts 2,2'-bipyridyl-5-vinylene (bpyV) units in the PPV backbone, and the second type involves metal chelation with the pby sites. Photoluminescence (PL) and exciton dynamics of two polymers of given structure with PV:bpyV ratios of 1 and 3 were examined in solution, and compared with those of the homopolymer, poly(2,5-bis(2'-ethylhexyloxy)-1,4-phenylene vinylene) (BEH-PPV). Similar studies were carried out for several metal-chelated polymers. The results can be explained by changes in pi-conjugation throughout the polymer backbone. The attenuation in pi-conjugation by the chemical modifications transforms a conducting polymer from one-dimensional semiconductor to molecular aggregates. 19 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806423

Item 140

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.217-21 A STUDY OF THE DIFFERENT STRUCTURAL PHASES OF THE POLYMER POLY(9,9'-DIOCTYL FLUORENE) USING RAMAN SPECTROSCOPY

Ariu M; Lidzey D G; Lavrentiev M; Bradley D D C; Jandke M; Strohriegl P Sheffield,University; Bayreuth,University

The polymer poly(9,9'-dioctyl fluorene) (F8) can be easily driven between a number of different structural phases by different thermal or solvent treatments. The phases that were identified include (i) as-spin-coated, (ii) semicrystalline, (iii) glassy, (iv) with an extended intrachain conformation. Atomic force microscopy was used to investigate the surface structures associated with the different phases of the polymer and different solvents used to cast the film. Raman spectroscopy was performed on these samples to understand how the polymer conformation changes with the phases. Variations in the relative intensity of the peaks and shifts in energy were observed. The F8 spectrum was compared with a trimer of fluorene with butyl side chains and acrylate/hydroxy end-groups attached to the fluorene main chain via hexyl spaces. A very small frequency dispersion in the

vibrational modes was identified in the vibrational modes connected to an increase in the conjugation length. Therefore, assignment of the vibrational modes of the trimer is very important in understanding the F8 spectrum. 15 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.806422

Item 141

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.207-11 DIELECTRIC, RAMAN, CALORIMETRIC AND X-RAY DIFFRACTION STUDIES OF A POLYCARBAZOLYLDIACETYLENE

Comoretto D; Parravicini G B; Tognini P; Stella A; Moggio I; Carpaneto L; Castellano M; Carnasciali M M; Dellapiane G Istituto Nazional per la Fisica della Materia;

Genova, University; Pavia, University

The temperature dependence of the dielectric properties of poly(1,6-bis(3,6-didodecyl-N-carbazolyl)-2,4hexadiyne) (polyDCHD-S) from 30 to 400K is reported. The data obtained from these measurements are confirmed, in selected temperature ranges, by FT-Raman spectroscopy, differential scanning calorimetry and X-ray diffraction. The transition from the blue to the red form in polyDCHD-S is detected in correspondence to the monomer melting point (about 340K). Other transitions, above and below this feature, are reported and discussed. 14 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.806421

Item 142

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.203-6 FTIR STUDIES OF CHARGED PHOTOEXCITATIONS IN REGIO-REGULAR AND REGIO-RANDOM POLY(3-ALKYLTHIOPHENE) FILMS

Jiang X M; An C P; Oesterbacka R; Vardeny Z V Utah, University

The low energy photoinduced absorption (PA) band of photogenerated polarons in a variety of poly(3alkylthiophene) (P3AT) films was studied, including regio-regular and regio-random stereo orders, different lengths of alkyl side groups, and various film preparation techniques. In addition to the traditional one-dimensional (1D) polaron PA bands, quasi-two-dimensional excitations were observed in regio-regular P3AT films, where the polymer chains self-organise to form 2D lamellar structures. Due to increased interlayer and interchain coupling, the two polaron energy levels split, resulting in two allowed optical transitions where the low energy band dominates and red-shifts into the mid infrared range. The lower energy band blue-shifts when the length of the alkyl side group increases, or when using lower boiling point solvent, or when preparing films at higher temperature. 13 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806420

Item 143

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.193-7 DENSITY OF STATES OF ENSEMBLES OF CONJUGATED MOLECULES DEDUCED FROM THE PHOTOBLEACHING AND ABSORPTION SPECTRA

Graupner W; Wohlgenannt M Virginia, Tech; Utah, University

An interpretation is presented of both the absorption spectra and the photobleaching spectra of different conjugated molecules. Based on this quantitative analysis it is possible to show how the photobleaching spectra can be used as a direct tool to probe the density of states in a conjugated material. Furthermore, this quantitative analysis can also explain the behaviour of the observed photobleaching signal if external parameters such as pressure or modulation frequency and intensity of the exciting light source are varied. 30 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806419

Item 144

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.189-92 PHOTOPHYSICS OF SEGMENTED BLOCK PPV COPOLYMER DERIVATIVES Kyllo E M; Gustafson T L; Wang D K; Sun R G;

Epstein A J Ohio,State University

The photophysics of the luminescent dimethoxy-substituted chromophore, (2,6-dimethoxy-1,4-phenylene)-1,2-ethenylene-(2,5-dimethoxy-1,4-phenylene)-1,2-ethenylene-(3,5-dimethoxy-1,4-phenylene) was studied in a series of segmented block copolymer, monomer, and polymer samples. Fluorescence lifetimes of the monomer

and segmented block copolymer solution and thin film were determined over a temperature range from 77 to 298 K. Comparison of absorbance and emission spectra and timeresolved fluorescence studies indicate exciton confinement in the chromophore moieties of the segmented block copolymer, leading to near unity quantum efficiency. Steady state absorption spectra show an increasing blue-shifted peak upon formation of the spin-coated thin film. Conformational geometry in the monomer thin film facilitates excimer formation, especially evident at low temperatures. 16 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806418

Item 145

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.185-8 EXCITATION ENERGY MIGRATION IN HIGHLY EMISSIVE SEMICONDUCTING POLYMER BLENDS PROBED BY PHOTOLUMINESCENCE DETECTED MAGNETIC RESONANCE

List E J W; Partee J; Shinar J; Gadermaier C; Leising G; Graupner W Graz, Technische Universitat; Iowa State University;

Virginia,Tech

The excitation energy migration (EEM) in methylsubstituted ladder-type poly(para-phenylene) (m-LPPP) doped with small amounts of the red emitter poly(peryleneco-diethynylbenzene) (PPDB) was studied by photoluminescence (PL) detected magnetic resonance (PLDMR). It is suggested that the EEM is a two-step process: (i) migration within the host and (ii) transfer from the host to the guest. The contributions of the emissions from m-LPPP and PPDB to the PL-enhancing polaron PLDMR at g=2, which are due to a reduction in the density of polarons acting as singlet exciton (SE) quenching centres, evolve differently with temperature. This provides clear evidence for SE migration in m-LPPP. The triplet exciton (TE) PLDMR_ at g=4 shows a distinct peak for each polymer, with the intensity of the PPDB feature being proportional to its concentration. However, the spectral dependence recorded at the peak of each resonance is the same. This rules out the triplet-triplet annihilation mechanism in these blends for simple energetic reasons. Instead it is proposed that the resonance at g=4 is due to an SE-quenching mechanism similar to that for the polaron resonance at g=2. At the field-for-resonance the number of TEs decreases, and hence the PL increases. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE Accession no.806417

Item 146

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.171-4 SPECTROSCOPICAL EVIDENCES OF PHOTOINDUCED CHARGE TRANSFER IN BLENDS OF C60 AND THIOPHENE-BASED COPOLYMERS WITH A TUNABLE ENERGY GAP Luzzati S; Panigoni M; Catellani M

Milano, Istituto di Chimica delle Macromolecole

Photoinduced charge transfer in blends of buckminsterfullerene (C60) and thiophene-based copolymers with tunable energy gap is reported. The photoluminescence and steady state photoinduced absorption spectra demonstrate electron transfer from the photoexcited copolymer to C60. The efficiency of the charge transfer depends on the degree of miscibility of the two components, which is easily controlled by the copolymer composition. 25 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.806416

Item 147

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.167-70 OPTICAL ABSORPTION AND VIBRATIONAL SPECTROSCOPY OF CONDUCTING POLYPYRROLE UNDER PRESSURE Mikat J; Orgzall I; Hochheimer H D Potsdam,Universitat; Colorado,State University

Polypyrrole in its conducting form was chemically synthesized using p-toluenesulfonic acid as doping agent. UV-visible absorption and vibrational spectroscopy was used for characterization of the electronic properties. The measurements were conducted under high pressure, up to 4 Gpa, which allows for observation of changes in the structural parameters without changing the chemical nature. The results are interpreted in terms of the stability of charge carriers. A change in the character of the charge carriers from bipolarons to polarons is suggested. 25 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.806415

Item 148

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.157-61 ELECTRONIC PROPERTIES OF THE CONDUCTING FORM OF POLYANILINE FROM

ELECTROABSORPTION MEASUREMENTS

Premvardhan L; Peteanu L A; Pen-Cheng Wang; MacDiarmid A G Carnegie-Mellon University; Pennsylvania,University

The polaron band at approx. 1.4 eV of d,l-camphorsulphonic acid-doped polyaniline in a polymethyl methacrylate matrix was studied used electroabsorption (Stark effect) spectroscopy at 298 K. A very small change in dipole moment on excitation in the order of 1.4 D was measured as well an average change in polarizability of only -1.3 Angstrom. The electroabsorption signal in this region showed evidence of heterogeneity in the absorption band. 18 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806414

Item 149

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.153-6 FIELD ENHANCED PHOTOLUMINESCENCE OF ISOLATED CHAINS OF 3BCMU IN THEIR MONOMER SINGLE CRYSTALS

Moeller S; Weiser G; Lecuiller R; Lapersonne-Meyer C Marburg,Philipps Universitat; Paris VI,Universite; Paris VII,Universite

Monomer single crystals of 3BCMU (poly-5,7dodecadiyne-1,12-diol-bis(3-butoxy-carbonylurethane)) contain, in addition to a small amount of blue polymer chains with excitons at 1.9 eV, a very small fraction of conjugated bonds with excitons at 2.28 eV detected by their resonant and strong fluorescence. Their behaviour in electric fields was studied and the quadratic Stark shift common to polydiacetylene was found in electroabsorption spectra. The luminescence responded to electric fields by significant enhancement by a few percent in fields that are too small to observe the Stark effect. The enhancement increase was sublinear with field and was attributed to excitons generated by carriers injected from band states of regular blue chains into chain segments of different confirmation. 9 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; WESTERN EUROPE

Accession no.806413

Item 150

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.149-52 ELECTROABSORPTION AND PHOTOCONDUCTIVITY STUDIES OF THE FRENKEL EXCITONS AND NEGATIVE POLARONS IN POLY(2,5-PYRIDINEDIYL) Feller F; Monkman A P

Durham, University

Electroabsorption and photocurrent measurements are presented of disordered and oriented films of the conjugated polymer poly(2,5-pyridinediyl) (PPY). The electroabsorption spectrum is dominated by a Stark-red-shift of the first allowed optical transition at 3.2 eV and by the emergence of a normally one-photon forbidden state at 3.7 eV. The spectrum was successfully fitted to a linear combination of the linear absorption spectrum and its first and second derivative revealing the transition at 3.2 eV to be due to Frenkel excitons. Polarized EA spectroscopy on oriented films allowed separation of the parallel and perpendicular components (with respect to the polymer chain axis) of the first allowed optical transition. Analysis of the spectra indicates the existence of a small number of delocalised Wannier-like excitons photogenerated by light polarized perpendicular to the polymer chains. Photoconductivity measurements were carried out on ITO/PPY/Au (semitransparent) sandwich cells using the four possible directions of the applied electric field and illumination directions. Analysis of the results showed that the photocurrent originates from the dissociation of excitons, which are photogenerated inside the polymer near the negative electrode. Evidence is given for the electron transporting properties of PPY. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.806412

Item 151

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.145-8 MODIFICATION OF POLYMER LIGHT EMISSION BY LATERAL MICROSTRUCTURE Safonov A N; Jory M; Matterson B J; Lupton J M; Salt M G; Wasey J A E; Barnes W L; Samuel I D W Durham,University; Exeter,University

The use of wavelength-scale microstructure to control the intensity, spectrum and polarisation of light emission from thin polymer films is reported. It is shown that periodic corrugation of the emissive layer can substantially increase the efficiency of light emission. Detailed photoluminescence studies of the angle dependence of the emission together with theoretical modelling show that the observed emission enhancement is associated with a Bragg scattering of waveguided light out of the polymer layer. The use of this approach to increase the efficiency of a light-emitting diode is demonstrated. 14 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.806411

Item 152

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.139-43 ORIGIN OF THE DELAYED EMISSION IN FILMS OF A LADDER-TYPE POLY(PARA-PHENYLENE)

Hertel D; Romanovskii Yu V; Schweitzer B; Scherf U; Bassler H

Marburg, Philipps University; Russian Academy of Sciences; Max-Planck-Institut fuer Polymerforschung

Observations of delayed fluorescence (DF) and phosphorescence (P) from films of the ladder-type poly(para-phenylene) (MeLPPP) are reported. Delayed emission occurs upon pulsed optical excitation. DF varies linearly with pump light intensity, while P shows a sublinear intensity dependence. It is argued that singletsinglet annihilation is responsible for the sublinear phosphorescence intensity dependence, because the intensity dependence of the prompt fluorescence shows the same behaviour above excitation intensities of 1 microJoule/pulse. Both DF and P decay according to a power law. The data analysis reveals that the DF is caused by recombination of geminate electron hole pairs rather than triplet-triplet annihilation. This conclusion is supported by investigations of the response of the DF to an applied electric field. 22 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; RUSSIA; WESTERN EUROPE

Accession no.806410

Item 153

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.127-33 OPTICAL PROPERTIES OF FILMS OF POLYCARBAZOLYLDIACETYLENE PDCHD-HS FOR PHOTONIC APPLICATIONS

Giorgetti E; Margheri G; Gelli F; Sottini S; Comoretto D; Cravino A; Cuniberti C; Dell'Erba C; Moggio I; Dellepiane G

CNR,Istituto di Ricerca sulle Onde Elettromagnetiche; Genova,University

Spun films of polycarbazolyldiacetylene polyDCHD-HS were prepared from toluene solutions with a thickness ranging from 9 nm up to 3.6 micrometres. Thicker films were characterized as waveguides at 849 and 1321 nm; 5 dB/cm propagation losses were measured at 1321 nm. The off-resonance third-order nonlinearity of ultra-thin samples (9-14 nm) was measured at 1064 nm with picosecond pulses and using surface plasmon spectroscopy. A very large value was detected for the real part of the third-order susceptibility. 9 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE Accession no.806409

Item 154

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.115-21 PHOTOEXCITED SPECTROSCOPY AND IN SITU ELECTROCHEMICAL SPECTROSCOPY IN CONJUGATED POLYMERS: A COMPARATIVE STUDY

Neugebauer H; Kvarnstroem C; Cravino A; Yohannes T; Sariciftci N S Johannes-Kepler-University

A comparison of doping and photoinduced IRAV spectra of conjugated polymers with more complex structures is presented. Differences in behaviour regarding the comparison of p- and n-doped states of different materials were observed. In contrast, a comparison between doped and photoinduced IRAV spectra often show a similar band pattern. The results found do not agree with the predictions given by theoretical descriptions, which were developed for simpler structures. From these theories, the same IRAV pattern for p- and n-doping, but differences to photoinduced IRAV, should be expected. 34 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

AUSTRIA; EUROPEAN UNION; WESTERN EUROPE *Accession no.806408*

Item 155

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.107-10 EXPERIMENTAL AND THEORETICAL STUDIES OF THE ANISOTROPICAL COMPLEX DIELECTRIC CONSTANT OF HIGHLY STRETCH-ORIENTED POLY (P-PHENYLENE-VINYLENE)

Comoretto D; Dellepiane G; Marabelli F; Tognini P; Stella A; Cornil J; dos Santos D A; Bredas J L; Moses D Genova,University; Pavia,University; Mons Hainaut,University; California,University at Santa Barbara

A spectroscopic determination of the anisotropical complex optical constants of highly stretch-oriented poly(p-phenylene-vinylene) (PPV) is presented, by means of Kramers-Kronig transformation of the reflectivity spectra and inversion of reflectance and transmittance over the transparent spectral region. The experimental data are discussed and compared with those obtained from quantum chemical calculations extended to include the electronic correlation in an 11-ring PPV oligomer. On the basis of this comparison a new assignment of the optical transitions in PPV is proposed. 15 refs. Proceedings of the Fourth International Topical Conference on Optical

Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE Accession no.806406

Item 156

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.101-5 FIRST-PRINCIPLES CALCULATION OF OPTICAL ABSORPTION SPECTRA IN CONJUGATED POLYMERS: ROLE OF ELECTRON-HOLE INTERACTION

Rohlfing M; Tiago M L; Louie S G Muenster, University; California, University at Berkeley; Lawrence Berkeley Laboratory

Experimental and theoretical studies have shown that excitonic effects play an important role in the optical properties of conjugated polymers. The optical absorption spectrum of trans-polyacetylene, for example, can be understood as completely dominated by the formation of exciton bound states. A recently developed first-principles method for computing the excitonic effects and optical spectrum, with no adjustable parameters, is reviewed. This theory is used to study the absorption spectrum of two conjugated polymers: trans-polyacetylene and polyphenylenevinylene (PPV). 27 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.806405

Item 157

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.95-9 OPTICAL PROPERTIES OF DISUBSTITUTED POLYACETYLENE THIN FILMS

Fujii A; Hidayat R; Sonoda T; Fujisawa T; Ozaki M; Vardeny Z V; Teraguchi M; Masuda T; Yoshino K Osaka,University; Utah,University; Kyoto,University

Studies of the optical properties of thin films of novel disubstituted acetylene polymers such as poly(1-phenyl-2-p-n-butylphenylacetylene) (PDPA-nBu) and poly(1-nhexyl-2-phenylacetylene) (PHxPA) show that these polymers exhibit high photoluminescence (PL) quantum efficiency compared with unsubstituted or monosubstituted polyacetylene. The polarisation dependence of PL and Raman scattering of PDPA-nBu and PHxPA were studied in order to clarify the emission mechanism. Assuming the model of short polyene conjugation length in the acetylene polymers, the average conjugation length was estimated from the respective stretching vibration frequency of the carbon-carbon double bond. The emission mechanisms of PHxPA and PDPA-nBu are discussed in relation to the electronic excited states of these polymers. 15 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. JAPAN; USA

Accession no.806404

Item 158

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.91-4 PHOTOEXCITATIONS IN DISUBSTITUTED POLYACETYLENE: SOLITONS AND POLARONS

Gontia I; Frolov S V; Liess M; Vardeny Z V; Ehrenfreund E; Tada K; Kajii H; Hidayat R; Fujii A; Yoshino K; Teraguchi M; Masuda T Utah,University; Technion-Israel Institute of Technology; Osaka,University; Kyoto,University

Photoexcitations in films of disubstituted polyacetylene, a pi-conjugated polymer with degenerate ground state, are discussed. The polymer in its pristine form supports charged and neutral topological soliton excitations. Photooxidised films or polymer/C60 blends also exhibit polaron excitations. At the same time the polymers show a strong emission band with high quantum efficiency, which leads to stimulated emission in thin films and lasing in cylindrical micron-cavities. 8 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

ISRAEL; JAPAN; USA *Accession no.806403*

Item 159

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.87-90 PHOTOPHYSICS OF PHENYL-SUBSTITUTED POLYACETYLENES, THEORY Shukla A; Ghosh H; Mazumdar S

Japan Science & Technology Corp.; Indian Institute of Technology; Arizona, University

A theoretical study is presented of the electronic structures of poly-phenylacetylene (PPA) and poly-diphenylacetylene (PDPA). Strong photoluminescence (PL) in PDPA is due to the occurrence of the 2Ag two-photon state above the optical 1Bu, in spite of the polyene backbone. This reversed energy ordering (as compared to linear polyenes and transpolyacetylene, t-PA) is a sign of reduced effective electron correlations in PPA and PDPA. The optical gaps of the substituted materials are smaller than polyenes of the same chain length. 8 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

INDIA; JAPAN; USA Accession no.806402

Item 160

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.81-5 DEFECT CHARACTERIZATION OF HIGHLY EMISSIVE PARA-PHENYLENE-TYPE MOLECULAR FILMS BY PHOTOLUMINESCENCE-DETECTED MAGNETIC RESONANCE AND THERMALLY STIMULATED CHARGE TRANSPORT

List E J W; Kim C H; Shinar J; Pogantsch A; Petritsch K; Leising G; Graupner W

Graz, Technische Universitat; Iowa State University; Virginia, Tech

A new combined photoluminescence-detected magnetic resonance (PLDMR) and thermally stimulated current (TSC) study of defects in wide bandgap amorphous methyl-substituted ladder-type poly(para-phenylene) (m-LPPP) and polycrystalline para-hexaphenyl (PHP) films, both with PL quantum yields of approx. 30%, is described. As TSC probes the density of mobile charge carriers after detrapping and PLDMR reveals the influence of trapped charges of the PL, their combination yields the concentration of traps, their energetic position, and their contribution to PL quenching. A comparison of the PLDMR and TSC results shows that the interaction and hence the non-radiative quenching of singlet excitons at polarons is stronger in PHP than in m-LPPP due to a higher diffusivity of singlet excitons in PHP. Furthermore, it is shown that PLDMR results are in agreement with photoinduced absorption results of pristine and photooxidised m-LPPP. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE *Accession no.806401*

Item 161

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.75-9 TRIPLET STATE SPECTROSCOPY OF CONJUGATED POLYMERS STUDIED BY PULSE RADIOLYSIS

Monkman A P; Burrows H D; Miguel M da G; Hamblett I; Navaratnam S Durham,University; Coimbra,University; Manchester,Paterson Institute for Cancer Research

The energies and kinetics of triplet states in soluble luminescent conjugated polymers were elucidated using pulse radiolysis. The technique is explained using poly(2methoxy,5-(2'-ethyl-hexoxy)-p-phenylenevinylene (MEH-PPV) as an example, together with its use in studying triplet states in conjugated polymers. Triplet energy transfer is used to determine energy gaps and the kinetics of triplet-triplet absorption yields triplet lifetimes. In the case of MEH-PPV, the triplet decay rate shows no change at concentrations up to 50 mg/l, indicating that self-quenching of triplets is not significant. However, if very high electron beam doses are used, high intra-chain triplet concentrations can be generated. In this high concentration regime triplet-triplet annihilation becomes effective, as determined by the onset of delayed fluorescence. 23 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; UK; WESTERN EUROPE

Accession no.806400

Item 162

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.71-3 ARE BREATHER EXCITONS THE PRIMARY PHOTOEXCITATIONS IN CONJUGATED POLYMERS?

Kanner G S; Vardeny Z V; Lanzani G; Zheng L X Northern Arizona,University; Utah,University; Milano,Politecnico

A new interpretation of photoexcitations in transpolyacetylene and polydiacetylene-4BCMU is discussed. Based on the results of picosecond photoinduced absorption and resonant Raman scattering, it is postulated that breather excitons may be the primary species photogenerated in these, and perhaps other, conjugated polymers. 17 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.806399

Item 163

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.67-70 FEMTOSECOND EXCITON DYNAMICS IN DOO-PPV FILMS

Korovyanko O J; Shkunov M N; Levina G A; Vardeny Z V Utah, University

Femtosecond photoinduced absorption decay was used to study the ultrafast exciton dynamics in DOO-PPV films. The exciton dynamics were found to contain an ultrafast decay component of about 2 ps that remains unchanged at intensities up to five times the threshold excitation intensity for the phenomenon of emission spectral narrowing. It is argued that amplified spontaneous emission of waveguided or leaky modes, depending on film thickness and excitation geometry, is the dominant mechanism for both spectral narrowing and ultrafast decay components. In very thin films it was found that the process of amplification of leaky waves may be responsible for the amplification of the 0-0 emission band rather than the 0-1 band, which has usually been observed at high excitation intensities in thicker films. 12 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806398

Item 164

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.61-5 STUDIES OF TRANSIENT STIMULATED EMISSION IN DOO-PPV FILMS

Huang J D; Frolov S; Vardeny Z; Lee C W; Wong K S Utah, University; Hong Kong, University of Science & Technology

The stimulated emission band in neat 2,5-dioctyloxy poly(p-phenylenevinylene) (DOO-PPV) films was experimentally and theoretically investigated. Spectral narrowing due to ASE was observed at moderately high excitation intensities. A complex ASE build-up and decay dynamics as a function of excitation intensity and stripe length was observed. It was also found that the exciton energy relaxation process within inhomogeneously broadened energy distribution becomes faster when ASE occurs. A theoretical model taking into account the polymer film gain and loss, the propagation effect and the time dependent exciton generation process is developed and used to explain the experimental data. 16 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

HONG KONG; USA *Accession no.806397*

Item 165

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.57-60 SUB-10 FS EXCITED STATE EVOLUTION IN POLYCARBAZOLYLDIACETYLENE-POLYETHYLENE BLENDS

Cerullo G; Lanzani G; Zavelani-Rossi M; De Silvestri S; Comoretto D; Moggio I; Dellepiane G Istituto Nazional per la Fisica della Materia; Milano,Politecnico; Genova,Universita

Sub-10 femtosecond time-resolved optical dynamics in polycarbazolyldiacetylene blended in a polyethylene matrix, which is a prototype of single chain systems, is reported. Transmission difference data reveal an ultrafast kinetics that is assigned to the rapid internal conversion taking place following photoexcitation. Oscillations in the time-dependent traces are assigned to impulsive stimulated resonant Raman scattering, based on the comparison with cw Raman data. 10 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.806396

Item 166

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.53-6 PROBING OF THE 2AG STATE IN NANOPOLYACETYLENE ON THE TIME SCALE FROM FEMTOSECONDS TO MILLISECONDS Golovnin I V; Paraschuk D Yu; Pan X Y; Chigarev N V; Knize R J; Zhdanov B V; Kobryanskii V M Moscow,Lomonosov University; US,Air Force Academy; Moscow,Institute of Chemical Physics

The dynamic properties of the 2Ag state in films of nanopolyacetylene were measured using photoinduced spectroscopy and photoinduced polarimetry methods both in the transient and cw regime. The excitation density per polyacetylene nanoparticle was no more than one absorbed pump proton. Using femtosecond pulses, the rise time (greater than or equal to 0.2 ps) and the decay time (approx. 1 ps) of the photoinduced response from the 2Ag state of trans-nanopolyacetylene were evaluated. The longest relaxation time, approx. 7 microseconds, was measured at room temperature. Using picosecond pulses and a novel photoinduced polarimetry method, the first measurements of the transient polarisation response of a conjugated material have been achieved. The observed polarisation signal is associated with a small photoinduced dichroism and birefringence in the 2Ag state. The decay time of the polarisation signal was approx. 0.3 ns. 9 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

RUSSIA; USA Accession no.806395

Item 167

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.45-8 OPTICAL NONLINEARITIES IN POLYENES: ROLE OF INTRINSIC LOCALIZED MODES Saxena A; Kivshar Y S; Bishop A R

Los Alamos National Laboratory; Australian National University

A simple theoretical model is used to demonstrate the effect of intrinsic localised modes such as breathers on nonlinear optical properties. Enhancement of optical nonlinearities in ab initio numerical simulations of finite polyenes had previously been observed. Experimental implications of the results are discussed. 24 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers

and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. AUSTRALIA; USA Accession no.806394

Item 168

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.41-4 PHOTOLUMINESCENCE DECAY DYNAMICS OF DENDRITICALLY SUBSTITUTED CONJUGATED POLYMERS Jakubiak R; Bao Z; Rothberg L J

Rochester, University; Lucent Bell Laboratories

Subnanosecond photoluminescence (PL) decay dynamics of dendron decorated poly(phenylene vinylenes) (PPVs) in solutions and as neat films are reported. Previous PL studies revealed that two conformations of the polymer, with distinct luminescence quantum yields and PL, are responsible for the photophysics of these polymers. These conformations are characteristic of isolated and aggregated chains. From the decay dynamics, energy transfer between the two species is evident and repopulation of exciton states occurs in aggregated regions of the sample. 12 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806393

Item 169

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.35-40 INTERCHAIN AND INTRACHAIN EXCITON TRANSPORT IN CONJUGATED POLYMERS: ULTRAFAST STUDIES OF ENERGY MIGRATION IN ALIGNED MEH-PPV/ MESOPOROUS SILICA COMPOSITES Schwartz B J; Nguyen T-Q; Wu J; Tolbert S H California,University at Los Angeles

Composite samples consisting of chains of the semiconducting polymer MEH-PPV embedded into the channels of oriented, hexagonal nanoporous silica glass allow control over energy transfer and exciton migration in the polymer. The composite samples are characterised by two polymer environments: randomly oriented and film-like segments with short conjugation length outside the channels, and well aligned, long conjugation segments that are isolated by encapsulation within the porous glass. Ultrafast emission anisotropy measurements show that excitons migrate unidirectionally from the polymer segments outside the pores to the oriented chains within the pores, leading to a spontaneous increase in emission polarisation with time. Because the chains in the pores are isolated, the observed increase in polarisation can only take place by exciton migration along the polymer

backbone. The anisotropy measurements show that energy migration along the backbone occurs more slowly than Forster energy transfer between polymer chains; transfer along the chain probably takes place by a thermallyactivated hopping mechanism. Similar timescales for intra- and interchain energy transfer are also observed for MEH-PPV chains in solution. All the results provide new insights for optimising the use of conjugated polymers in optoelectronic devices. 37 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. USA

Accession no.806392

Item 170

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.31-4 PHOTOPHYSICS OF PHENYL DISUBSTITUTED POLYACETYLENES: PICOSECOND PHOTOLUMINESCENCE AND FEMTOSECOND PHOTOINDUCED ABSORPTION STUDIES OF PDPA-N-BU

Gustafson T L; Kyllo E M; Frost T L; Sun R G; Lim H; Wang D K; Epstein A J; Lefumeux C; Burdzinski G; Buntinx G; Poizat O

Ohio,State University; Lille,Universite des Sciences et Technologies

Picosecond (ps) photoluminescence (PL) decays of phenyldisubstituted polyacetylenes (PDPA) with an attached nbutyl group (PDPA-n-Bu) in solution and as thin films were obtained. In solution, only a single exponential decay was observed at all emission wavelengths over the range 2.15-2.50 eV. The PL lifetime in solution was 190 ps. The PL decays in thin films could not be satisfactorily fitted using a single exponential, and are significantly lower in thin films than in solution. Also, the PL decay times vary with emission wavelength in thin films, with longer PL decay times observed at lower emission energies. The femtosecond (fs) photoinduced absorption (PA) spectra of PDPA-n-Bu in solution over the range 1.70-2.95 eV was also obtained. These data exhibit fast ground state bleaching at high energy, along with the growth of a broad PA feature at low energies that decays with a time constant consistent with the PL decay time in solution. At long times (greater than 200 ps) the growth of a long-lived PA feature peaked at 2.3 eV was seen that persisted for hundreds of nanoseconds. A broad feature in the infrared PA was observed at 0.23 eV whose dynamics are the same as the band at 2.3 eV. These two long-lived bands were assigned to polaron transitions. 27 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; USA; WESTERN EUROPE

Accession no.806391

Item 171

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.27-30 FEMTOSECOND PHOTO-CURRENT EXCITATION CROSS-CORRELATION ON A LADDER TYPE POLYMER

Zenz C; Lanzani G; Cerullo G; Graupner W; Leising G; Scherf U; DeSilvestri S Sassari,University; Milano,Politecnico; Graz,Technische Universitat; Virginia,Tech; Max-Planck-Institut fuer Polymerforschung

Transient photocurrent cross-correlation experiments were carried out on methyl-substituted ladder-type poly(para-phenylene) (m-LPPP). In this experiment, the first pulse at 390 nm created singlet excitons (S0 to S1) that were re-excited to a higher lying state by the time delayed second pulse at 780 nm (S1 to Sn). The change in (390 nm)-induced photocurrent caused by the 780 nm pulses was measured as a function of blue-red time delay. Measurements showed that the charge generation rate is greatly increased if the exciton is re-excited within the first picosecond, demonstrating the role of exciton migration in the ionisation process. For longer time delays, a charge generation rate that follows the excited state population was observed, suggesting enhanced dissociation from a higher lying state. 21 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. AUSTRIA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; ITALY; USA; WESTERN EUROPE Accession no.806390

Item 172

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.23-6 EXCITONIC PHOTOCONDUCTIVITY OF 4BCMU POLYDIACETYLENE SINGLE CRYSTALS

Moeller S; Weiser G; Lapersonne-Meyer C Marburg,Philipps Universitat; Paris VI,Universite; Paris VII,Universite

Thermal annealing of 4BCMU single crystals increases the transition energy of excitons from 2.0 to 2.3 eV and a similar increase is observed for the free carrier gap resolved by electroabsorption spectra. This modification leads to a significant change of the photocurrent threshold, which after the transformation shifts to the excitonic absorption edge. Because the exciton binding energy of 0.5 eV is not altered, this excitonic photoconductivity cannot be due to dissociation of excitons. It is proposed that Auger excitation of trapped carriers into free carrier states acquire energy from recombination of free excitons. The crucial step is the escape from the chain, which requires sufficient excess energy of these excited carriers. This energy is provided by excitons of 2.3 eV but not by those of 2 eV. 19 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000. EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; WESTERN EUROPE

Accession no.806389

Item 173

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.19-22 MECHANISM OF CARRIER GENERATION AND RECOMBINATION IN CONJUGATED POLYMERS

Moses D; Dogariu A; Heeger A J California,University at Santa Barbara

Transient excited-state absorption measurements in the spectral region spanning the infrared active vibrational (IRAV) modes in prototypical luminescent polymers, poly(phenylene vinylene) (PPV), and poly(2-methoxy-5-(2-ethyl-hexyloxy)-(phenylene vinylene)) (MEH-PPV), reveal charge carrier generation within 100 fs after photoexcitation. The photocarrier quantum efficiency in MEH-PPV is approx. 0.1 in zero applied electric field. There is no correlation between the temporal behaviour of the photoinduced IRAV signals and the exciton lifetime. Thus, carriers are photoexcited directly and not generated via a secondary process from exciton annihilation. Data indicate that the carrier recombination rate is sensitive to the strength of the interchain interaction. 23 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA Accordio

Accession no.806388

Item 174

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.15-8 TRIPLET STATE DYNAMICS IN POLY(2,5-PYRIDINE DIYL)

Wong K S; Law C W Y; Sun T; Monkman A P; Vaschetto M E; Hartwell L J; Horsburgh L E; Burrows H D; Miguel M da G

Hong Kong,University of Science & Technology; Durham,University; Coimbra,University

Pulse radiolysis was used to determine the triplet state energy (2.3 eV) of poly(2,5-pyridine diyl) (PPY) film, which was found to be coincident with the emission energy. Detailed time-resolved photoluminescence (PL) and pumpprobe measurements were applied to study the photoexcited state relaxation dynamics. In films, a very large spectral red-shift (approx. 0.35 eV) for the PL occurred within the first 100 ps whereas no spectral red-shift was observed for the PPY in solution. This result provides clear evidence for the evolution of short-lived single emission (S1 to S0) at approx. 450 nm to long-lived triplet emission (T1 to S0) at approx. 520 nm for the PPY thin film. Streak camera measurement indicates the long-lived component has a decay time constant of several ns. The picosecond photoinduced triplet state absorption (T1 to T2 transition) peaks at approx. 600 nm as measured by pump-probe, which is consistent with both the radiolysis and cw photo-induced absorption measurements. A triplet lifetime of approx. 6 ns was measured, which is again consistent with the streak camera measurement. These results suggest that the longlife component of the emission from PPY film is in fact phosphorescence. Furthermore, there is evidence that oxygen plays a very important role in the fast triplet radiative lifetime in PPY films. 27 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; HONG KONG; PORTUGAL; UK; WESTERN EUROPE

Accession no.806387

Item 175

Synthetic Metals 116, Nos.1-3, 15th Jan.2001, p.9-13 ULTRAFAST CHARGE PHOTOGENERATION IN CONJUGATED POLYMER THIN FILMS Silva C; Stevens M A; Russell D M; Setayesh S; Muellen K; Friend R H Cavendish Laboratory; Max-Planck-Institut fuer

Polymerforschung

Femtosecond transient absorption spectroscopy on thin films of blue-emitting derivatives of polyindenofluorene (PIF) is reported. Probe wavelength and pump intensity dependence measurements allow the separation of the broadly overlapped 1Bu exciton and charge pair absorption spectra. It was found that charge pairs are produced within the instrument resolution (approx. 100 fs) followed by exciton-exciton bimolecular annihilation on a picosecond timescale. Two possible mechanisms for ultrafast charge generation are considered: direct charge separation of nascent 1Bu excitons by static quenching at intrinsic defects and sequential transitions to produce highly energetic excitons that dissociate efficiently. Photophysical modelling of intensitydependent data reveals that sequential absorption followed by charge separation is the most likely mechanism for ultrafast charge pair generation, with the ratio of excitedstate to ground-state absorption cross-section times the effective yield of charge pairs approx. 0.1. These observations are consistent with previous photocurrent measurements and quantum chemical calculations assigning highly excited states to greatly delocalised excitons. 11 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.806386

Item 176

Synthetic Metals

116, Nos.1-3, 15th Jan.2001, p.5-7 MULTIPLE PULSE TRANSIENT SPECTROSCOPY IN LUMINESCENT PI-CONJUGATED POLYMERS

Frolov S V; Bao Z; Wohlgenannt M; Vardeny Z V Bell Laboratories,Lucent Technologies; Utah,University

Relaxation processes between even and odd parity excitons in poly(p-phenylene vinylene) derivative polymers were examined using a multiple femtosecond pulse transient spectroscopy. By tuning the energy of reexcitation and probe pulses across a wide spectral range, it was possible to measure a complete spectrum of the 1Bu exciton and also probe its counterparts: higher lying mAg and kAg excitons. Dramatically different relaxation paths were found for two later states: whereas the majority of mAg excitons experience an ultrafast internal conversion back to their 1Bu state, most kAg excitons transform into a non-emissive state, which was attributed to weakly bound polaron pairs. 11 refs. Proceedings of the Fourth International Topical Conference on Optical Probes of pi-Conjugated Polymers and Photonic Crystals, Salt Lake City, Utah, USA, 15-19 February 2000.

USA

Accession no.806385

Item 177

Weinheim, Wiley-VCH, 1998, pp.xxxvi.914. 25cms. 6128

HANDBOOK OF LIQUID CRYSTALS VOL.1 FUNDAMENTALS

Edited by: Demus D; Goodby J; Gray GW; Spiess HW; Vill V

(Hull,University; Max-Planck-Institut fuer Polymerforschung; Hamburg,University)

This book contains nine heavily referenced chapters on liquid crystals in general. It discusses the history of the field, the nomenclature of liquid crystals and the physical theory related to the liquid crystalline state. Synthetic strategies are described and the theory of symmetric and chiral liquid crystals discussed. The physical properties of liquid crystals and the techniques used to measure them are described in great detail and a final chapter covers the applications of liquid crystalline materials.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.806383

Item 178

Patent Number: EP 1070682 A1 20010124 **RADIATION CURABLE RESIN COMPOSITION** Komiya Z; Abel A G M; Alkema D P W; Mase M DSM NV; JSR Corp.

This composition comprises a (meth)acrylate urethane compound derived from a polypropylene glycol or a propylene oxide/ethylene oxide copolymer glycol having a molecular weight between 1,000 and 13,000 and an amount of unsaturation less than 0.01 meq/g. It has improved liquid stability, can produce cured products having superior mechanical characteristics by polymerisation and can be used as a coating material for optical fibres, adhesives and the like. The composition is particularly suitable as a coating material for optical fibres for which long-term stability is required.

EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE-GENERAL

Accession no.806306

Item 179

Reactive & Functional Polymers 46, No.3, 2001, p.225-31 POLYSILOXANE-BASED PHOTOREFRACTIVE MATERIALS WITH DUAL-FUNCTION DOPANTS Wu S; Zeng F; Li F; Li J

South China, University of Technology

Photorefractive polymer systems are investigated based on functionalised polysiloxane doped with a single small molecule species that has the dual function of providing both charge-transport and optical non-linearity. Detailed studies including photoconductivity, carrier mobility, etc. are conducted. The non-local character of the photorefractivity is demonstrated through asymmetric energy transfer in a two-beam coupling experiment. Net two-beam coupling gains are observed for the systems. Finally, the field dependence of the gain coefficient is described. 32 refs.

CHINA

Accession no.806279

Item 180

Reactive & Functional Polymers 46, No.3, 2001, p.213-23 SYNTHESIS AND CHARACTERISATION OF TWO NOVEL FUNCTIONAL LADDER-LIKE POLYSILSESQUIOXANES FOR NONLINEAR OPTICAL RESPONSE

Liu C; Liu Y; Feng J; Yuan Q; Xie P; Dai D; Zhang R Chinese Academy of Sciences; China Petrochemical Corp.

Two novel functional ladder-like polysilsesquioxanes with double-chain macromolecular backbones and non-linear optical (NLO) chromophore-containing side chains for NLO applications (NLO-T1 and NLO-T2) are synthesised successfully for the first time via the introduction of the NLO chromophores to the side chains of the ladder-like polychloropropylsilsesquioxane (Cl-T1) with ladder-like poly(4-chloromethylphenyl)ethylsilsesquioxane (Cl-T2), respectively, by an etherification reaction. The obtained polymers are characterised by FTIR, 1H NMR, 13C NMR, 29Si NMR, X-ray diffraction, differential scanning calorimetry, thermogravImetric analysis, vapour pressure osmometry, fluorescence spectroscopy and secondharmonic generation (SHG) measurements. The poled thin films of the above two ladder-like NLO polymers show d33 coefficients of 9.2 and 9.6 pm V-1, respectively. Compared with the corresponding single main chain polymers, the poled thin films of the synthesised ladderlike NLO polymers demonstrate a much higher thermal stability of SHG. 13 refs.

CHINA

Accession no.806278

Item 181

Patent Number: EP 1063539 A2 20001227 RESIN COMPOSITION FOR OPTICAL FIBER LOOSE TUBES, OPTICAL FIBER LOOSE TUBE AND PRODUCTION PROCESS THEREOF Ohno M; Sugie K; Sasaki S; Oki H Teijin Ltd.; Hitachi Cable Ltd.

This composition contains (A) 100 parts by weight of polybutylene terephthalate having a terminal carboxyl group concentration of 10 eq/ton or less and an intrinsic viscosity of 1.0 to 1.2 and (B) 0.005 to 0.1 part by weight of polyethylene wax. The optical fibre loose tube is produced by extrusion moulding the above composition at a haul-off speed of 200 m/min or more.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; WESTERN EUROPE-GENERAL Accession no.806225

Item 182

Polymer 42, No.8, 2001, p.3315-22 HIGH GLASS TRANSITION CHROMOPHORE FUNCTIONALISED POLYIMIDES FOR SECOND-ORDER NONLINEAR OPTICAL APPLICATIONS

Van den Broeck K; Verbiest T; Degryse J; Van Beylen M; Persoons A; Samyn C Leuven,Catholic University

The synthesis of donor-embedded side chain polyimides and chromophore-functionalised polyimides and the nonlinear optical properties of these polyimides are reported. The donor-embedded side chain polyimides were produced by the polycondensation of а diaminochromophore and 4,4'-(hexafluoroisopropyidene) diphthalic anhydride and the chromophore-functionalised polyimides were obtained by functionalisation of the respective hydroxyl polyimides with hydroalkyl chromophores by means of the Mitsunobu reaction. These non-linear optical polymers exhibited Tgs from 218 to 298C and the donor-embedded polyimide lost only 10% of its non-linearity after 200 h. heating at 125C. 29 refs. BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.806129

Item 183 Patent Number: US 6132650 A1 20001017 METHOD AND APPARATUS FOR MANUFACTURING DISTRIBUTED REFRACTIVE INDEX PLASTIC OPTICAL-FIBER Nakamura T

Sumitomo Wiring Systems Ltd.

A base polymer is mixed with a non-polymerisable compound having a higher refractive index to form a fibre material. This material is continuously transformed into a fibre in a fibre-preparing unit. The fibre is dipped in diffusion tanks containing monomer substances to diffuse these substances into the fibre and cured in a heater to polymerise these substances. By alternatingly repeating this procedure, the monomer substances and the nonpolymerisable compound are diffused in the fibre and form a graded refractive index. Next, the fibre is drawn, coated with a cladding and coiled. This method can be performed with a high running ratio, minimising the necessity of scaling-up of the facilities when the production is increased, and easily confers a desired index grading on the fibre. It also allows continued manufacture of a graded refractive index plastic optical-fibre with a desired length and of constant quality.

JAPAN; USA

Accession no.806085

Item 184

Journal of Sol-Gel Science and Technology 19, Nos.1-3, Dec.2000, p.687-90 NEAR- AND MID-INFRARED SPECTROSCOPY OF SOL-GEL DERIVED ORMOSIL FILMS FOR PHOTONICS FROM TETRAMETHOXYSILANE AND TRIMETHOXYSILYLPROPYL-METHACRYLATE

Tadanaga K; Ellis B; Seddon A B Sheffield,University

Ormosil (organically modified silicate) dipped thin films and cast films were prepared using tetramethoxysilane and trimethoxysilylpropyl methacrylate(TMSPM). Structural changes during thermally-induced polymerisation of the organic groups were investigated using near- and mid-IR spectroscopy. IR spectra of the ormosil dipped thin films, dried at 60C, showed that further heat treatment of the films at 160C led to the free radical polymerisation of C:C bonds in TMSPM. In the mid-IR spectra, the intensity of the band at around 3500/ cm, due to O-H bonds, increased with the progress of polymerisation of vinyl groups. Near-IR spectra of the cast films showed that this increase in intensity of the O-H band was due to the increase of monomeric water molecules hydrogen bonded to silanols. It was suggested that optical loss measurements should be made in a dry atmosphere or, with a cover coating to protect the ormosil from adsorption of water, to reduce this source of optical loss for waveguides based on TMSPM. 19 refs. (10th

International Workshop on Glass and Ceramics, Hybrids and Nanocomposites from Gels, 'Sol-Gel '99', Yokohama, Japan, Sept.1999) EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.805112

Item 185

Journal of Polymer Science: Polymer Chemistry Edition

39, No.1, 1st Jan.2001, p.253-62 SYNTHESIS AND CHARACTERIZATION OF DIFFERENT POLY(1-VINYLINDOLE)S FOR PHOTOREFRACTIVE MATERIALS

Brustolin F; Castelvetro V; Ciardelli F; Ruggeri G; Colligiani A

Pisa, University; Napoli, Universita Federico II

Poly(1-vinylpyrrole), poly(1-vinylindole) and some methyl-substituted compounds of poly(1-vinylindole) were considered as possible replacements for poly(1vinylcarbazole), a component commonly employed for organic photorefractive materials. The optimum conditions for both monomer synthesis and polymerisation were determined. The Tg values of the new polymeric substrates were constantly lower than that of poly(1-vinylcarbazole), which could lead to materials that required a lower amount of plasticiser in the final photorefractive blend to display photorefractive behaviour at room temp. The verified higher electric dipole moments of the pyrrole and indole derivatives could also improve the compatibility of the optically non-linear component required in the system, typically an azo molecule, by increasing its solubility inside the blend. All the vinyl monomers and polymers synthesised gave clear spectroscopic evidence of the formation of charge-transfer complexes with 2,4,7-trinitrofluorenylidene malonitrile, an efficient sensitiser for photoconductivity. 17 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE Accession no.804988

Item 186 Polymer Composites 21, No.6, Dec.2000, p.857-63 RELAXATION OF THE AXIAL STRAIN INDUCED STRESSES IN DOUBLE-COATED OPTICAL FIBERS Sham-Tsong Shiue Feng Chia,University

Axial strain-induced stresses in double-coated optical fibres were analysed using the viscoelastic theory and the relaxation of stresses was considered. A closed form solution of the axial strain-induced viscoelastic stresses was obtained. The axial strain-induced stresses were proportional to the applied axial strain and were a function of the material's properties and thickness. If the applied axial strain increased linearly, the induced stresses increased with time, but if the axial strain was fixed, apart from the axial stress in the glass fibre, the stresses decreased exponentially with time. Apart from the axial stress in the glass fibre, the axial strain-induced stresses decreased with increasing relaxation time of the polymeric coating. A compressive interfacial radial stress resulted in an increase of the transmission losses and a tensile interfacial radial stress possibly resulted in debonding at the interface of the glass fibre and primary coating. 17 refs.

TAIWAN

Accession no.804947

Item 187

Patent Number: US 6126867 A1 20001003 2000 NONLINEAR-OPTICALLY ACTIVE COPOLYMERS, POLYMER MATERIALS PRODUCED FROM THEM, AND ELECTROOPTICAL AND PHOTONIC COMPONENTS CONSTRUCTED THEREFROM Kanitz A; Fricke C

Siemens AG

The invention relates to nonlinear-optically active copolymers, to crosslinked NLO polymer materials produced from them and having high orientation stability, and to electrooptical and photonic components comprising these polymer materials. The copolymers of the invention are of a given general formula 1 in which W is preferably a chromophoric group of a given general formula 2. The chromophores employed in accordance with the invention exhibit high thermal stability and so can be processed at elevated temperatures while retaining the optical activity. EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.804827

Item 188

Plastics News(USA) 12, No.45, 8th Jan.2001, p.20-1 **ELECTRONICS MARKET RINGING WITH OPTIMISM** Renstrom R

The US electronic equipment markets are examined, with particular reference to trends in demand for mobile phones, desktop and laptop computers, computer printers, and document copiers. It is forecast that shipments of mobile communications devices will continue to grow dramatically with another boom year ahead, according to research analysts. The growth in demand for mobile phones is examined, and in particular, sales of internet-enabled devices. Although desktop computers continue as a mainstay, growth is reported to be slowly declining, and demand for portable computers is said to be continuing.

BLUETOOTH USA Accession no.803103

Item 189

Patent Number: US 6129865 A1 20001010 MANUFACTURING METHOD OF MULTIFIBER CONNECTOR FERRULE FOR RIBBON-TYPE OPTICAL CABLE

Jeong M Y; Chun O G; Ahn S H; Choy T G; Chun H J Korea,Electronics & Telecommunications Research Institute; Korea Telecom

A high degree of precision is achieved by reverse direction connection dependent merely on the predetermined height of a reference plane. The reference plane is formed by relatively easy plane processing as the method of maintaining precise height and directivity of flow is added to the inside of a mould.

KOREA; USA

Accession no.802890

Item 190

Patent Number: US 6129864 A1 20001010 PROCESS FOR PRODUCING OPTICAL WAVEGUIDE SUBSTRATE

Imaeda M; Kawaguchi T; Inoue T; Yamauchi M NGK Insulators Ltd.

Disclosed is a process for producing an optical waveguide substrate including a ridge-shaped structural portion containing at least an optical waveguide. It involves forming an optical waveguide-forming layer on a substrate body to prepare a substrate workpiece and forming the ridge-shaped structural portion at the substrate workpiece by grinding.

JAPAN; USA

Accession no.802889

Item 191

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.276-7 SYNTHESIS AND NONLINEAR OPTICAL PROPERTIES OF A NEW SYNDIOREGIC MAIN-CHAIN HYDRAZONE POLYMER Lindsay G A; Chifin A P; Hayden L M; Kim W-K

US,Navy; Maryland,University

(ACS, Div.of Polymeric Materials Science & Engng.)

The synthesis, linear optical and NLO properties of a new syndioregic main-chain polymer having loss optical loss in the visible wavelengths and a high thermal stability are presented. The main purpose for preparing this polymer is for a study comparing the relative relaxation rates of a chromophore in the syndioregic configuration and in the side-chain configuration. This NLO polymer may also be useful for light modulation in the blue-green region of the visible spectrum. Use of the hydrazone chromophore in the NLO polymer is motivated by results reported on side-chain hydrazone polymers. The syndioregic polymer of the present study, AC2729, exhibits low optical loss and good thermal stability of the NLO properties but has a low absolute non-linearity. 8 refs.

USA

Accession no.802771

Item 192

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.272-3 SYNTHESIS AND CHARACTERISATION OF NEW CHIRAL MONOMERS WHICH CAN BE USED IN THE DESIGN OF NONLINEAR OPTICAL POLYMERS

Percino J; Chapela V M; Sosa A; Ortega-Martinez R; Rodriguez A A

Puebla,Universidad Autonoma; Mexico,Universidad Nacional Autonoma

(ACS, Div. of Polymeric Materials Science & Engng.)

Extensive development of organic non-linear optical (NLO) materials has resulted in compounds potentially suitable for applications in optical telecommunication and data storage devices. Much of the research has been directed toward materials that produce second-harmonic generation (SHG), the frequency doubling of laser light. Organic materials possess several attractive properties for their study. Second harmonic generation in the solid state is restricted to materials that crystallise in noncentrosymmetric space groups, but approximately 75% of all organic materials crystallise in centrosymmetric space groups and therefore SHG-inactive. The synthesis of monomers by means of optically active pure substances attached to methacryloyl chloride, which can be used in the design of organic nonlinear optical materials, is described. 16 refs.

MEXICO

Accession no.802769

Item 193

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.264-5 OPTICAL ELECTROCHEMICAL AND THERMAL PROPERTIES IN LIGHT EMITTING POLYMERS

Zheng M; Sarker A M; Gurel E E; Lahti P M; Karasz F E Amherst, Massachusetts University

(ACS, Div. of Polymeric Materials Science & Engng.)

It has been previously shown that PPV related copolymers containing aromatic conjugated and aliphatic non conjugated blocks are soluble, have good film forming and mechanical properties and are suitable for fabrication of light emitting applications. These alternating block copolymers also provide exciton confinement due to the microphase separated domains and can be designed to provide emission at any selected portion of the spectrum. Such copolymers have shown to be efficient light emitting electroluminescent materials in several LED architectures. Synthesised copolymers to date have glass transition temperatures (Tg) 50 deg.C above ambient as a result of the methylene soft block incorporated into the backbone. The synthesis and properties of additional copolymers with well-defined conjugated segments and with m-xylene spacer unit in the soft block are described. The effect of m-xylene block and selected substituents on the chromophore unit is investigated by optical, thermal and electrochemical techniques. 11 refs.

USA

Accession no.802765

Item 194

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.261-2 NOVEL SECOND-ORDER NONLINEAR OPTICAL MATERIAL WITH AMPHIPHILIC SIDE CHAINS Liu G; Baker G L

Michigan, State University

(ACS, Div. of Polymeric Materials Science & Engng.)

An attempt is made to exploit phase separation to prepare crystalline materials with aligned dipole moments. The hydrophobic and hydrophilic portions of amphiphilic molecules generally segregate to form ordered structures in solution and in the solid state. For example, simple AB surfactants based on ethylene oxide (EO) oligomers and linear alkyl (C) chains phase separate and crystallise in lamellar structures. If a molecule with a strong dipole moment is inserted at the junction between an (EO)m and a (C)n chain, the driving force for phase separation might be large enough to overcome the normal antiparallel pairing of the dipoles. This method should lead to noncentrosymmetric arrays of polar molecules. This approach is tested by preparing p-nitroaniline derivatives that contain pendant (C)n and (EO)m chains and examining their properties. 4 refs.

USA

Accession no.802763

Item 195

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.260

NOVEL DEPOSITION TECHNIQUES FOR SELF-ASSEMBLED NON-LINEAR OPTIC THIN FILMS Guzy M E; Shah S; Davis R M; Van Cott K E; Heflin J R; Wang H; Gibson H W

Virginia Tech

(ACS, Div. of Polymeric Materials Science & Engng.)

Materials exhibiting second-order harmonic generation comprise a class of nonlinear optical (NLO) materials useful for applications in electrooptic modulators and for spectroscopy. At present, electro-optic modulators that convert electrical signals into optical signals for fibre optic communications are based on inorganic NLO crystals that are difficult and expensive to fabricate. Polymeric NLO devices could, in principle, be fabricated more quickly, be less costly, and could have several key performance advantages over inorganic devices. However, polymeric electro-optic devices based on poling to orient chromophores currently do not meet performance and stability requirements needed for applications. As an alternative to the poling approach, a self-assembly technique for fabricating polymeric films with oriented chromophores is examined. 4 refs.

USA

Accession no.802762

Item 196

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.258-9 NEW O- AND P-

METHACRYLOYLAMINOPHENYLARSONIC MONOMERS FOR SECOND ORDER NONLINEAR OPTICAL MATERIALS

Percino J; Chapela V M; Ortega-Martinez R; Rodriguez A A

Puebla,Universidad Autonoma; Mexico,Universidad Nacional Autonoma

(ACS, Div. of Polymeric Materials Science & Engng.)

The development of new polymeric materials, using methacryloyl-based derivatives, which can feature nonlinear optical properties, is described. Attention has been focused on monomers with an attached group, i.e. the -AsO(OH)2 group. New organic molecules, o- and pmethacryloylaminophenylarsonic acids are reported. In a first approach it may be speculated that the presence of the attached group in the molecular unit results in second harmonic generation. 13 refs.

MEXICO

Accession no.802761

Item 197

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.254-5 MOLECULAR ORGANIC LIGHT EMITTING DEVICES UTILISING END-CAPPED OLIGOTHIOPHENE OLIGOHETEROCYCLES AS LIGHT EMISSION CENTRES

Kushto G; Mitschke U; Bauerle P; Kafafi Z US,Naval Research Laboratory; Ulm,University (ACS,Div.of Polymeric Materials Science & Engng.)

The evaluation of the photoluminescence and electroluminescence properties of any possible molecular dopants is of significant importance. The results of a study found that the derivatisation of the central thiophene ring in the end-capped quinquethiophene oligomer to a furan, oxazole or 1,3,4-oxadiazole ring significantly increases the photoluminescence quantum yield of the material. In addition, the molecular orbital energetics of the derivatives are altered from those of the parent material, expanding the possibility of using these new materials as charge transport materials in OLEDs and other organic semi-conducting devices. In an attempt to further elucidate the properties of these materials and evaluate their possible utility as emission centres in MOLED structures, an investigation is undertaken of the absolute photoluminescence quantum yields of each of the derivatised quinquethiophenes dispersed in a suitable host material. Inaddition, the most efficient of the emitters is incorporated into multilayer MOLED devices and the effects of dopant concentration on the device efficiencies are evaluated. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.802759

Item 198

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.243-4 COMPACT EO POLYMER VIBRATION SENSOR UTILISING RIDGE AND SLAB-MODE WAVEGUIDES

Yacoubian A; Lin W; Olson D; Bechtel J IPITEK Corp.

(ACS, Div. of Polymeric Materials Science & Engng.)

The use of integrated optical interferometers for sensing applications has been extensively investigated. Mach-Zehnder and Michelson interferometer based polymer integrated optical circuits are often long due to the required low angle waveguide bends. Long devices result in high propagation loss, material wastage and low yield per wafer. Furthermore, directional coupler based Michelson interferometers impose additional difficulties, such as high fabrication precision and the close proximity of the input and output waveguides that make it difficult to couple light in and out. To overcome these problems, a new device design is proposed that is much shorter, does not use a directional coupler for splitting light, and the input and output ports are located on perpendicular faces of the sample. 9 refs.

USA

Accession no.802752

Item 199

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.241-2 **POLYMERIC THIN-FILM THERMO-OPTIC BEAM DEFLECTOR** Han X; Li B; Ni J; Tang S Radiant Research Inc.

(ACS, Div. of Polymeric Materials Science & Engng.)

A thermo-optical beam defector based on a hybrid thinfilm made from fluorinated acrylic polymers and GeO2doped silica is reported. The thin-film waveguide beam deflector consists of a SiO2 bottom cladding layer, a top cladding layer containing the low refraction index of a fluorinated polyacrylate and a guiding layer of alternatively positioned fluorinated polyacrylate and doped silica microprisms, which is cascaded in a linear array pattern. The beam deflection is achieved through the temperature changes in both polymer and doped silica microprism. Such a novel device concept takes advantage of the opposite thermo-optic responses between the optical polymers and optical glasses. 3.7 degree of beam defection angle is obtained from the temperature increase from 20 to 80 deg.C with the power consumption of about 100 mW. 15 refs.

USA

Accession no.802751

Item 200

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.239-40 COVALENT SELF-ASSEMBLY APPROACH TO IMPROVEMENT OF INTERFACIAL OLED ANODE/HOLE TRANSPORT LAYER CONTACTS

Cui J; Qingwu W; Marks T J Northwestern University (ACS,Div.of Polymeric Materials Science & Engng.)

A procedure is reported that employs an interlinked holeconducting self-assembled, densely-packed monolayer and multilayers thereof to improve the interfacial stability and charge injection efficiency at the ITO/HTL interface. A self-assembled TPD moiety, triphenylamine (SA-TPA) functionalised with trichlorosilyl groups, is used as the ITO modifying layer. The substantial influence of this nano-regular, uniformly grown, covalent-bonded interlayer on the electroluminescence performance of conventional OLED devices is described.

USA

Accession no.802750

Item 201

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.229-30 OPTICAL WAVEGUIDES AND MODULATORS BASED ON LOW-LOSS INDEX-TUNABLE EO POLYMERS

Ashley P R; Lindsay G A; Herman W N; Cites J S US,Army; US,Navy; Aegis Technologies (ACS,Div.of Polymeric Materials Science & Engng.)

For a given optical waveguide dimension in a Mach-Zehnder modulator, the difference between the index of refraction of the core and cladding materials must be designed to achieve an adequate trade-off between optical loss and V pi. The optimum index of refraction difference can be estimated by modelling wherein one of the parameters is varied while the others are fixed. However due to margins of error in reproducing the refractive index and in determining thickness of the core and cladding layers, best results are achieved when a final timing is performed which includes consideration of changes in material properties during the poling process. A fluorinated non-linear optical polymer, whose index of fraction can be tuned by design, and a method for minimising the optical loss in active devices in Mach-Zehnder optical modulators, are reported. 2 refs.

Accession no.802745

Item 202

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.224-5 **NONLINEAR OPTICAL PROPERTIES OF A NEW PURE LIQUID PHTHALOCYANINE** Flom S R; Shirk J S; Pong R G S; Snow A W;

Maya E M

US,Naval Research Laboratory (ACS,Div.of Polymeric Materials Science & Engng.)

Recently, a pure liquid phthalocyanine thin film, made by peripherally substituting polyethylene oxide chains onto the phthalocyanine rings, has been shown to lead to good limiting performance coupled with novel photovoltaic response. This viscous liquid formed excellent, stable, non-scattering films. It was suggested that the long lifetime observed in the lead substituted polyethylene oxide phthalocyanines might be due to a facile excited state charge transfer and subsequent trapping to give a long lived excited state. In order to explore this possibility, an attempt was made to measure the nonlinear optical and photoelectric properties on diluted samples. However, the Pb ion was found to be labile in the polyethylene oxide substituted material when it is dissolved in a number of solvents. Since other Pb phthalocyanines are stable in deoxygenated solution, an alternative was sought to the polyethylene oxide substituents. Another substituent that can give liquid phthalocyanines properties is polydimethylsiloxane. It has several advantages including the greater inertness of the polydimethylsiloxane moiety compared to polyethylene oxide. The linear and non-linear optical properties of thin films of the first member of a new series of polysiloxyphthalocyanines are reported. 12 refs.

USA

Accession no.802743

Item 203

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.210-1 CHARGE TRANSPORT HETEROCYCLIC LIQUID CRYSTALS FOR ORGANIC LIGHT EMITTING DIODE APPLICATIONS

Twieg R J; Gu S; Semyonov A; Sukhomlinova L; Malliaras G G; Fan R; Singer K; Ostroverkhova O; Shiyanovskaya I

Kent State University; Cornell University; Case Western Reserve University

(ACS, Div. of Polymeric Materials Science & Engng.)

The synthesis and physical properties of a variety of heterocyclic liquid crystalline materials are reported. Electrochemical behaviour of some of them is evaluated and charge transport properties investigated by the timeof-flight technique. Also described are fabrication and properties of single and multilayer devices containing these materials that operate at room temperature. 12 refs. USA

Accession no.802736

Item 204

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.204-5 EFFICIENT LIGHT-EMITTING WITH POLYFLUORENES EMITTING LAYER AND THERMALLY POLYMERISED AMINE-CONTAINING HOLE TRANSPORTING LAYER Jiang X Z; Liu S; Ma H; Zheng X; Liu M S; Jen A K Y Washington,University

(ACS, Div. of Polymeric Materials Science & Engng.)

During the last decade, polymer light-emitting diodes (PLEDs) have been intensively investigated due to their great potential in large-screen flat panel colour displays and backlights for liquid crystal displays. A balanced hole and electron injection/transport is required for good device performance. Since few polymers are both hole and electron injecting/transporting materials, multilayer device configuration is frequently employed to fabricate high performance devices. To date, polyfluorene and its derivatives (PFs) have attracted much attention because of their good film-forming ability, thermal stability and high solid state fluorescence efficiency. The facile substitution at the 9-position of the fluorene molecule provides good control over polymer properties such as processability and morphology. Another way to tune the properties of fluorene-based polymers is through copolymerisation, which can be carried out via the Suzuki coupling reaction. A series of binaphthyl-containing PFs have been developed for PLED application. To enable the fabrication of multilayer devices, a series of triphenylamine and tetraphenyldiamine (TPD)-containing hole transporting materials has also been developed. The hole transporting layer (HTL) using these materials is fabricated by spin-coating their monomer precursor solutions onto indium tin oxide glass substrates followed by curing at 225 deg.C. High brightness and efficiency

blue PLED is demonstrated. Double-layer PLEDs are reported using TPD-containing polymer as the HTL and PFs as the electron transport/emitting layer. 11 refs.

Accession no.802733

Item 205

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.196-7 **INTERDEPENDENCE OF THE NONLINEAR RESPONSE MECHANISMS OF PTS** Flom S R; Lindle J R; Bartoli F J; Liu M; Stegeman G I

US,Naval Research Laboratory; Central Florida,University (ACS,Div.of Polymeric Materials Science & Engng.)

The non-linear optical response mechanisms observed in single crystals of the polydiacetylene, poly(2,4hexadiyne-1,6-diol-bis(p-toluenesulphonate) (pTS) have been extensively studied. In particular, the effects and interactions of two-, three- and four-photon absorption and refraction in pTS have recently been investigated. A necessary consequence of any linear or non-linear absorption is the creation of excited state populations. The original goal in undertaking non-linear optical studies of pTS was to assess the importance of the excited state population on the overall non-linear response, particularly near the band edge where the small band tail one-photon absorption might well complicate the interpretation of the nonlinear optical data. Previous reports have demonstrated that the dominant non-linear response mechanism in the spectral region between between 700 and 750 nm is twophoton absorption. Transient absorption studies have also been performed in addition to the single pulse non-linear transmission measurements. In these two pulse experiments the white light continuum probes the sample before, during and after the arrival of the intense pump pulse. Large induced absorption is observed throughout the region between 750 and 950 nm and is attributed to excited state absorption from the two-photon state. In addition, strong emission peaks from stimulated Raman processes are observed. The time and intensity dependence of these induced spectral features and their interdependence is described. 5 refs.

USA

Accession no.802729

Item 206

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.190-1 PHOTOCONDUCTIVE FATIGUE STUDIES IN FAST PHOTOREFRACTIVE POLYMERS

Herlocker J A; Ferrio K B; Hendrickx E; Zhang Y; Wang J F; Mash E; Peyghambarian N; Kippelen B Arizona,University

(ACS, Div. of Polymeric Materials Science & Engng.)

Soon after the first observation of photorefractivity in a polymer, guest-host polymer composites were doped with birefringent chromophores, enhancing the index modulation through dipole reorientation by the photorefractive space-charge field. Subsequently, guesthost polymers have been refined to produce nearly 100% diffraction efficiency, improved dynamic range, increased shelf-life and ever-improving response times. Guest-host photorefractive polymer composites present the possibility of economical media for holographic recording and optical data processing. In contrast to the aforementioned improvements in these materials, lesser consideration has been given to photoconductive fatigue and optical operating lifetime. The stability of photorefractive polymer composites initially optimised for short response times and large index modulations under continuous-use conditions is examined. A systematic study is presented of response timesevolving with exposure for a series of chromophores with ionisation potentials progressively higher than that of the host polymer. The results show that the response time can be dramatically stabilised over extended exposure. Measurements that illuminate the mechanisms contributing to this stabilisation are reported, although a full explanation remains a subject of active research. 8 refs.

USA

Accession no.802726

Item 207

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.188-9 PHOTOCONDUCTIVE MECHANISMS IN THE DYNAMIC PHOTOREFRACTIVE RESPONSE IN POLYMER COMPOSITES Ostroverkhova O; Singer K D

Case Western Reserve University; Kent State University

(ACS, Div. of Polymeric Materials Science & Engng.)

Photorefractive materials (PR) are characterised by their ability to create a space charge field under the influence of low intensity coherent optical beams producing a spatial modulation of the refractive index. A variety of applications such as holographic data storage, image processing, adaptive optics and telecommunications has been suggested for such materials. Almost all of these applications require fast response times. The speed limitations of the PR effect in organic materials are yet not clearly understood, although recently several studies have been directed towards making a connection between the photorefractive and photoconductive properties. A study of photorefractive speed is presented along with studies of carrier mobility, photoconductivity and quantum efficiency for several polyvinyl carbazole-based photorefractive materials. 7 refs.

USA

Accession no.802725

Item 208

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.172-3 DESIGN AND SYNTHESIS OF NONCENTROSYMMETRIC ORGANIC THIN FILMS WITH HYDROGEN MAIN CHAIN POLYMERS

Landsorf C; Simpson J; Jacobsen J; Dyer D J Southern Illinois,University (ACS,Div.of Polymeric Materials Science & Engng.)

Organic thin films formed by chemical transformations or through self-assembly processes are intellectually fascinating and technologically important. Chemists and materials scientists are particularly interested in developing methodologies that allow for the 'controlled' synthesis of large supramolecular assemblies with welldefined structures. A major goal is to design selfassembling organic thin films with a non-centrosymmetric polar architecture. Many emerging technologies require materials that exhibit thermodynamically stable noncentrosymmetric architecture. For instance, non-linear optics (NLO) provides an approach for the manipulation of light with electro-optic devices. Second-order NLO effects require acentric orientation of highly polarisable molecules with large first molecular hyperpolarisability. The great potential for organic NLO materials is derived from well-developed synthetic methodologies that may be used to tailor the properties of a material to specific functions. In addition, organic materials are easily processed into thin films on surfaces like silicon. Currently, however, NLO active organic materials have yet to be incorporated into commercial devices due to several key problems. Specifically needed are materials with larger NLO response and improved polar stability. 15 refs.

USA

Accession no.802717

Item 209

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83. Washington, D.C., 20th-24th Aug.2000, p.171

NEW CROSSLINKABLE POLYESTERS FOR PHOTONIC APPLICATIONS

Sun S; Maaref S; Alam E; Saulter J; Wyatt S Norfolk,State University (ACS,Div.of Polymeric Materials Science & Engng.)

A facile protocol has recently been explored and developed to synthesise processable and easily crosslinkable NLO polyester systems. Preliminary data on maleic anhydride and similar co-monomers condensing with a NLO chromophore such as Disperse Red-19 (DR-19) demonstrate that the synthesised unsaturated polyesters are processable, stable and good quality thin films can easily be obtained via spin coating. In addition, these polyester thin films can easily be thermally crosslinked at polymer glass transition state in air. The aim is to develop convenient and inexpensive synthetic and fabrication protocols to fabricate photonic polymer thin films with the capability of being either thermally or photo crosslinked. These thermal or photo crosslinkable photonic functional polymer thin films have potential applications in wave-guide device fabrication. 3 refs. USA

Accession no.802716

Item 210

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.169-70 ELECTRO-OPTIC MODULATION (40 MHZ) IN TRANSMISSION AND REFLECTION USING SINGLE-CRYSTAL THIN-FILMS OF DAST Bhowmik A K: Tan S: Abyi A C: Mishra A: Thakur M

Bhowmik A K; Tan S; Ahyi A C; Mishra A; Thakur M Auburn, University

(ACS, Div. of Polymeric Materials Science & Engng.)

Electro-optic (EO) modulation in organic materials is attractive as they offer high bandwidth operation. The large second order susceptibilities of organic crystals can lead to devices with a very short interaction length. Singlecrystal films of the organic molecular salt, DAST, have recently been shown to possess the largest known electrooptic coefficient. This exceptionally large electro-optic coefficient may lead to many novel device architectures for applications in high-speed optical signal processing. New results for EO modulation in DAST single-crystal films are discussed with both transmission and reflection geometries. Measurements are performed as a function of the frequency of the applied electric field up to 40 MHz. 2 refs.

USA

Accession no.802715

Item 211

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.167-8 RECENT PROGRESS IN FABRICATING WIDEBAND POLYMER ELECTROOPTIC MODULATORS FOR SPACE APPLICATIONS

Barto R R; Ermer S E; Anderson W W; Girton D G; Dries L J; Taylor R E; Van Eck T E; Eades W D; Moss A S; Mendenilla G S

Lockheed Martin Advanced Technology Center (ACS,Div.of Polymeric Materials Science & Engng.)

Electro-optic (EO) polymers have been investigated for many years as the active switching components for photonic modulators. Photonic modulators and switches are of interest for RF signal distribution and control in space systems because of the inherent high bandwidth, light weight and immunity to electromagnetic interference. For an external modulator the sensitivity is described by the half-wave voltage figure of merit, V pi. In an RF photonic link, maximum gain and minimal noise figure would be achieved by minimising V pi and also by maximising the detected photocurrent, which requires minimising optical loss. In addition to the key performance requirements of high sensitivity and low optical loss, there are also many survivability requirements for space applications that are very missionspecific. Progress in the development of polymer based high sensitivity EO devices for space applications is discussed. 6 refs.

USA

Accession no.802714

Item 212

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.165-6 NOVEL PERFLUOROCYCLOBUTANE-CONTAINING THERMOSET POLYMERS AND DENDRIMERS FOR ELECTRO-OPTIC DEVICES

Ma H; Chen B; Dalton L R; Jen A K Y Washington,University

(ACS, Div. of Polymeric Materials Science & Engng.)

A large number of highly non-linear chromophores has been synthesised and some of these exhibit very large macroscopic nonlinearities in guest/host poled polymers. In order to realise a stable dipole alignment, it is common practice to utilise either high glass transition temperature polymers with NLO chromophores as side-chain or crosslinkable polymers with NLO chromophores that can be locked within the polymer network. Recently, perfluorocyclobutane (PFCB) polymers have been found to be excellent matrices for E-O materials due to the combination of excellent processability and high performance such as low dielectric constant, low moisture absorption, good thermal and thermal oxidative stability, high glass-transition temperature and optical transparency. Novel perfluorocyclobutane-containing thermoset polymers and dendrimers for electro-optic devices are described. 7 refs.

USA

Accession no.802713

Item 213

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.529-30 CONTROLLING CONJUGATED POLYMER PHOTOPHYSICS: ROLE OF INTERCHAIN SPACING WITHIN TWO-DIMENSIONAL ASSEMBLIES

McQuade D T; Kim J; Swager T M Massachusetts,Institute of Technology (ACS,Div.of Polymeric Materials Science & Engng.) Data are presented demonstrating that interchain distance has a strong influence on the spectral properties of polyphenylene ethynylenes and provides a strategy for controlling polymer spacing and thus film characteristics. Utilising this approach, sensors are currently being developed which take advantage of the orientation and the higher density that the edge-on structure provides. 18 refs.

USA

Accession no.802372

Item 214

Composites Part A: Applied Science and Manufacturing 32A, No.2, 2001, p.189-96 STATIC STRENGTH OF CFRP LAMINATES WITH EMBEDDED FIBRE-OPTIC EDGE CONNECTORS

Sjogren B A

Sweden, Aeronautical Research Institute

The effect of embedded fibre-optic ferrules on the static strength of aircraft composite structures made from carbon fibre/epoxy prepreg was investigated in tension and compression. Fractography was employed to to determine the governing failure mechanisms in tension and compression. It was found that the ferrules had a considerably large effect on static strength, which was attributed mainly to extensive ply waviness occurring when the ferrules were embedded. 12 refs.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.801516

Item 215

Chinese Journal of Polymer Science 19, No.1, Jan.2001, p.39-44 PREPARATION AND SECOND-ORDER OPTICAL NONLINEARITY OF NOVEL PHENOXYSILICON NETWORKS BY SOL-GEL PROCESS

Huang X; Wang J; Zhang L-z; Cai Z-g; Liang Z-x Zhongshan, University

Several phenoxysilicon networks were produced by an extended sol-gel process involving the alcoholysis of trialkoxysilane with the aromatic hydroxyl groups of chromophore-containing glycidyl phenolic resin. Films were prepared by spin coating solutions of the sols onto various substrates, poled and crosslinked at 170C and the second-order non-linear optical coefficients and their decay as a function of time at room temperature and 120C investigated. These networks were found to exhibit good second-order non-linear optical coefficient stability, which was attributed to the locking in of the orientation of the chromophores in the networks. 12 refs. CHINA

Accession no.801454

Item 216

Patent Number: US 6122428 A1 20000919 RADIATION-CURABLE COMPOSITION FOR OPTICAL FIBER MATRIX MATERIAL Duecker D C

Borden Chemical Inc.

A curable composition is disclosed that is useful for securing colour coded optical fibers in a matrix of an optical fibre cable. The matrix material can be stripped from the individual fibres without removing the color coding associated with the individual fibres. The matrix material is also resistant to solvents used in the stripping process.

USA

Accession no.800975

Item 217

Analytical Chemistry 72, No.24, 15th Dec.2000, p.5967-72 STUDY OF THE SENSITIVITY OF THE ACOUSTIC WAVEGUIDE SENSOR Gizeli E Cambridge,University

The sensitivity of the acoustic waveguide sensor to mass deposition in the presence of liquid was optimised as a function of the over-layer thickness. The waveguide geometry consisted of a 0.2 to 2.2 micrometre PMMA over-layer deposited on the surface of a shear acoustic wave device and supported a Love wave. The response of each polymer-coated waveguide was initially assessed by monitoring the frequency and insertion loss of the device in the presence of air. Sensitivity to viscous and mass loading was studied by recording the amplitude and phase of the wave during the application of water and of a supported lipid bilayer, respectively, on the device surface. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.800750

Item 218

Patent Number: US 6107402 A1 20000822 **OPTICAL POLYMER COMPOSITION** Kim E-J; Han K-S; Jang W-H; Rhee T-H SamSung Electronics Co.Ltd.

Polymers having the same repeating units with different polymerisation ratios are mixed in an arbitrary ratio. An optical material having a desired refractive index can be produced by adjusting the mixing ratio based on weight. With such a composition, it is easy to adjust the difference in refractive indices between a core and a cladding forming an optical waveguide.

KOREA; USA

Accession no.800056

Item 219

Patent Number: US 6107361 A1 20000822 SOLVENT-FREE, RADIATION-CURABLE, OPTICAL GLASS FIBER COATING COMPOSITION AND SOLVENT-FREE METHOD FOR MAKING A SOLVENT-FREE, RADIATION-CURABLE, OPTICAL GLASS FIBER COATING COMPOSITION

Tortorello A J; Murphy E J DSM NV

The coating composition contains a) a urethane oligomer with a functional group capable of polymerisation in the presence of actinic radiation and an average functionality of at least about 1.2, having a vinyl addition polymer, as backbone, b) a urethane compound having a functional group capable of polymerisation in the presence of actinic radiation, with an average functionality of at least about 1, containing an organic moiety having about 5 or more carbon atoms, as backbone and c) a reactive diluent.

USA

Accession no.800017

Item 220

Patent Number: US 6110593 A1 20000829 RADIATION-CURABLE OPTICAL FIBER PRIMARY COATING SYSTEM

Szum D M; Chawla C P; Petisce J R; Pasternack G; Bishop T E; Snowwhite P E; Zahora E P DSM NV

This has excellent ribbon stripping and adhesion behaviour. The excellent stripping and adhesion behavior can be provided by an inner primary coating composition having a slip enhancing component and a high modulus outer primary coating composition. Stripping behaviour can be measured by crack propagation and fibre friction measurements.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; USA; WESTERN EUROPE

Accession no.799901

Item 221

Patent Number: US 6110592 A1 20000829 METHOD FOR THE PREPARATION OF A POLYMERIC MIXTURE FOR CABLE INSULATORS AND COATINGS, POLYMERIC MIXTURE THUS PRODUCED AND CABLES CONTAINING IT

Grizante R E; Zaopo A; Castellani L Pirelli Cavi SpA

A polymeric mixture for cable insulators and coatings and sheaths for optical fibre cables is produced by completely mixing (i) from 50 to 80 parts (w/w) of a first thermoplastic polymer, which is amorphous, highly resistant to flames and combustion and consists of an aromatic polyester of isophthalic and terephthalic acid with bisphenol A, and (ii) from 20 to 50 parts (w/w) of at least a second thermoplastic polymer consisting of an elastomeric polyether-ester block copolymer having a Shore D hardness greater than 50 and a Vicat softening point greater than 170C for less than 10 min. to produce a homogeneous composition.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.799900

Item 222

Plastics Additives & Compounding 2, No.9, Sept. 2000, p.8 **WIRE AND CABLE PREDICTED TO GROW**

The European market for plastics in wire and cable applications is examined with reference to a report from Frost & Sullivan. The market is predicted to rise from 811.5 million US dollars in 1999 to 959 million US dollars by 2006. The use of plastics in cable covering is reported to be growing at a higher rate than the cable market as a whole, with plastics replacing traditional materials such as rubber and electrical paper. Rapid developments in telecommunications and information technology are providing new opportunities for plastics, but European plastics suppliers are facing competition from US manufacturers and the growth of in-house plastics compounding by cable manufacturers. The industry is further analysed in terms of markets, consumption trends, and suppliers.

FROST & SULLIVAN EUROPE-GENERAL Accession no.799499

Item 223

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.914-5 **NOVEL URETHANE-UREA COPOLYMERS CONTAINING SILOXANE LINKAGES FOR ELECTRO-OPTIC APPLICATIONS** Wang C; Zhang C; Zhou C; Chen M; Dalton L R; Sun G; Zhang H; Steier W H Southern California,University (ACS,Div.of Polymer Chemistry)

Considerable efforts have been devoted to the study of polymer-based materials exhibiting efficient second-order nonlinear optical (NLO) properties due to their potential applications in the photonics-based industries. One of the key issues in realising this potential application is the temporal stability of NLO polymers. For second-order NLO polymers utilising an external electric field to achieve the effective poling of the randomly oriented chromophores, the resulting NLO signal is thermodynamically unstable, especially at elevated temperatures. Various strategies have been used to prevent the randomisation of the aligned chromophores in the polymer matrix. In this regard, the polyfunctionalised PUs have been intensely investigated, and have offered reasonable number density of high mu beta chromophores, high poling efficiency, good solubility, as well as easy preparation and processing. To further enhance the temporal stability of this kind of polymer, a new methodology is developed that introduces urea groups and dimethylsiloxane units simultaneously into the main chains of PUs. A series of urethane-urea copolymers containing siloxane linkages of different length is prepared, showing improved temporal stability, low optical loss and good solubility in common organic solvents. 10 refs.

USA

Accession no.798811

Item 224

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.912-3 CHROMOPHORE INCORPORATED FLUORINATED AROMATIC POLYESTER FOR ELECTRO-OPTIC APPLICATIONS

Zhang C; Wang C; Zhou C; Lee M; Chen M; Dalton L R; Zhang H; Steier W H Southern California,University (ACS,Div.of Polymer Chemistry)

Polymeric electro-optic materials have been of great interest for many years. For practical applications, the materials must satisfy three key requirements: high electro-optic coefficient (r33), good thermal stability of chromophore dipole alignment which is generally induced by electric field poling, and low optical loss at communication wavelengths. In previous studies, emphasis was placed on various PU systems and achieved high r33 and good temporal stability were obtained. However, optical loss still remains an issue. Covalent incorporation of chromophores into polymer systems enhances thermal stability and material homogeneity, but it also introduces difficulty in polymer synthesis. Due to the limited stability, covalent attachment of very high mu beta chromophores into rigid polymers such as polyimides and polyarylethers has to be performed after polymerisation to avoid harsh polymerisation conditions such as high temperature, strong acid/base. Postpolymerisation method may introduce new problems such as low yield, poor repeatability of loading density. The direct incorporation of hydroxy-functionalised CLD chromophore into fluorinated aromatic polyester is reported, together with preliminary results on the electric field poling behaviour and thermal stability of the new material. 5 refs.

USA

Accession no.798810

Item 225 Journal of Applied Polymer Science 79, No.1, 3rd Jan.2001, p.176-82

EVALUATION OF HALOGENATED POLYIMIDE ETCHING FOR OPTICAL WAVEGUIDE FABRICATION BY USING INDUCTIVELY COUPLED PLASMA

Han K; Kim J; Jang W-H Samsung Electronics

By using inductively coupled plasma (ICP) oxygen plasma etching of a series of halogenated polyimides was performed for low-loss waveguide fabrication. Investigations were carried out on the effects of etching parameters such as ICP power, rf power, and 02 flow rate on the etching rate and etching profile of polymer films. The increase in the etch rate with the ICP power and the rf power was identified. Both the vertical profile and sidewall roughness were found to be related to the ion energy (dc bias). By optimising these parameters, a vertical profile and a smooth sidewall were obtained by 500 W of ICP power, 150 W of rf power, 5 mTorr of chamber pressure, and 40 sccm of the 02 flow rate. 15 refs.

Accession no.798788

Item 226

Antec 2000.Conference proceedings. Orlando, Fl., 7th-11th May, 2000, paper 297 FIBER-OPTIC ELECTRIC FIELD SENSORS USING POLYMER-DISPERSED LIQUID CRYSTAL COATINGS AND EVANESCENT-FIELD INTERACTIONS Tabib-Azar M; Sutapan B; Srikhirin T; Lando J

Case Western Reserve University (SPE)

An optical fibre was coated with a mixture of liquid crystal (E7) and poly(methyl methacrylate), to prepare an electric field sensor. Phase separation resulted in micron-sized droplets of liquid crystal in the polymer matrix. In the absence of an applied electric field, directors in the droplets had no preferred orientation and were randomly distributed, and light was scattered due to the mismatch of the refractive indices between the droplets and matrix. When a field was applied, the directors aligned themselves parallel to the field, and the effective refractive index became equal to the ordinary refractive index of the droplets, and because this had the same value as that of the matrix, the film appeared transparent. The resulting change in the optical properties of the coating changed the transmission output of the fibre, and it was possible to detect the electric field by monitoring the light intensity, changes being detected by evanescent wave interaction. 11 refs.

USA

Accession no.798579

Item 227 **Polymer** 42, No.3, 2001, p.1101-7

SYNTHESIS AND CHARACTERISATION OF BI-FUNCTIONAL PHOTOREFRACTIVE POLYMERS

Chen Y; He Y; Wang F; Chen H; Gong Q Mainz,University; Peking,University; Berlin,Technical University

Azo derivatives as electro-optic chromophores and carbazolyl groups as photoconductive moieties were covalently linked onto an acrylate backbone in the synthesis of a bi-functional photorefractive acrylate polymer. Photorefractive experiments were carried out to determine the synthesised polymers' properties. 21 refs. CHINA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.798383

Item 228

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1311 **OPTICAL WAVEGUIDE ACTINOMETER BASED ON A DUAL CLADDING CONFIGURATION** Hoyt A E; Harrah L A; Coons N C; Powers T M Adherent Technologies Inc.

(ACS,Div.of Polymer Chemistry)

The results of fabrication of optical waveguide actinometers for UV light on fused silica rods acting optical waveguides are presented. Fused silica rods are used to demonstrate the figuration and to test the analytical expression for their sensitivity. 1 ref.

USA

Accession no.798357

Item 229

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1309-10 **NOVEL PHOTOREFRACTIVE POLYMERS SENSITISED BY METALLOPORPHYRIN** Wang Q; Wang L; Yu L Chicago,University

(ACS,Div.of Polymer Chemistry)

Porphyrin and its derivatives are well-known model compounds for photosynthetic processes that involve charge separation. In natural photosynthetic systems, the primary electron transfer step occurs from a porphyrinbase complex. A feasible incorporation of metal metalloporphyrin into conjugated polymers has been demonstrated using the Heck coupling reaction. These polymers have shown large photoconductivity and relatively high quantum yield for photocharge generation, which are essential to a high photorefractive response. The results of the synthesis and characterisation of a novel fully functionalised photorefractive polymer using zinc porphyrin as a photosensitiser are reported. It is found that this system is a high-performance photorefractive material with large net optical gain and high diffraction efficiency. 8 refs. USA

Accession no.798356

Item 230

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1307-8 **POLYCYANURATE BASED WAVEGUIDES WITH LOW LOSS AND HIGH THERMAL STABILITY** Bauer J; Dreyer C; Bauer M; Zawadzki C; Yilmaz S; Wirges W; Yao H; Keil N Fraunhofer-Institut fuer Zuverlassigkeit & Mikrointegration; Heinrich-Hertz-Institut fuer Nachrichtentechnik (ACS,Div.of Polymer Chemistry)

New polycyanurate copolymers with adjustable refractive indices for optical waveguide applications and singlemode channel waveguides based on these materials are fabricated. These polymers have glass transition temperatures above 250 deg.C and thermal stabilities in the same range and show good processability. Propagation losses of slab waveguides, obtained from certain dicyanate/monocyanate copolymers, of ~0.6 dB/cm at 1550 nm and nearly equal insertion losses of the corresponding channel waveguides are found. These values remain on a low level in a wide wavelength range around 1550 nm. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.798355

Item 231

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1306 **CONTROLLED REFRACTIVE INDEX OPTICAL COATING MATERIALS** Schuman P D Optical Polymer Research Inc. (ACS,Div.of Polymer Chemistry)

Fluorinated methacrylate and acrylate polymers are receiving much attention due to an increasing interest in optical fibre applications. Further experimentation on fluorinated methacrylate and acrylate polymers encompasses characterisation of primary and secondary relaxations via dielectric spectroscopy and dynamic mechanical spectroscopy. These studies reveal that fluorinated methacrylate and acrylate polymers are optimum materials for fibre cladding applications. The development of coating systems based on fluorinated acrylate and methacrylate polymers is described. 5 refs.

Accession no.798354

Item 232 Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1302-3 **SYNTHESIS AND PROPERTIES OF OPTICALLY ACTIVE POLYURETHANE IONOMERS CONTAINING ERBIUM** Gu Q; Risen W M

Brown University (ACS,Div.of Polymer Chemistry)

Optically active PU acid copolymers are synthesised which are soluble and which contain photocrosslinkable chain segments. Solutions of their ionomers are also formed with erbium and other metal ions. Films of each of these are photocrosslinked inked and imaged. The PU acid copolymers are synthesised with a cyclic triisocyanate and with optically active forms of tartaric acid and with polybutadiene diol as chain extenders. The reaction conditions exert a reasonably strong influence over the optical rotatory properties of the products, as shown by the results presented. The erbium ionomers, made by reacting the acid copolymer solutions with erbium acetylacetonate in a modified solvent system, have an optical activity that has a different wavelength dependence from that of the acid copolymers. 3 refs.

USA

Accession no.798352

Item 233

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1300-1 **OPTIMISING PERFORMANCE OF PHOTOCURED ADHESIVES IN OPTICAL FIBRE COMPONENTS** Dower W V; Oxman J D

3M Co. (ACS,Div.of Polymer Chemistry)

A ferruleless interconnect design for optical fibre cabling which uses moulded plastic plug ends is assembled with a photocured adhesive. This process requires bonding the duplex connector plugs to both the polyimide and the polymer-coated glass fibre elements of the optic fibre cable. To optimise adhesive performance, the optical properties of the materials of the plug and the cable are analysed. These properties are used to explain the relative performance of several visible-light cured adhesives and the inferior performance of ultraviolet-cured adhesives. 2 refs.

USA

Accession no.798351

Item 234

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1295

NLO-CONTAINING POLYMERS WITH VERY LOW NEAR-IR ABSORPTION

Belfield K D; Stegeman G I; Najjar O; Schafer K J; Meier J; Pliska T Central Florida,University (ACS,Div.of Polymer Chemistry)

An attempt is made to address the key nonlinearity-loss trade-off, which must ultimately be faced, through molecular design of NLO chromophore functionality. Progress in the preparation and characterisation of organic polymers containing NLO chromophores with the goal of achieving minimal near-IR absorption while maintaining high nonlinearity is reported. One strategy to accomplish this involves using the phosphonate group as electronmoieties in NLO chromophores, employing synthetic methodology. Another strategy being pursued utilises electron-donor/electron-acceptor substituted fluorene derivatives, in which the fluorene ring system serves as a thermally and photochemically robust pi-electron bridge. The nonlinearity of chromophore containing polymers is characterised by a standard Maker fringe technique, after poling. Waveguide loss is measured in a planar waveguide of 1.1 mu m thickness at 780 nm. 4 refs.

USA

Accession no.798348

Item 235

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1293-4 **PERFLUOROCYCLOBUTANE (PFCB) POLYMERS FOR OPTICAL FIBRES AND DIELECTRIC WAVEGUIDES**

Shah H; Hoeglund A; Radler M; Langhoff C; Smith D W

Clemson, University; Dow Chemical Co. (ACS, Div. of Polymer Chemistry)

Initial optical and thermal data are compared for polymers prepared from bis-trifluorovinyloxybiphenyl (BPVE), tris-trifluorovinyloxyphenylethane (TVE) and their 50 wt.% copolymer (TVE-co-BPVE). The thermosetting polymer from TVE has previously been reported as a potential waveguide material and an attenuation of 0.25 dB/cm at 1515-1565 nm is determined. 11 refs.

USA

Accession no.798347

Item 236

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1289-90 **UV-TRANSPARENT COATINGS FOR THE FABRICATION OF OPTICAL FIBRE GRATINGS** Simoff D A; Espindola R P; Paczkowski M A; Atkins R M; A; Wang N P; Hale A Lucent Technologies

(ACS, Div. of Polymer Chemistry)

The development of polymeric coatings that are transparent enough to permit irradiation of the fibre through the polymer coating to generate gratings in the core is described. This achievement can enable mass-production of fibre gratings by eliminating the cumbersome stripping and re-coating steps. The manufacture of glass optical fibres involves coating them in situ with a protective polymeric material. The technology of choice employs UV-curable acrylates because of their extremely high cure speed and because the reaction can be triggered at will. These two properties enable a fast production rate while ensuring practically unlimited pot life of the liquid coating. Because the photoinitiators employed in these coatings have very high absorbances in the 240-260 nm region, attempts to write gratings through the coatings generally fail because the intensity that reaches the fibre core is too low to induce significant index changes. Increasing the intensity of the grating-writing laser is not an option because the polymer would be damaged or even destroyed. One way to circumvent this problem is to fabricate fibre with a thermally-cured transparent coating, but this approach creates some manufacturing and performance concerns. Another option is to replace the photoinitiator with one that is more transparent in the 240-260 nm region. The development of coatings that achieve improved transparency through the use of alternate photoinitiators is described. Even better results obtained using a different family of coatings are also presented. 5 refs.

USA

Accession no.798345

Item 237

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1287-8 FLUORESCENT OPTICAL FIBRES FOR DATA TRANSMISSION

Poisel H; Klein K F; Levin V M Nurnberg,Fachhochschule G-S.Ohm; Giessen-Friedberg,University of Applied Sciences; RPC (ACS,Div.of Polymer Chemistry)

Usually fluorescent polymer optical fibres and data transmission belong to different worlds: until recently fluorescent fibres have been used for sensor applications or for decorative purpose whereas data transmission is usually done with clear undoped fibres. It is shown that a combination of both worlds opens the door to new applications in data transmission systems. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; RUSSIA; WESTERN EUROPE

Accession no.798344

Item 238

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings.

New Orleans, La., August 1999, p.1283-4 WAVELENGTH-TUNABLE FIBRE GRATINGS Hale A; Abramov A; Windeler R S; Strasser T A Lucent Technologies (ACS,Div.of Polymer Chemistry)

The last few years have seen a tremendous increase in the data transmission capacity of optical fibres. The ability to transmit simultaneously a large number of closely spaced wavelengths through a single optical fibre (WDM - wavelength division multiplexing) has been in great part responsible for this progress. Although the idea of using WDM is not new, it was not until the advent of optical amplifiers that WDM became practical. Erbium-doped fibre amplifiers (EDFA) are widely used to amplify signals in the 1530-nm wavelength range. However, because these amplifiers do not have a flat gain response over the wavelength region of interest, it is necessary to 'flatten' their gain. One way to achieve this is by using gain equalisers based on long-period fibre gratings. Longperiod fibre gratings can be designed to couple the fundamental mode in a single-mode fibre to forwardpropagating cladding modes, which decay relatively rapidly as they propagate along the fibre axis owing to scattering losses and bends in the fibre. Because the coupling is wavelength-range the fibre grating acts as a wavelength-selective loss element. This property makes long-period fibre gratings very well suited to be employed as gain-equalisers in broadband amplifiers or as bandrejection filters in a variety of applications. Although it is well understood how one can design long-period fibre gratings with fixed responses, the dynamics of optical communication networks requires the ability to tune the response of wavelength-selective devices. The design of wavelength tunable long-period fibre gratings based on silica fibres that employ a specially tailored polymer as an optical outer cladding, where the tunability is achieved by varying the temperature, is outlined. 3 refs. USA

Accession no.798342

Item 239

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1279-80 **PLASTIC OPTICAL FIBRES-PIPE-DREAM OR REALITY?** Quan X Lucent Technologies (ACS,Div.of Polymer Chemistry)

There has been interest in plastic optical fibres (POF) since the advent of optical fibre communications. The aim has been to build extremely low-cost optical networks from POF manufactured with inexpensive, continuous extrusion processes. Large-diameter POF can be used due to the low elastic modulus of polymers. This relaxes the alignment tolerances needed in these networks which can dramatically decrease overall system costs since simple injection-moulded connectors can be used. Installation costs are also expected to be substantially lower due to simpler end-face preparation techniques. To balance all these potential advantages, there has been a number of issues preventing the widespread adoption of POF. However, recent research results offer the promise of finally overcoming some of these obstacles. 10 refs. USA

Accession no.798340

Item 240

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1271-2 **PERMANENT PROTECTIVE COATINGS FOR OPTICAL FIBRES**

Walker C B; Novack J C; Berger T P 3M Co.

(ACS, Div. of Polymer Chemistry)

Optical fibre will be included in the next generation local area network for data transmission. Standard glass optical fibre consists of a glass core, a glass cladding, and two buffer coats that bring the total fibre diameter to 250 micron. Buffer coats are required for protection against microbending and for abrasion resistance. However, when standard glass optical fibre is stripped of its buffer coats to permit insertion into ferruled connectors, bare glass is exposed. A disproportionate percentage of failures has been observed at the stripped fibre sites. 3M has developed a fibre identified as GGP with a permanent protective polymeric layer that demonstrates improved performance. The chemistry of GGP is discussed. USA

Accession no.798336

Item 241

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1269-70 **TRANSPARENT FLUOROCARBON POLYMER BLENDS FOR FIBRE CLADDING APPLICATIONS**

Calves M C; Harmon J P South Florida,University (ACS,Div.of Polymer Chemistry)

Fluorocarbon methacrylate blends are important transparent materials for applications in plastic optical devices. Early studies focused on the miscibility of blends composed of methacrylate and vinylidene difluoride homopolymers. It was later recognised that blends of methacrylate copolymers and fluorocarbon copolymers exhibit a greater miscibility range. This study on optically stable vinylidene difluoride/tetrafluoroethylene copolymer and methyl methacrylate/ethyl acrylate copolymer blends reports UV/ vis spectroscopy, differential scanning calorimetry, dynamic mechanical analysis and refractive index data. USA

Accession no.798335

Item 242

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1265-6 **DEVELOPMENT OF NEW SPECTROELECTROCHEMICAL WAVEGUIDE SENSORS**

Ross S E; Seliskar C J; Heineman W R Cincinnati,University (ACS,Div.of Polymer Chemistry)

The significant problem in chemical sensor development is achieving adequate selectivity for determination of an analyte in a real sample where interferences often confuse the sensor measurement. To date, sensing has been demonstrated based on a novel selectivity concept by challenging prototype sensors with various mixtures containing the analyte and certain direct interferences. As an essential component in the selectivity concept, a series of chemically-selective optical materials is prepared by the sol-gel process. To achieve the first level of selectivity, the sol-gel processed films are blended with organic polyelectrolytes, i.e. they contain ion-exchange moieties. These polyelectrolyte-containing silica composites are less brittle than the parent silica glass due to the incorporation of the organic polyelectrolyte. The combination of a new sensor concept employing three modes of selectivity and a novel spectroelectrochemical sensor design based on planar waveguide technology are described. 11 refs.

USA

Accession no.798333

Item 243

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1256-7 **TUTORIAL ON OPTICAL POLYMERS FOR FIBRES AND WAVEGUIDES** Harmon J P South Florida,University (ACS,Div.of Polymer Chemistry)

There has been much recent interest in using polymers as core and cladding materials in plastic optical fibres as cladding materials for silica fibres and as waveguides. The identification and optimisation of polymers for use in these applications are described. 14 refs.

USA

Accession no.798328

Item 244

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.1156-7 POLYMER FILLED NEMATICS: A NEW CLASS OF LIGHT SCATTERING ELECTRO-OPTICAL DEVICES Van Boxtel M C W; Broer D J; Bastiaansen C W M Eindhoven,University of Technology; Philips Research Laboratories

(ACS, Div. of Polymer Chemistry)

Recently, electro-optical switches consisting of a continuous liquid crystal (LC) phase and a dispersed, spherical inorganic phase with small diameter have been investigated. These LCDs can be switched from a scattering to a transparent state due to polydomain formation of the LC in the off-state and homeotropic alignment of the LC in the on-state. Due to the small size of the dispersed particles, refractive index matching between the two phases is not required. A new display principle is presented, based on a mixture of LC and wellcontrolled polymer spheres. These blends are designed with the objective of improving command over the morphology of the blends and thus to improve the optical and electro-optical properties. These polymer/LC mixtures consist of sub-micron sized crosslinked polymer particles dispersed in a continuous LC matrix and are referred to as the so-called 'polymer filled nematics'. Some initial experimental results are presented concerning synthesis of the polymer particles and characterisation of the polymer/liquid crystal blends. 14 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE Accession no. 798279

Item 245

Polymers for Advanced Technologies 11, Nos.8-12, Aug./Dec.2000, p.601-11 **POLYMERIC MATERIALS FOR DEVICES IN OPTICAL FIBRE SYSTEMS** Blythe A R; Vinson J R Corning Cables

A review is presented of the literature on recent developments of polymers as materials for optical communication systems. Particular attention is paid to polymer optical fibres, planar waveguides and their fabrication, couplers and splitters, thermo-optic switches, diffraction gratings, non-linear optical devices, and sources and amplifiers. 55 refs. (5th International Symposium on Polymers for Advanced Technologies, Tokyo, Aug./Sept.1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.798044

Item 246

Polymers for Advanced Technologies 11, Nos.8-12, Aug./Dec.2000, p.597-600 **OPTICAL FUNCTIONAL WAVEGUIDE DEVICES USING OPTICALLY ACTIVE POLYMERS** Muto S; Tatsuzawa Y Yamanashi,University

Functional devices such as waveguide-type optical modulator and optical isolator using optically active

polymers and diamagnetic polymer were proposed. These devices were based on the reciprocal and/or nonreciprocal TE-TM mode conversion caused by the offdiagonal element of the dielectric tensor in the core polymer. As the structures of these devices were very simple, they could easily be assembled. These operations in the blue wavelength region were analysed theoretically and experimentally. Polymers used were poly-L-menthyl methacrylate and L-menthyl methacrylate-benzyl methacrylate copolymer. 5 refs. (5th International Symposium on Polymers for Advanced Technologies, Tokyo, Aug./Sept.1999) JAPAN

Accession no.798043

Item 247

Polymers for Advanced Technologies 11, Nos.8-12, Aug./Dec.2000, p.553-9 **ORGANIC MATERIALS FOR OPTICAL SWITCHING** Kar A K Heriot-Watt University

Both conjugated polymers and guest-host organic materials were investigated as potential candidates for optical switching applications. The non-linear optical properties were characterised and their suitability was compared with that of the standard switching criteria. Particular attention is paid to ultrafast non-linear refraction in polydiacetylene nanocrystals and to the characterisation of the third-order non-linear optical response of zwitterionic thin films. 20 refs. (5th International Symposium on Polymers for Advanced Technologies, Tokyo, Aug./Sept.1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.798036

Item 248

Reactive & Functional Polymers 46, No.1, Nov.2000, p.59-65 **SYNTHESIS AND CHARACTERISATION OF A NEW LAMBDA-TYPE POLYMER FOR NONLINEAR OPTICS BASED ON CARBAZOLE DERIVATIVE SALT**

Meng F; Ren Q; Xu D; Yuan D; Lu M; Zhang G; Guo S; Zhao X; Wang X; Fang C; Xu G; Liu X; Ye P Shandong,University; Chinese Academy of Sciences

Details are given of the synthesis of a new polymer containing carbazole derivative salt by the copolymerisation of diformylhexylcarbazole with hexylbimethylpyridinium ditetraphenylborate. The second order non-linear optical properties of polymer films were determined. 35 refs.

CHINA

Accession no.797882

Item 249

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings. New Orleans, La., August 1999, p.732-3 SECOND ORDER NONLINEAR OPTICAL POLYURETHANE NETWORKS CONTAINING AZO SIDE GROUPS

Wang H; Yang C; Jing X; Wang Q; Chen T; Han X; Wang F Chinese Academy of Sciences (ACS,Div.of Polymer Chemistry)

Interest in polymeric non-linear optical (NLO) materials has grown tremendously for the past two decades. Compared with doped composites or side chain polymers, crosslinked second order NLO polymers with NLO chromophores covalently bonded to the polymer backbones have demonstrated improved temporal and thermal stability of their non-linearities. Several polymer systems, such as thermosetting epoxy polymers, PUs and polyacrylates have been studied. The NLO properties of these polymers are stable up to 140 deg.C for a long time. Thermosetting PUs containing NLO side groups are synthesised and demonstrate a long-term NLO thermal stability at 80 deg.C. 6 refs.

CHINA

Accession no.797233

Item 250

Patent Number: US 6106948 A1 20000822 NONLINEAR OPTICAL STRUCTURE AND METHODS OF MAKING

Wang X; Balasubramanian S; Li L; Tripathy S; Kumar J

Massachusetts, University

A multilayer structure having macroscopic second order nonlinear optical properties is made by contacting a substrate having ionic adsorption sites with a first charged polyion, ceasing contact of the substrate with the first charged polyion and then contacting the substrate with a second charged polyion having a charge opposite to that of the first charged polyion. At least one of the polyions includes a non-linear optical chromophoric side chain. USA

Accession no.796585

Item 251

Patent Number: US 6093334 A1 20000725 GLASS WAVE GUIDE ELEMENT AND METHOD OF MANUFACTURING THE SAME

Suzuki R; Uetsuka H; Kobayashi D; Arai H; Tamura K Hitachi Cable Ltd.

A glass waveguide element, which is small in size and amenable to integration and mass-production, includes a core having a diffraction grating formed on an under cladding, an over cladding covering the core and a heater for changing the Bragg wavelength of the diffraction grating, the heater being arranged on the over cladding. The core and a central portion of both claddings in a surrounding portion around the core are continuously separated along a longitudinal direction of the core from the substrate through a gap. The core and the surrounding portion around the core are spatially intermittently separated in a width direction of the core from a surrounding portion of both claddings through a gap. The waveguide is formed by etching to form gaps spaced intermittently along both sides of a core with under cladding and over cladding and then removing a patterned silicon film from underneath the core.

JAPAN; USA

Accession no.794610

Item 252

Polymer Bulletin 45, No.2, Sept.2000, p.145-50 OPTICAL WAVEGUIDING IN NOVEL PHOSPHAZENE POLYMER FILMS Page G: Aguille Longz F: Carreido G A: Carr

Rojo G; Agullo-Lopez F; Carreido G A; Garcia Alonso F J; Fidalgo Martinez J I

Madrid, Universidad Autonoma; Oviedo, University

Highly confining optical waveguides of two soluble phosphazene polymers with glass transition temperatures of 150C or above were prepared on glass and quartz surfaces. One of the phosphazene polymers contained the 4-((4'-nitrophenyl)azo phenoxy) non-linear optical side group. Film thicknesses of 0.5-2 micrometres and index steps of about 0.2 for quartz and 0.1 for glass at a wavelength of 0.633 micrometres were achieved. From one to five well-defined modes were observed, depending on the film thickness and the index step. The refractive index dispersion was fitted to a Sellmeier equation. Waveguide losses were estimated to be around 10 dB/ cm. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE Accession no.794368

Item 253

Patent Number: US 6077928 A1 20000620 BIS(DIALKYLMALEIMIDE) DERIVATIVE AND POLYETHERIMIDE FOR OPTICAL COMMUNICATIONS FORMED THEREFROM Suh D-H; Chung E-Y; Rhee T-H SamSung Electronics Co.Ltd.

Disclosed are a bis(disubstituted maleimide) derivative and a polyetherimide for optical communications. The polyetherimide has a high refractive index so that when using such polyetherimide as a material for the core of an optical fibre, the range of the materials that can be selected for the cladding becomes wide. Coating and adhesion to a substrate are improved, resulting in good film forming property and heat stability. Because the polyetherimide can minimise optical loss at a near infrared wavelength range, the polyetherimide is very useful as an optical material in the optical communications field adopting the light of near infrared wavelength.

KOREA; USA

Accession no.793500

Item 254

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.275-7 FILMS OF A NOVEL POLYDIACETYLENE FOR PHOTONICS STUDIES

Cravino A; Moggio I; Dell'Erba C; Comoretto D; Cuniberti C; Dellepiane G; Giorgetti E; Grando D; Margheri M; Sottini S Genova,Universita; Florence,Istituto di Ricerca sulle Onde Elettromagnetiche

A polycarbazolyldiacetylene which was highly soluble in several organic solvents was prepared. The electronic absorption spectra in different solvents showed the presence of the red form of the polymer with the excitonic absorption peak around 540 nm. Thin films with thickness in the range 0.02 to 2.5 micrometres were prepared by the spin casting technique to characterise the linear optical properties and test the possibility of obtaining guided propagation of light. Films from chloroform solution, despite having marked surface roughness, allowed measurement of the TE and TM refractive indices at both 849 and 1321 wavelengths. Higher quality films, obtained from toluene, gave a marked improvement in the waveguiding properties. The results appeared to be promising for future photonics applications. 6 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.792590

Item 255

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.251-6 SYNTHESIS AND MICROWAVE CHARACTERIZATIONS OF CROSSLINKED OLIGOIMIDE

Bes L; Boutevin B; Rousseau A; Mercier R; Bellini B; Decoster D; Larchanche J F; Vilcot J P Montpellier,Ecole Nationale Superieure de Chimie; Laboratoire des Materiaux Organiques a Proprietes Specifiques; Villeneuve,Institut d'Electronique et de Microelectronique du Nord; CNRS

A microwave characterisation of polymers for electrooptical devices was carried out as a collaboration between chemical and physical research groups. The synthesis and characterisation of telechelic oligoimides functionalised with trialkoxysilane end groups were studied. Addition of a crosslinking agent, tris(4hydroxyphenyl)ethane, and thermal curing were shown to lead to network formation, with the trialkoxysilyl end groups as crosslinking sites. The network formation was confirmed by FTIR spectroscopy. The resulting material exhibited a Tg above 300C and a thermal decomposition temp. above 450C. The permittivity from 250 MHz to 40 GHz was determined by spin coating the polymer on a structure as close as possible to a travelling wave electrooptical modulator. 10 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.792588

Item 256

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.245-50 SUBGLASS TRANSITION AND RELAXATION OF ORIENTED CHROMOPHORES IN POLYIMIDES FOR SECOND ORDER NONLINEAR OPTICS

Chauvin J; Nakatani K; Delaire J A; Faure S; Mercier R; Sillion B

Cachan, Ecole Normale Superieure; LMOPS

Side chain polyimides(PIs) bearing disperse red 1(DR1) or NPP groups were synthesised and characterised. The copolymers were soluble in organic solvents and had a very high Tg. Dielectric loss measurements at different frequencies provided evidence for a subglass transition temp. round 120C. Relaxation kinetics of polar order of non-linear optical chromophores were also measured by second harmonic generation at different temps. over a wide range extending from 80 to 180C. An Arrhenius plot of the effective relaxation time clearly showed that there was a transition temp. near the subglass transition with two different activation energies for PI-DR1. An extrapolation of the low temp. regime to room temp. allowed a relaxation time of about 1.25 years to be predicted. The subglass transition temp. value also coincided with the temp. at which an oriented PI-DR1 films started to disorient when heated gradually from room temp. A physical ageing procedure was described which resulted in an increase in the thermal stability. 18 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE Accession no.792587

Item 257

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.241-4 NONLINEAR OPTICAL PROPERTIES OF HIGH GLASS-TRANSITION TEMPERATURE POLYPHOSPHAZENE FILMS

Rojo G; Agullo-Lopez F; Carriedo G A; Garcia Alonso F J; Fidalgo Martinez J I

Madrid, Universidad Autonoma; Oviedo, University

Polyphosphazenes with high Tgs were prepared in which the 4-((4'-nitrophenyl)azo)phenoxy chromophore was incorporated as a side chain group at a concentration of about 30 wt %. The non-linear optical properties of polyphosphazene films were studied. The three components of the second-order NLO susceptibility tensor for corona poled films were determined for a poling field of 6 kV and a temp. of 140C. The thermal stability of the second-order NLO response was found to be very high at room temp. The third-order NLO susceptibility was also determined for the unsubstituted and substituted polymers. 19 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.792586

Item 258

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.151-5 ELECTRIC FIELD DEPENDENCE OF POLING RESPONSE FOR NEMATIC LIQUID CRYSTALLINE MAIN CHAIN POLYMERS WITH LARGE SECOND ORDER OPTICAL NONLINEARITIES

Koch A T H; Warner M; Fridrikh S V; Toussaere E; Zyss J; Schwarzwaelder C E; Tajbakhsh A R; Moratti S C; Friend R H

Cambridge,University; Cachan,Ecole Normale Superieure

Second-order non-linear optical properties were studied for a semiflexible main chain random copolymer with a head to tail structure synthesised from 4-carboxy-4'-(N-(11-hydroxyundecyl)-N-methylamino)-azobenzene and hydroxybenzoic acid. This polymer exhibited a nematic liquid crystal mesophase with a nematic-isotropic transition temp. of 200C. A complex phase behaviour was observed for the polymer and it was shown that the polymer films could be readily annealed into large homogeneously aligned monodomains in device configurations. Measurements of the field-dependent poling behaviour were carried out by means of an ellipsometric set-up after Teng and Man. Three distinctive field regions were found which corresponded to different mechanisms in the response of the polymer chains. No saturation in the poling response could be detected for fields up to 100,000,000 V/m. 22 refs. (European Materials Research Society, Strasbourg, France, June1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; UK; WESTERN EUROPE

Accession no.792582

Item 259

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.109-19 **TOWARDS NON-LINEAR PHOTONICS IN ALL-**

OPTICALLY POLED POLYMER MICROCAVITIES

Piron R; Toussaere E; Josse D; Brasselet S; Zyss J Cachan,Ecole Normale Superieure

An overview is given of the application of macroscopic molecular orientation techniques to quadratic non-linear photonics and a brief historical review is presented of the development of all-optical poling. The basic principles of all-optical poling are described. The definition and linear characterisation of the microcavity structure are considered and photoinduced birefringence and threewave orientation of polymer microcavities are discussed. 62 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.792577

Item 260

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.33-5 6FDA-ODA WAVEGUIDES ETCHED BY ION SHRINKAGE

Trigaud T; Aubry C; Chiron D; Moliton J P; Colombeau B Limoges,University

6FDA-ODA (PI2566), a fluorinated polyimide from Du Pont, was used as a bulk material for the fabrication of low-cost waveguides for use in optical telecommunications. Dry etching of the polymer was carried out by means of ion shrinkage with energetic ions. As ion-bombarded polymers showed losses higher than 2.3 db/cm, guides were made from virgin 6FDA-ODA. Fabrication conditions and waveguiding properties of the products are discussed. 7 refs. (European Materials Research Society, Strasbourg, France, June 1999)

DU PONT

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE Accession no.792565

Item 261

Synthetic Metals 115, Nos.1-3, 1st Nov.2000, p.13-20 POLYMER WAVEGUIDE DEVICES WITH PASSIVE PIGTAILING: AN APPLICATION OF LIGA TECHNOLOGY

Bauer H D; Ehrfeld W; Harder M; Paatzsch T; Popp M; Smaglinksi I

Institut fuer Mikrotechnik Mainz GmbH

A combination of precision mechanics and LIGA (lithography/electroforming/moulding) was used to obtain metallic three-level tools for compression moulding of transparent thermoplastic polymers. These tools could be used for production of waveguide preforms and fibre positioning grooves in the same process step. A timeconsuming active pigtailing could thus be avoided. A second polymeric material, usually a casting resin or optical adhesive, was used as a waveguide core material, immersion medium and to fix the cover plate of the device simultaneously. 13 refs. (European Materials Research Society, Strasbourg, France, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.792562

Item 262

Patent Number: US 6074577 A1 20000613 METHOD OF MOLDING AN OPTICAL CONNECTOR FERRULE

Katsura H; Honjo M; Kakii T; Sakurai W; Shibata M Sumitomo Electric Industries Ltd.

An end-face-side core from which an optical fibre hole forming pin is projected is fastened by a mould to a fibreside core from which an optical fibre hole forming pin and a cavity forming member (for example, a tape fibre hole forming rectangular body) are projected, while the end-face-side core and the fibre-side core are opposed to each other, the cavity forming member being behind the optical fibre hole forming pin and larger than the optical fibre hole forming pin. A resin is injected into a cavity formed in the mould. The mould is opened, the end-faceside core and the fibre-side core are slid in directions in which the end-face-side core and the fibre-side core are separated from each other, and a moulded product is then taken out.

USA

Accession no.792200

Item 263

Patent Number: US 6074511 A1 20000613 METHOD OF JOINING PLASTIC OPTICAL FIBERS TO EACH OTHER

Takano Y; Sugiyama N Asahi Glass Co.Ltd.

Solvent splicing is carried out by means of an organic solvent capable of dissolving or swelling the plastic material of the optical fibres.

JAPAN; USA

Accession no.792197

Item 264

Applied Organometallic Chemistry 14, No.10, Oct.2000, p.640-3 DEGENERATE FOUR-WAVE MIXING MEASUREMENTS OF THE X(3) NON-LINEAR OPTICAL PROPERTIES OF POLYARYLENE-ETHYNYLENESILYLENES

Antipov O L; Domrachev G A; Douglas W E; Guy D M H; Klapshina L G; Koritin A I; Kuzhelev A S; Semenov V V Russian Academy of Sciences; Montpellier II,Universite The third-order optical non-linearity in solution of a series of polyarylene-ethynylenesilylenes containing a variety of backbone arylene groups and substituents at silicon is studied by using the degenerate four-wave mixing technique at 1064 nm with a 6 ns pulse duration. Thermal grating effects may be neglected under the experimental set-ups employed. The results obtained are greater by more than two orders of magnitude than those previously measured for some of the polymers using the Z-scan technique at the same wavelength. The electronic contribution to the fast non-linearity is greater than the nuclear (orientational) contribution by a factor of at least 4. The presence of a single 8-(dimethylamino)naphthyl ligand at silicone affording pentacoordination has a beneficial effect on the X(3) properties. The high X(3)properties of the polymers confirm the presence of extensive through-Si conjugation along the backbone. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; RUSSIA; WESTERN EUROPE Accession no.792121

Item 265

Composite Structures 47, Nos.1-4, Dec.1999, p.759-65 STRUCTURAL INTEGRITY ANALYSIS OF EMBEDDED OPTICAL FIBRES IN COMPOSITE STRUCTURES Hadzic R; John S; Herszberg I

Royal Melbourne Institute of Technology

The virtues of having sensors in manufactured goods for increased functionality purposes are well documented. Benefits include sophisticated structures requiring less maintenance and repair, increased safety and reliability, and avoidance of 'over design'. Although many schemes of sensing are available, these so-called 'smart' products in the near future will increasingly rely on the optical fibres (OF) principles because of numerous inherent advantages. OFs are small, lightweight, possess geometrical flexibility, EMI immunity, operate over a wide range of environmental conditions and can be configured to respond to many physical parameters. The suitability of embedding OF in commonly used carbon fibre composites is reported. These panels are designed, manufactured and tested for the effects of typical fibre-optic geometrical and physical parameters such as types of fibre coating polymers, fibre diameter and fibre distribution. Corroboration of these test results with finite element results are shown. Based on tensile and compression tests on OF-embedded composites, it is shown that significant deterioration on strength is observed beyond a certain OF density level. Emphasis is on the macroscopic effect of having optical fibres in composites from a structural integrity point of view. To this end, an exposition on the theoretical considerations using continuum mechanics the energy principles is provided. 6 refs. AUSTRALIA

Accession no.792090

Item 266

Journal of Materials Science Letters 19, No.18, 15th Sept.2000, p.1673-5 EFFECT OF THE ANGLE BETWEEN OPTICAL FIBRE AND ADJACENT LAYER ON THE MECHANICAL BEHAVIOUR OF CARBON/ EPOXY LAMINATES WITH EMBEDDED FIBRE-OPTIC SENSOR

Kim M S; Lee S; Hwang W Pohang,University of Science & Technology

An extensive evaluation of the influence of angles between an embedded optical fibre and adjacent layer on the mechanical behaviour of composite laminates has not yet been firmly reported. This issue is addressed by quantifying the effects of optical fibre orientation on the tensile behaviour of carbon/epoxy laminates. 10 refs.

SOUTH KOREA

Accession no.791472

Item 267

Patent Number: US 6071441 A 20000606 METHOD OF MANUFACTURING DISTRIBUTED REFRACTIVE INDEX OPTICAL FIBER

Koganezawa K; Yoshihara N; Onishi T; Tsukamoto T Asahi Glass Co.Ltd.

A cylindrical base material having an outer and inner at least two layer structure is produced by using a cylindrical moulded body made of a low-refractive-index material as a mould, and forming at least one layer made of a layerforming material having a relatively high refractive index in the inner surface of the cylindrical moulded body by the rotational moulding, wherein the centrifugal force during the rotational moulding is changed.

JAPAN; USA

Accession no.790803

Item 268

Patent Number: US 6084050 A1 20000704 THERMO-OPTIC DEVICES

Ooba N; Watanabe T; Kurihara T; Imamura S; Hayashida S; Tamamura T; Ishii T; Inoue Y; Toyoda S Nippon Telegraph & Telephone Corp.

In a digital thermo-optic switch and an optical ADM filter of the present invention, functional components such as a splitter and a grating structure part formed in the course of an optical circuit as a component are composed of silicone materials which are superior in heat resistance, reduced loss, and low birefringence, thereby achieving sufficiently practical thermal stability, low loss at 1.55 to 1.58 mu.m band, wavelength selectivity, and cost reduction.

JAPAN; USA Accession no.790411

Item 269

Patent Number: EP 1038922 A2 20000927 POLYARYLENE SULFIDE RESIN COMPOSITION FOR OPTICAL TELECOMMUNICATION MEMBERS Murakami T; Iga T; Suzuki S

Idemitsu Petrochemical Co.Ltd.

Disclosed is a polyarylene sulphide resin composition having extremely high dimensional accuracy and suitable, e.g. for fibre-optics connector members. A composition for optical telecommunication members comprises (A) from 20 to 35% by weight of a polyarylene sulphide having a crystallisation temperature, as measured by DSC, of not lower than 250C and (B) from 65 to 80% by weight of silica, preferably spherical silica having a mean particle size of from 1 to 10 micrometers.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; WESTERN EUROPE-GENERAL Accession no.789456

Item 270

Polymer 41, No.26, Dec.2000, p.9155-61 REFRACTIVE INDEX DISTRIBUTION OF GRADED POLYMETHYL METHACRYLATE PREFORM DESCRIBED BY SELF-DIFFUSION APPROACHES OF FREE-VOLUME THEORY IN A TERNARY SYSTEM Zhang F; Wang X; Zhang Q

Hefei, University of Science & Technology

A series of graded index PMMA preforms with monomer/ dopant = 5:1, 7:1, 10:1 is made by an interfacial-gel polymerisation procedure, in which polymerisation is performed in a PMMA tube and a dopant, bromobenzene (BB), is used as a higher refractive index molecule. The graded index is formed by the diffusion of the molecules. While describing the process of interfacial-gel polymerisation, the distribution of the polymer concentration at the radial direction of the tube is assumed to be w = a(r/R)2 + b. According to the self-diffusion approach of the free-volume theory in ternary systems and its application in a high-conversion polymerisation system, a model of forming the graded index is established, and a quadratic refractive index (RI) distribution on the cross-section of the preform is obtained. Compared with the theory in a binary system, the result is more identical with experiments in both the changing trend and the value of RI. TheRI distributions of preforms prepared with different MMA/BB are simulated. The effect of MMA/BB on the RI distribution is also discussed. 25 refs. CHINA

Accession no.789386

Item 271 **Polymer Engineering and Science**

40, No.9, Sept.2000, p.1996-9 POLYMER-POLYMER MISCIBILITY STUDY FOR PLASTIC GRADIENT INDEX OPTICAL FIBER

Bongsoo Lee; Choi W Y; Walker J K Nanoptics Inc.

Several polymer systems were investigated to test polymer-polymer miscibility for fabrication of plastic gradient index(GRIN) materials. The systems included methyl methacrylate(MMA)/benzyl methacrylate(BMA), MMA/trifluoroethyl methacrylate(3FMA) and BMA/ 3FMA copolymers. The BMA/MMA and MMA/3FMA copolymers offered the advantages of polymeric materials with no low molec.wt. additives, a controlled numerical aperture up to about 0.25 and low moisture absorption. The results should be useful for producing plastic GRIN fibre using a new extrusion process and GRIN preforms using interfacial-gel copolymerisation method. 21 refs. USA

Accession no.788872

Item 272

Synthetic Metals 102, No.1-3, June 1999, p.1275-6 NEW HIGH EFFICIENCY LIGHT EMITTING MATERIAL

Min Zheng; Fenglian Bai; Yuliang Li; Gui Yu; Chunhe Yang; Daoben Zhu

Chinese Academy of Sciences

A high efficiency light emitting copolymer, poly(phenylene vinylene-co-triphenylamine) was synthesised by reaction between 4,4'-diformyl triphenylamine and 1,4-xylene-bis(dimethyl phosphate). The copolymer was highly soluble in common solvents and could easily be processed into thin amorphous films. The fluorescence quantum yield in chloroform solution was almost 1.00. The thin films exhibited both photoluminescence and electroluminescence, emitting green light. Homogeneous dispersions of the copolymer in a polyvinyl carbazole (PVK) matrix resulted in thorough energy transfer due to overlaps of the emission spectrum of PVK and the absorption spectrum of the copolymer. Light emitting diodes were fabricated consisting of indium tin oxide/copolymer/aluminium, with a threshold voltage of 1.5 V. 10 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

CHINA

Accession no.787938

Item 273

Synthetic Metals 102, No.1-3, June 1999, p.1158 ELECTROLUMINESCENCE AND PHOTOLUMINESCENCE CHARACTERISTICS

OF POLY(DISILANYLENEOLIGOPHENYLENE)S AND POLY(DISILANYLENEOLIGO-THIENYLENE)S

Yoshino K; Hirohata M; Sonoda T; Hidayat R; Fujii A; Naka A; Ishikawa M

Osaka,University; Kurashiki,University of Science & Arts

The optical absorption spectra, photoluminescence (PL) and electroluminescence (EL) in poly(disilanylene oligophenylene)s (PDSiOP) and poly(disilanylene oligothienylene)s (PDSiOT) were dependent upon the lengths of the oligophenylene and oligothienylene units. Blue and green EL was observed in PDSiOP with terphenyl and quaterphenyl oligophenylenes, respectively. In PDSiOT the EL colour changed from green to red when the length of the oligothienylene increased from three to seven thiophene rings. The stability of the polymers was much higher than that of polysilanylene and increased with increasing length of the oligophenylene and and oligothienylene units. Spectral narrowing of the PL was observed on intense light excitation. 3 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

JAPAN

Accession no.787736

Item 274

Synthetic Metals 102, No.1-3, June 1999, p.1155-6 DEVICE CHARACTERISTICS OF NANOSTRUCTURED POLY(P-PHENYLENEVINYLENE)

Markart P; Zojer E; Tasch S; Smith R; Gin D; Leising G Graz, Technische Universitat; California, University at Berkeley

An aqueous solution of of poly(p-phenylene vinylene) (PPV) precursor was mixed with a self-assembling monomer to obtain an inverted hexagonal lyotropic liquid crystalline mesophase, giving hexagonally packed nanoscale tubular channels filled with PPV chains. The nanocomposite was used as the emissive layer in the fabrication of light emitting diodes. The current-voltage characteristics, the electroluminescence spectra and performance of the device were compared with that of pure PPV LEDs. 5 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998. AUSTRIA; EUROPEAN UNION; USA; WESTERN EUROPE *Accession no.787734*

Item 275

Synthetic Metals 102, No.1-3, June 1999, p.1138-9 TURN ON BEHAVIOR OF LIGHT EMITTING ELECTROCHEMICAL CELLS Wenzl F P; Holzer L; Tasch S; Scherf U; Mullen K; Winkler B; Mau A W H; Dai L; Leising G Graz, Technische Universitat; Max-Planck-Institut fuer Polymerforschung; CSIRO, Div. of Molecular Science

To improve the device response time, salt dissociation in light emitting electrochemical cells (LEC) was investigated using infrared spectroscopy. The active layers consisted of blends of methyl-substituted laddertype poly(p-phenylene) blended with poly(ethylene oxide) (PEO) and lithium triflate, or blends of poly(2,5bis(triethoxymethoxy)-1,4-phenylene vinylene) with PEO and lithium triflate. The results were compared with those from measurements are on the active layer of LECs fabricated using conjugated polymers with short ethylene oxide side chains attached to the backbone, to establish the ionic species which were present. The triflate ions exhibited different dissociation behaviour in LECs fabricated from blends of high molecular weight PEO compared with systems with short ethylene oxide chains attached to the conjugated polymer backbone. Most of the ions were associated at room temperature in the former whilst the latter exhibited no phase separation, and free ions were present to some extent. 22 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

AUSTRALIA; AUSTRIA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE *Accession no.*787726

Item 276

Patent Number: US 6057034 A1 20000502 COATING COMPOSITION FOR OPTICAL FIBER

Yamazaki K; Nishimura M; Uemura T; Yamamoto A; Kozakai S; Asano M

Takeda Chemical Industries Ltd.; Shin-Etsu Chemical Co.Ltd.

This contains a polyurethane (meth)acrylate oligomer (A), which is based on a urethane prepolymer having an equivalent ratio of NCO group in a polyisocyanate (a) to OH group in a polyol (b) of more than 3.0. The oligomer (A) has a mixing weight ratio of an oligomer (d) having a number-average molecular weight of 800 or less to an oligomer (e) having a number-average molecular weight of 1,000 or more of 30/70 to 70/30. The coating composition has a low viscosity and is suitable for rapid fibre-drawing in the production of optical fibres. Cured materials obtained from the coating composition have a high elastic modulus and high elongation and exhibit a slight change of elastic modulus with a change of temperature to improve the long-term reliability of optical fibres.

JAPAN; USA Accession no.787477

Item 277

Patent Number: US 6057018 A1 20000502 BLEND OF NON PLASTICIZED POLYVINYL CHLORIDE AND ETHER-BASED POLYURETHANE Schmidt I W Siecor Corp.

A telecommunications cable includes an extruded plastic member formed of an extruded blend of a non-plasticised polyvinyl chloride and an ether-based polyurethane. The blend may be used in the extrusion of tubes or ribbons holding light waveguides or metallic conductors. USA

Accession no.787474

Item 278

Synthetic Metals 102, No.1-3, June 1999, p.1115 LIGHT EMITTING DIODES OF THE MULTILAYER STRUCTURES WITH MODIFIED PVK POLYMERS

Sanetra J; Armatys P; Chrzaszcz R; Pielichowski J; Barta P; Niziol S Cracow,University of Technology; Cracow,University

The electroluminescence of poly(N-vinyl carbazole) (PVK), with iodine substituted in positions 3 and 6,was evaluated to determine the suitability of using PVK for the fabrication of LEDs. The photoluminescence and electroluminescence decreased, and it was concluded that the resulting polymers were unsuitable for LED fabrication. 2 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998. EASTERN EUROPE; POLAND

Accession no.787257

of Mining & Metallurgy

Item 279

Synthetic Metals 102, No.1-3, June 1999, p.1091-2

INDEX OF REFRACTION AND WAVEGUIDING IN THIN FILMS OF A CONJUGATED POLYMER WHICH EXHIBITS STIMULATED EMISSION

Miller E K; McGehee M D; Diaz-Garcia M; Srikant V; Heeger A J

California, University at Santa Barbara

Spectroscopic ellipsometry measurements were made on thin films of the soluble derivative of poly(paraphenylene vinylene), poly(2-butyl-5-(2'-ethyl)hexyl-1,4-phenylene vinylene), in the emission region of the spectrum. The films were birefringent, with a higher and more dispersive index of refraction for light polarised with the electric field in the plane of the film. The anisotropy was attributed to preferential in-plane orientation of the polymer chains. As a consequence of this orientation, on typical substrates including glass and quartz, only transverse-electric waveguide modes propagated in the polymer, whilst transverse-magnetic modes were evanescent. The implications of this on amplified spontaneous emission, and the design of in-plane laser structures are discussed. 13 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

USA

Accession no.787253

Item 280

Synthetic Metals 102, No.1-3, June 1999, p.1046-9 LIGHT-EMITTING ELECTROCHEMICAL CELLS WITH MICROSECOND RESPONSE TIMES BASED ON PPPS AND NOVEL PPVS Tasch S; Holzer L; Wenzl F P; Gao J; Winkler B; Dai L; Mau A W H; Sotgiu R; Sampietro M; Scherf U; Mullen K; Heeger A J; Leising G Graz, Technische Universitat; California, University at Santa Barbara; CSIRO, Div. of Molecular Science; Milano, Politecnico; Max-Planck-Institut fuer Polymerforschung

Light emitting electrochemical cells were prepared by spin casting blends of a ladder-type poly(paraphenylene), polyethylene oxide and lithium triflate, or blends of a poly(phenylene vinylene) and lithium triflate, onto glass substrates coated with indium tin oxide, aluminium, silver or gold. An electrode of aluminium, silver or gold was evaporated on top of the film. It was established that the response times could be decreased to several microseconds by minimising phase separation in the active layer. Efficient devices were obtained with extremely low onset voltages. 21 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

AUSTRALIA; AUSTRIA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; ITALY; USA; WESTERN EUROPE

Accession no.787236

Item 281

Synthetic Metals 102, No.1-3, June 1999, p.1026-9 ROLE OF IONIC SPECIES IN DETERMINING CHARACTERISTICS OF POLYMER LEDS MacDiarmid A G; Huang F Pennsylvania,University

The electroluminescence of aluminium/ poly(methoxyethylhexyloxyphenylenevinylene)/indium tin oxide (Al/MEH-PPV/ITO) and Al/MEH-PPV/ polyaniline (emeraldine base)/ITO was studied as a function of time and applied voltage, and it was concluded that even traces of ionic species in the emissive polymer layer in Al/MEH-PPV/ITO or in the non-emissive emeraldine base layer in Al/MEH-PPV/EB/ITO could dramatically change characteristics of the LEDs, including improved quantum yield and/or operation in both forward and reverse bias modes, due to reduction of electron/hole injection energies facilitated by ion diffusion phenomenon. 16 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998. USA

Accession no.787231

Item 282

Synthetic Metals 102, No.1-3, June 1999, p.1024-5 SYNTHESIS OF PORPHYRIN-PPV COPOLYMERS FOR APPLICATIONS IN LEDS Iqbal R; Yahioglu G; Milgrom L; Moratti S C; Holmes A B; Cacialli F; Morgado J; Friend R H Cambridge,University; Imperial College

Poly(2-methoxy-5-ethylhexyloxyphenylenevinylene-coporphyrin) copolymers with the porphyrin units attached as side groups were synthesised to control aggregation and the associated fluorescence quenching. The fluorescence was dominated by the porphyrin units, emission being red-shifted due to efficient exciton transfer to the fluorescence porphyrin unit. 9 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.787230

Item 283

Molecular Crystals & Liquid Crystals Vol.338, 2000, p.141-9 SYNTHESIS AND MOLECULAR PROPERTIES OF NEW SIDE-CHAIN LIQUID CRYSTALLINE POLYMERS BASED ON THE BAYLIS-HILLMAN REACTION

Lavrenko P; Yevlampieva N; Okatova O; Polushin S; Lacey D; Hall A W Russian Academy of Sciences; St.Petersburg,State University; Hull,University

A new methodology is employed in synthesis of two sidechain liquid-crystalline polymers with cyanobiphenylene mesogenic groups and variation of -CN, -COCH3 and -OH groups displacement in the backbone surrounding. Hydrodynamic and electrooptical (the Kerr effect) methods are used to study their molecular properties in solution in benzene and chloroform. Electrooptical properties of polymers are compared with the same ones of homologous series of alkoxycyanobiphenylenes as the model compounds of the polymer mesogenic groups. Different mobility of the side-chain mesogenic groups in polymers under investigation is observed and related to the chemical and dipole structure. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; RUSSIA; UK; WESTERN EUROPE

Accession no.786874

Item 284

Patent Number: US 6068796 A1 20000530 SUB-MINIATURE OPTICAL FIBER CABLES, AND APPARATUSES AND METHODS FOR MAKING THE SUB-MINIATURE OPTICAL FIBER CABLES

Graham L; Holman J R; Mathis T D; Viriyayuthakorn M Lucent Technologies Inc.

A simplex optical fibre cable of this invention includes an optical fibre, a buffer preferably of nylon, surrounding and in contact with the optical fibre, a yarn layer with strength fibres, preferably aramid fibres, disposed about the buffer and a sheath preferably formed of polyvinyl chloride (PVC) surrounding and in contact with the yarn layer. In crosssection, the simplex optical fibre cable has a diameter less than 2.0 millimeters (mm), and thus is much smaller in diameter than optical fibre cables presently available. Preferably, if the buffer is relatively thin providing limited protection to the optical fibre, a slick substance such as talc is applied to an outer surface of the buffer before the yarn layer is disposed thereon. The slick substance allows the buffer of the optical fibre to slide to a degree in contact with the yarn layer and thus reduces fatigue caused by axial movement of a ferrule of the connector terminating the optical fibre cable. On the other hand, if the buffer is relatively thick, a friction-reducing substance such as Modaflo TM can be applied to the optical fibre to allow the buffer to be stripped relatively easily. A zip-cord duplex optical fibre cable of this invention includes essentially two simplex optical fibre cables with their respective sheaths joining at a middle portion along the axial length of the simplex optical fibre cables. Thus, in cross-section, the zipcord duplex optical fibre cable has a figure-eight shape with a relatively thin portion in the middle which can be manually pulled apart to separate the zip-cord duplex optical fibre cable into separate simplex optical fibre cables. This feature of the invention allows the zip-cord duplex optical fibre cable to be split at its ends to allow connectors attached to respective ends of the optical fibre cables for connection to respective spaced connector receptacles. A second duplex optical fibre cable of this invention includes two simplex optical fibre cables arranged side-by-side with an oversheath extruded about and holding together the two simplex optical fibre cables. In cross-section, the two duplex optical fibre cables of this invention are less than 2.0 mm in height and 4.0 mm in width, and thus are much smaller than currently available duplex optical fibre cables. The invention also includes die assemblies and methods for making the simplex and duplex optical fibre cables. USA

Accession no.786120

Item 285

Journal of Applied Polymer Science 77, No.7, 15th Aug.2000, p. 506-12 SYNTHESIS OF A PHOTO-CROSSLINKED STABLE NONLINEAR OPTICAL POLYMER AND APPLICATION TO EXTERNAL ELECTRO-OPTIC MEASUREMENT Zhang D; Sun J; Shen J; Yi M

China, State Key Laboratory on Integrated Optoelectronics; Jilin, University

Using bisphenol-A as the polymer backbone, pnitroaniline as the chromophore and cinnamyl group as the photo-sensitiser, a photocrosslinked side-chain second-order nonlinear optical polymer was synthesised. The polymer was characterised and an electro-optical film produced by spin coating and an external electro-optic measurement system was established based on the film. 15 refs.

CHINA

Accession no.786055

Item 286

Macromolecules 33, No.15, 25th July 2000, p.5747-50 EFFECT OF PRESSURE DURING POLING ON THE RELAXATION OF A GUEST-HOST NLO POLYMER Won-Kook Kim; Hayden L M

Maryland, University

The effect of applying pressure during poling and glassification on the sub-Tg relaxation of PMMA doped with Disperse Red 1 was studied. The thermal stability of chi(2) in this guest-host system was studied using second harmonic generation decay techniques. The depoling temp. was also determined as a function of the poling pressure. As many polymeric materials are processed near Tg under pressure and subsequently cooled to sub-Tg, resulting in non-equilibrium conditions, this study could provide useful information not only for non-linear optical polymer device fabrication but also for polymer processing. 23 refs.

USA

Accession no.786020

Item 287

Polymers for Advanced Technologies

11, No.7, July 2000, p.349-58 SYNTHESIS AND CHARACTERIZATION OF PHOTOREFRACTIVE POLYMERS WITH TRIPHENYLAMINE UNIT AND NLO CHROMOPHORE UNIT ON A SIDE CHAIN Sang-Hun Park; Ogino K; Sato H Tokyo,University of Agriculture & Technology

Acrylate-type copolymers(TPA-DCV) were synthesised which consisted of triphenylamine(TPA) unit as a hole transport agent and dicyanovinyl aniline(DCV) as a second-

order non-linear optical chromophore on a side chain. The polymers exhibited good solubility and adequate morphological stability after film formation. The diffraction efficiency and gain coefficient increased as the Tg decreased. A TPA-DCV composite doped with fullerene and dibutyl phthalate had a high photoconductivity of 0.000000000051 S/cm at an applied electric field of 50V/ micrometre. Diffraction efficiency and response rate were measured as functions of the parameters determining the photoconductivity, e.g. applied electric field, density of the photocharges generated and writing beam intensity. The maximum diffraction efficiency and gain coefficient were 12.9% and 64/cm, respectively, at an applied electric field of 80 V/micrometre. The maximum response time of 700 msec was obtained at an applied electric field of 80V/ micrometre. Photoconductivity, response rate and diffraction efficiency increased with the increase of applied electric field. Field dependence of the response rate was attributed to the charge generation efficiency and/or the drift mobility. A similar power dependence of the photoconductivity and the response rate on the writing beam intensity was observed. The response rate and diffraction efficiency showed a good linear relationship with the log of the photoconductivity. 33 refs.

JAPAN

Accession no.785914

Item 288

Synthetic Metals 102, No.1-3, June 1999, p.943-4 NOVEL PROCESSABLE POLYDIACETYLENE FOR PHOTONICS STUDIES

Cravino A; Moggio I; Dell'Erba C; Comoretto D; Cuniberti C; Dellepiane G; Giorgetti E; Grando D; Sottini S

Genoa, University; CNR, Istituto di Ricerca sulle Onde Elettromagnetiche

Polycarbazolyldiacetylene was synthesised, and was soluble in common organic solvents, forming homogeneous films. The electronic spectra of the polymer in different solvents was determined. The polymer was considered to be a candidate material for waveguide applications. 3 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.784968

Item 289

Journal of Polymer Science: Polymer Chemistry Edition

38, No.15, 1st Aug. 2000, p.2824-39 MAIN-CHAIN SYNDIOREGIC NONLINEAR OPTICAL POLYMERS. II. EXTENDED PI CONJUGATION AND IMPROVED THERMAL PROPERTIES Stenger-Smith J D; Zarras P; Hollins R A; Chafin A P; Merwin L H; Yee R; Lindsay G A; Herman W N; Gratz R F; Nickel E G

US,Naval Air Warfare Center Weapons Div.; US,Navy; Virginia,Mary Washington College; Porphyrins & Intermediates

Attempts to synthesise processable non-linear optical polymers having Tgs above 200C, heat stabilities above 300C and r33 values higher than 15 pm/V at 1.3 micrometers are reported. The refractive indices, optical loss and non-linear optical coefficients of the polymers produced, including polymers with extended pi conjugation in the chromophore and chromophores with improved heat stability, are discussed. 60 refs.

USA

Accession no.784307

Item 290

Journal of Applied Polymer Science 77, No.10, 6th Sept.2000, p.2172-7 SYNTHESIS OF FLUORINATED POLYIMIDES AND THEIR APPLICATION TO PASSIVE OPTICAL WAVEGUIDES Han K; Jang W H; Rhee T H

Samsung Electronics Co.Ltd.

Fluorinated and chlorofluorinated polyimides with high thermal stability and low optical absorption loss in the optical communication wavelengths of 1.3 and 1.55 mu m are investigated for low-loss passive waveguide applications. These polyimides are prepared from pyromellitic dianhydride (PMDA), with 1,4-bis-(4-amino-(trifluoromethyl)phenoxy)tetrafluorobenzene (ATPT), 1,4-bis-(4-amino-2-(trifluoromethyl)phenoxy)benzene (ATPB), and 1,3-bis-(4-amino-2-(trifluoromethyl) phenoxy)-4-6-dichlorobenzene (ATPD). Control of the refractive indices of the polymers is achieved from 1.5397-1.5671 for TE polarisation and 1.5239-1.5513 for TM polarisation at 1.55 mu m by copolymerisation of PMDA/ATPT and PMDA/ATPB. As the amount of PMDA/ATPT is increased, the refractive indices of the polymers are decreased. Rib-type optical waveguides are fabricated using these fluorinated polyimides. The waveguides exhibit a low propagation loss of less than 0.5 dB/cm at 1.55 umu m. 17 refs.

KOREA

Accession no.784171

Item 291

Proceedings of the National Science Council Republic of China 24, No.4, July 2000, p.310-5 ALIGNING MECHANISM OF AN IN SITU POLED NONLINEAR OPTICAL POLYMER PREPARED USING THE CHEMICAL VAPOUR DEPOSITION METHOD Yang P-K; Huang J-Y; Jou J-H Taiwan,National Chiao-Tung University; Tsinghua,University

Second harmonic (SH) microscopy is applied to investigate an in-plane electric-field poled polymer. It is shown that the local orientation of the non-linear optical (NLO) chromophore can be deduced from two SH images obtained with different polarisation combinations. A model is developed to illustrate the aligning dynamics of NLO chromophores during the film deposition process. 20 refs.

TAIWAN Accession no.783967

Item 292

Patent Number: US 6048911 A1 20000411 COATED OPTICAL FIBERS Shustack P J; Wilson D A Borden Chemical Inc.

Coated optical fibres comprise a glass optical fibre and a radiation-cured coating formed from a radiation-curable liquid coating composition. The liquid coating composition comprises at least one aliphatic urethane acrylate oligomer, at least one acrylated or methacrylated compound selected from the group consisting of isobornyl acrylate, isobornyl methacrylate, alkanediol diacrylate, alkanediol dimethacrylates, alkoxylated derivatives thereof, and mixtures thereof, and a photoinitiator. In one embodiment, the compositions further include a silicone compatibility agent which reduces the coefficient of friction of the radiation-cured coating without disadvantageously effecting other physical properties of the liquid coating compositions or the cured coating, and particularly without disadvantageously effecting the optical clarity of the liquid coating compositions. In a second embodiment, the liquid coating compositions further comprise at least one silicone compatibility agent and at least one functionalised silicone compound which reduces the coefficient of friction of the radiation-cured coating while additional advantageous physical properties of the liquid coating composition and the cured coating, particularly optical clarity, are maintained. The liquid coating composition exhibits a UV absorbance at 500 nm relative to distilled water of less than about 0.04.

USA

Accession no.783559

Item 293

Chemistry of Materials 12, No.6, June 2000, p.1679-93 **ULTRAHIGH-TEMPERATURE POLYMERS FOR SECOND-ORDER NONLINEAR OPTICS. SYNTHESIS AND PROPERTIES OF ROBUST, PROCESSABLE, CHROMOPHORE-EMBEDDED POLYIMIDES**

Davey M H; Lee V Y; Wu L-M; Moylan C R; Volksen W; Knoesen A; Miller R D; Marks T J

Northwestern University; IBM; California, University; Adven Polymers

A general, convergent approach to the synthesis of a series of stilbene- and azo-based donor-acceptor, second-order nonlinear optical chromophores is reported. Three chromophores were used to prepare six high Tg polyimides. The chemical, thermal, microstructural, linear optical, and nonlinear optical characterisation of these polymers are described. 40 refs. USA

Accession no.782944

Item 294

Journal of Applied Medical Polymers 4, No.1, Spring 2000, p.15-9 HIGH BRIGHTNESS PLASTIC GRADED INDEX IMAGE GUIDES FOR ULTRATHIN ENDOSCOPES

Bongsoo Lee; Choi W Y; Walker J K Nanoptics Inc.

High brightness image guides with pixel size less than 5 micrometres were fabricated with plastic graded index optical fibres prepared from methyl methacrylate and benzyl methacrylate. The image brightness was measured and compared with that of existing glass step index image guides. The image brightness of the plastic graded index image guide was more than a factor of two higher than that of the glass step index image guides with the same numerical aperture and same microfibre diameter. Possible uses of this new design of optical systems in defence, industrial and medical applications are discussed. 13 refs. USA

Accession no.782646

Item 295

Patent Number: US 6042943 A1 20000328 OPTICAL FIBER CONTAINING A RADIATION CURABLE PRIMARY COATING COMPOSITION Levy A C

Levy A.C.,& Associates Inc.; Master Adhesives Inc.

The coating is composed of a component having a first end and a second end, a saturated aliphatic backbone, and at least one epoxide group at the first end of the component and at least one reactive functional group at the second end, a mixture of acrylate monomers composed of a first monomer having one acrylate group or vinyl ether group and a second monomer having at least two acrylate groups, functional groups or vinyl ether groups and a photoinitiator.

USA

Accession no.782405

Item 296 Patent Number: US 6043294 A1 20000328 **METHOD OF AND APPARATUS FOR**

OPTICALLY ENHANCING CHEMICAL REACTIONS

Hed A Z

Gate Technologies International Inc.

The chemical reaction is effected utilising light of an appropriate frequency supplied preferably via optical fibres to one or more light extractors having light-emissive surfaces in contact with the reactants. The light can be concentrated before being delivered. Wave guides and a number of such extractors can be provided within the vessel.

USA

Accession no.781363

Item 297

Advanced Materials for Optics & Electronics 9, No.5, Sept./Oct.1999, p.195-203 SYNTHESIS AND CHARACTERISATION OF A MODIFIED CROSSLINKABLE POLYURETHANE NON-LINEAR OPTICAL POLYMER

Zhao Li; Yuxia Zhou; Yuquan Shen Beijing,Institute of Photographic Chemistry

Hydroxyl groups formed during the reaction of diglycidyl ether of bisphenol A and aniline were used to form crosslinkable PU. The very active diisocyanate groups as a pure reagent were only introduced to the reaction system at the last step of the crosslinking reaction, which greatly improved the preparation procedure. A very good filmforming property was found and a second-order non-linear optical coefficient value as high as 320 pm/V was measured for the poled polymer film. 13 refs. CHINA

Accession no.781066

Item 298

Journal of Applied Polymer Science 77, No.1, 5th July 2000, p.189-94 PHOTOREFRACTIVE EFFECT IN A NEW COMPOSITE BASED ON BIFUNCTIONAL HOST POLYMER

Yi-Wang Chen; Yuan-Kang He; Hui-Ying Chen; Feng Wang; Zhi-Jian Chen; Qi-Huang Gong Peking,University

A photorefractive composite based on a bifunctional methacrylate copolymer with N-methacryloxypropyl-3-(p-nitrophenyl)azo carbazole and N-methacryloxypropyl carbazole as pendant side chains, which had high stability and potential applications, was synthesised. A two-beam coupling gain coefficient of 9.4/cm and an electrooptical coefficient of 9.3 pm/V were measured at the applied electric field of 92.4 V/micrometre by a typical two-beam coupling experiment technique. 17 refs. CHINA

Accession no.780023

Item 299

Patent Number: US 6028159 A1 20000222 POLYAMIDEIMIDE FOR OPTICAL COMMUNICATIONS AND METHOD FOR PREPARING THE SAME

Suh D-H; Chung E-Y; Rhee T-H Samsung Electronics Co.Ltd.; Korea,Research Institute of Chemical Technology

A polyamideimide for optical communications, having a minimum light absorption loss in a near infrared light wavelength range, high thermal stability and excellent film processibility, and a method for preparing the same are provided. The polyamideimide has a higher refractive index than the conventional fluorinated polyamideimide. Thus, when using such polyamideimide as a material for a core of an optical fibre, the selection range on the material for cladding becomes wide. Also the coating property and adhesiveness to a substrate are improved, thereby providing a good film processibility and heat resistance.

KOREA; USA Accession no.779938

Item 300

Polymer 41, No.16, 2000, p.6049-54 **HIGH GLASS TRANSITION CHROMOPHORE FUNCTIONALISED POLY(MALEIMIDE-STYRENE)S FOR SECOND-ORDER NONLINEAR OPTICAL APPLICATIONS** Samyn C; Verbiest T; Kesters E; Van den Broeck K; Van Beylen M; Persoons A Leuven, University

Non-linear optical(NLO) polymers with high Tgs were prepared by polymer analogous reaction of maleic anhydride copolymers with aminoalkyl-functionalised azo- and stilbene chromophores. The polymers exhibited Tgs from 178 to 228C, which resulted in stable NLOresponse at elevated temps. Poled films of the polymers were characterised by second harmonic generation and showed a non-linear optical response that was stable at elevated temps. One of the polymer systems, for example, lost only 24% of its non-linearity after 1000h of heating at 125C. 23 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.778477

Item 301

Journal of Materials Science Letters 19, No.1, 1st Jan. 2000, p.27-8 EXPERIMENTAL INVESTIGATION OF THE NONLINEAR OPTICAL RESPONSE IN FE:PVA Bulinski M; Iova I; Belea A Bucharest,University; Rumania,National Institute of Material Physics Polymer materials are of growing interest for the optical data processing technologies. There are potential applications as permanent and transient data storage materials or as basic materials for the fabrication of the active and passive light guides. The metal ion doped polymers represent a new class of organic materials for nonlinear optics. Among such materials, the ferric chloride doped polyvinyl alcohol (Fe:PVA) and the dichromate polyvinyl alcohol (DCPVA) seem to be suitable materials for real time holographic recording. Although their optical performances have been partially analysed, only a little information is available on the physics of the mechanism for the light induced change of the refractive index. A mechanism based on the modifications in the valence state of the metal ion has previously been proposed. The optical parameters are related to the Fe2+ contents. Optical, m-line and Mossbauer spectroscopy are used as complementary techniques relating the optical and the local parameters. 6 refs. EASTERN EUROPE: RUMANIA

Accession no.778211

Item 302

Reactive & Functional Polymers 44, No.2, May 2000, p.183-8 THIRD-ORDER NONLINEAR OPTICAL PROPERTIES OF AROMATIC POLYISOIMIDES Morino S; Yamashita T; Horie K; Wada T; Sasabe H Tokyo,Institute of Technology; Tokyo,University; RIKEN

Several aromatic polyisoimides were prepared and their third-order nonlinear susceptibilities were measured by optical third-harmonic generation. Thermal stabilities are discussed. 21 refs.

JAPAN

Accession no.777775

Item 303

Patent Number: US 6031061 A1 20000229 BIS(TRIALKYLTRIMELLITIC ANHYDRIDE) DERIVATIVE AND POLYESTERIMIDE FOR OPTICAL COMMUNICATIONS

Suh D; Chung S; Rhee T SamSung Electronics Co.Ltd.

Disclosed are a bis(trisubstituted trimellitic anhydride) derivative and a polyesterimide for optical communications. The polyesterimide has a high refractive index so that when using such a polyesterimide as a material for the core of an optical fibre, the range of materials that can be selected for the cladding becomes wide. Coating property and adhesion to a substrate are also improved, thereby providing a good film forming property and heat stability. Because the polyesterimide can minimise optical loss at a near infrared wavelength range, it is very useful as an optical material in the optical communications field, adopting light with a near infrared wavelength.

KOREA; USA Accession no.777055

Item 304 Polymer 41, No.13, 2000, p.5011-20 **SYNTHESIS OF POLYURETHANES AND POLYIMIDES FOR PHOTOREFRACTIVE APPLICATIONS** Belfield K D; Najjar O; Sriram S R

Central Florida, University; Detroit, Mercy University

Functionalised polyimides produced by two methods, 1) formation of a brominated polyimide derivate with subsequent Heck coupling with a styrene derivative, and 2) direct polycondensation of a fully functionalised triarylamine diamine analog with 4,4'-(hexafluoro-isopropylidene)diphthalic anhydride, were well defined, bearing charge transporting and nonlinear optical functionality covalently attached to each repeat unit. The non linear optical moities contained phosphonate ester and nitro electron-withdrawing groups. 17 refs. USA

Accession no.774655

Item 305

Patent Number: US 6013205 A 20000111 METHOD AND APPARATUS FOR MANUFACTURING DISTRIBUTED REFRACTIVE INDEX PLASTIC OPTICAL-FIBRE

Nakamura T; Yuuki H Sumitomo Wiring Systems Ltd.

A plastic optical fibre is provided with a desired length and a desired graded refractive index. To this end, a base polymer is first mixed with a non-polymerisable compound having a higher refractive index to obtain a fibre material. This material is then melted and continually spun into a fibre. The fibre is dipped into a polymerisable monomer and heated, during which both the nonpolymerisable monomer and the polymerisable monomer diffuse inside the fibre, thereby grading the refractive index. When the fibre is heated, the diffused polymerisable monomer is polymerised and the fibre is hardened. The fibre is further coated with a cladding to form the desired plastic optical fibre. Various devices are provided for carrying out the above described processes.

JAPAN

Accession no.774472

Item 306

Polimeros: Ciencia e Tecnologia No.4, Oct./Dec.1999, p.148-55 Portuguese **GRADIENT REFRACTIVE INDEX POLYMER OPTICAL FILMS** Bartoli J R; Costa R A; Verdonck P; Mansano R D;

Carreno M EPUSP

Fluorinated PMMA optical films were produced by CF4 + H2 plasma polymerisation and characterised by ESCA,

FTIR spectroscopy, gravimetry, contact angle measurements, refractometry and ellipsometry. It was found that a hydrofluorocarbon polymer was deposited on the exposed films and that fluorine concentration increased gradually with fluorinated film depth. The surface of the films had a lower refractive index than that of the PMMA, indicating a gradient refractive index, which is the reciprocal of fluorine concentration. The possibility of producing graded-index polymer waveguides and optical fibres having higher transmission rates is considered. 27 refs.

BRAZIL

Accession no.774208

Item 307

Polymer Journal (Japan) 32, No.1, 2000, p.8-14 **NONLINEAR OPTICAL POLYURETHANE FUNCTIONALIZED WITH A HETEROAROMATIC THIOPHENE RING HAVING A TRICYANOVINYL GROUP**

Han Young Woo; Hong-Ku Shim; Kwang-Sup Lee Korea,Advanced Institute of Science & Technology; Hannam,University

A new non-linear optical-functionalised PU with a highly non-linear heteroaromatic thiophene chromophore with a tricyanovinyl group in the side chain was synthesised and characterised. The polymer was soluble in N-methyl-2-pyrrolidinone and was processed into films with good optical quality by spin casting at about 100C. No weight loss was observed up to a temperature of 266C and a glass transition was noted at 176C. The polymer showed high second-order non-linearity with a second-order non-linear optical coefficient of 51 pm/V. A high orientational stability of the aligned chromophores was observed up to about 150C. This resulted from the rigidity of the polymer backbone caused by interechain hydrogen bridges between neighbouring PU chains. 30 refs.

KOREA

Accession no.773458

Item 308

Journal of Applied Polymer Science 76, No.3, 18th April 2000, p.290-5 SYNTHESIS AND CHARACTERIZATION OF SIDE-CHAIN POLYIMIDES FOR SECOND-ORDER NONLINEAR OPTICS VIA A POST-AZO-COUPLING REACTION

Yan-Gang Liu; Yu Sui; Jie Yin; Jian Gao; Zi-Kang Zhu; De-Yin Huang; Zong-Guang Wang Shanghai,Jiao Tong University

Non-linear optical side chain polyimides were synthesised by a two-stage method. A preimidised organosoluble polyimide with a benzene moiety pendant from the main chains was prepared, followed by the covalent bonding of the non-linear optical chromophores onto the polyimide backbone by a post-azo-coupling reaction. The glass transition temperature of the polyimides decreased by only 10-20C after functionalisation. This was a much smaller decrease in glass transition temperature than when the chromophores were chemically bonded to the polyimide main chains via an ether linkage using a post-Mitsunobu condensation reaction. The thermal stability and solubility of the polyimides were investigated and the results were discussed. 47 refs.

CHINA

Accession no.773412

Item 309

Macromolecules 33, No.7, 4th April 2000, p.2355-8 SYNTHESIS AND CHARACTERIZATION OF POLY(P-PHENYLENE) WITH NONLINEAR OPTICAL SIDE CHAINS Taylor D K; Samulski E T North Carolina,University

Nonlinear optical poly(p-phenylene) with 4'-(N,Ndiethylamino)-2,5-dichlorobenzophenone in the side chain (70.1 wt% substitution) was synthesised using a nickel catalyst. The polymer was thermally stable up to 400 C, with a glass transition temperature (Tg) of 186 C. The stability of the polar chromophore orientational distribution following removal of the external polling electric field, at temperatures below Tg, was evaluated by monitoring the second harmonic generation intensity as a function of time. High stability was observed. A stretched exponential was used to fit the relaxation data. 20 refs.

USA

Accession no.773173

Item 310

Journal of Macromolecular Science B B38, Nos. 5 & 6, 1999, p. 1095-9. **DIFFUSION OF ACETOPHENONE IN PEROXIDE CROSS-LINKED CABLE COMPOUNDS**

Wutzler A; Radusch H-J; Gehrmann K Halle,Martin-Luther-Universitat; Dow BSL Olefinverbund GmbH

An investigation using Fourier transform infrared microscopy was carried out into the diffusion of acetophenone in peroxide cross-linked low-density polyethylene in a medium voltage cable construction. Storage of the cable in acetophenone under a normal climate and for a period of up to two years was examined and the diffusion rate and coefficient of diffusion were determined. The coefficient of diffusion was found to be independent of the morphology of the cables investigated. 8 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.773139

Item 311

Journal of Applied Polymer Science 76, No.9, 31st May 2000, p.1448-56 FABRICATION AND CHARACTERISATION OF PLANAR AND CHANNEL POLYMER WAVEGUIDES. II. POLY(P-PHENYLENE BENZOBISTHIAZOLE) (PBZT) FILMS

Cintavey L A; Clarson S J; Husband D M; de Brabander G N; Boyd J T

Cincinnati, University; Wright-Patterson Air Force Base

The preparation of solutions of PBZT in methane sulphonic acid and characterisation of such solutions containing less than 0.04 wt.% of PBZT by dilute solution viscometry are described. Also described are the spin coating of thin-film planar PBZT waveguides from a 0.5 wt.% solution of PBZT onto oxidised silicon wafers and measurement of their optical attenuation. The effects of the thickness of the oxide layer on the silicon substrate and the wavelength of the incident light on waveguide optical losses are discussed. 11 refs.

USA

Accession no.772408

Item 312

High Performance Polymers 12, No.1, March 2000, p.169-76 SYNTHESIS AND CHARACTERISATION OF AROMATIC POLYIMIDES BEARING NONLINEAR OPTICAL CHROMOPHORES Bes L; Rousseau A; Boutevin B; Mercier R; Sillion B; Toussaere E

Ecole Nationale Superieure de Chimie de Montpell.; Laboratoire des Materiaux Organiques a Proprietes Specifiques; Ecole Normale Superieure de Cachan

The synthesis and characterisation of two polyimides prepared by the condensation polymerisation of 4,4'-(hexafluoroisopropylidene) diphthalic anhydride with 4-(4-amino,2-hydroxy)phenoxyaniline and 2,2-bis(3amino-4-hydroxyphenyl)hexafluoropropane, respectively, are reported. The physical properties of the polyimides, such as the second harmonic coefficient, temperature stability of the poling-induced polar order and heat stability, are also reported. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.772069

Item 313

Fullerene Science and Technology 8, Nos.1-2, 2000, p.55-64 **NONLINEAR OPTICAL PROPERTIES OF COPOLYMERS OF BENZYLAMINOFULLERENE WITH METHYL METHACRYLATE OR ETHYL METHACRYLATE** Yuan Sun: Thibus Lu: Sust Hong Gob: Wai Ji

Xuan Sun; Zhihua Lu; Suat Hong Goh; Wei Ji

Singapore, National University

Non-linear optical properties of a C60 derivative, benzylaminofullerene, and its copolymers with methyl methacrylate or ethyl methacrylate were observed by using 7 nanosecond laser pulses at 532 nm provided by a frequency-doubled Q-switched Nd:YAG laser. These copolymers were shown to be promising materials for optical limiting applications. 21 refs.

SINGAPORE Accession no.771960

Item 314 Polymer 41, No.14, 2000, p.5237-45 SYNTHESIS AND CHARACTERIZATION OF A NOVEL POLYIMIDE-BASED SECOND-ORDER NONLINEAR OPTICAL MATERIAL Kim T-D; Lee K-S; Lee G U; Kim O-K

Hannam, University; US, Naval Research Laboratory

A high second-order nonlinear optical polyimide was synthesised by the Mitsunobu reaction of a diol-type chromophore and a diimide, which did not require imidisation at high temperature. The polymer was soluble in common polar organic solvents, giving optical quality films by spin coating. The glass transition temperature was 186 C. 36 refs.

KOREA; USA Accession no.771790

Item 315

High Performance Polymers 11, No.3, Sept.1999, p.273-9 PHOTOINDUCED NONLINEAR OPTICAL EFFECTS IN 1,4-CIS-POLYBUTADIENE POLYMERS

Tkaczyk S; Kityk I V; Benet S; Mefleh A Czestochowa,Pedagogical University; Perpignan,University

Photoinduced non-linear optics phenomena in 1,4-cispolybutadiene were investigated. Both an external electrostatic field as well as UV laser photoinducing light lead to enhancement of the local non-centrosymmetry determining optical second harmonic generation (SHG). Using ab initio quantum chemical calculations and experimental nonlinear optics data it was shown that values of the external field exist corresponding to the maximal SHG values. Low temperature ordering (below 10 K), due to decrease of thermoreorientation, and hydrostatic pressure induced strength also favour photoinduced SHG. Time resolved HG measurements indicate an existence of at least two short-time components (about picosecond range) that may be caused by different mechanisms of the phenomenon observed. Both experimentally and theoretically it has been shown that the degree of non-centrosymmetry for the corresponding butadiene bonds is closely connected with the UV-photoinducing power, temperature, hydrostatic pressure and delaying time between the photoinducing and probing beams. 24 refs.

EASTERN EUROPE; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; POLAND; WESTERN EUROPE Accession no.771401

Item 316

Macromolecular Symposia Vol.146, Nov.1999, p.153-62 ELECTRON CRYSTALLOGRAPHY AND ORGANIC MATERIALS WITH NON-LINEAR OPTICAL PROPERTIES

Voigt-Martin I G; Kolb U; Kothe H; Yakimanski A V; Ri-Cheng Yu; Matveeva G N; Tenkovtsev A V Mainz,University; St.Petersburg,Institute of Macromol.Compounds

Electron microscopy studies were conducted of the crystal structures of a number of bisbenzylidene cyclohexanones. It was shown that some of these compounds were efficient crystalline non-linear optically active(NLO) chromophores with second harmonic generation properties. Appropriately functionalised chromophores of this type could be used as a polycondensation comonomer to produce partly crystalline main chain NLO-active polymers. Electron diffraction crystal structural data, obtained for very small crystals, permitted reasonable estimates to be made of macroscopic crystal NLOcoefficients, relating quantum-chemically calculated molecular first hyperpolarisability components to crystal axes. 23 refs. (IUPAC 3rd International Symposium on Molecular Order and Mobility in Polymer Systems, St.Petersburg, Russia, June 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; RUSSIA; WESTERN EUROPE

Accession no.770310

Item 317

Journal of Polymer Science: Polymer Chemistry Edition

38, No.3, 1st Feb.2000, p.546-59 SYNTHESIS AND CHARACTERISATION OF MAIN-CHAIN NLO OLIGOMERS AND POLYMER THAT CONTAIN 4-DIALKYLAMINO-4'-(ALKYLSULPHONYL)AZOBENZENE CHROMOPHORES

Huang D; Zhang C; Dalton L R; Weber W P Southern California, University

A w-amino carboxylic acid monomer that contains a nonlinear optical (NLO) chromophore is prepared by a convergent synthesis. Strategies for selective protection/ deprotection of the amino and carboxylic acid functionalities are developed. The protected monomer, 4-(N-(4-benzyloxycarbonyl)butyl-N-methylaminol-4'-(2",5"-bis(decyloxy)-4"-(phthalimido-methyl) benzylsulphonyl)azobenzene, can be deprotected selectively or sequentially to give HOOC-monomer-Nphthaloyl, benzyl-OOC-monomer-NH, or HOOCmonomer-NH2. Sequential synthesis is performed to yield main-chain NLO dimers and tetramers. This is accomplished by selective deprotection and dicyclohexylcarbodiimide coupling. The HOOCmonomer-NH2 is polymerised by treatment with diphenylphosphoryl azide to give a main-chain NLO polyamide. The monomer, dimer, tetramer and polymer NLO materials are characterised by 1H,13C, IR, and UVvisible spectroscopy as well as by gel permeation chromatography, differential scanning calorimetry and elemental analysis. The NLO properties of these materials are measured. Thin films of the oligomers and polymer are prepared by spin casting on indium-tin oxide coated glass. The second-order NLO properties of the oligomers and polymer thin films are studied by in situ corona poling/second-harmonic generation and attenuated total reflection methods. The optimal poling temperatures are significantly lower than the melting temperatures or glasstransition temperatures of the oligomers and polymer. The poling efficiency increases in the following order: monomer, oligomers and polymer. An electro-optic coefficient of 4 pm/V at 1.06 mu is obtained for the polymer. 44 refs.

USA

Accession no.769783

Item 318

Applied Spectroscopy 54, No.2, Feb.2000, p.202-8 IR CHEMICAL SENSOR FOR DETECTION OF AROMATIC COMPOUNDS IN AQUEOUS SOLUTIONS USING ALKYLATED POLYSTYRENE-COATED ATR WAVEGUIDES Yang J; Huang Y-S Chung Yuan Christian University

Chung-Yuan, Christian University

Polystyrene was derivatised with various alkyl group chain lengths in an attempt to increase the performance of solid-phase microextraction-IR/ATR for detecting aromatic compounds in aqueous solutions. The extraction properties of the alkylated polystyrenes with different chain lengths were compared and the effect of the chain length of the alkyl group in the PS on the extraction of low and high polarity aromatic compounds examined. 31 refs.

TAIWAN

Accession no.769517

Item 319

Polymer Engineering and Science 39, No.12, Dec.1999, p.2482-6 **POLYPYRROLE CONDUCTIVE POLYMER CHARACTERISTICS AS AN OPTICAL DISPLAY DEVICE** Al-Attar H A; Al-Kabbi A S; Faris F A Jordan, Al Al-Bayt University; Basrah, University; Amman, Applied Science University

The redox electrochemically prepared thin films of polypyrrole is studied. A semi-empirical formula to explain the redox behaviour is formulated and it seems applicable to the reduction dynamic. The redox dynamic is dominated by a diffusion process, depending on the relation between the film thickness and the rise time (t1/2) of the process. The diffusion coefficient, D, is measured to be 2 x 10-9 sq.cm/sec for perchloride (ClO4) anion dopant and 1.1 x 10-9 sq.cm/sec for paratoluenesulphonate (PTS-) anion dopant. The polypyrrole films exhibit a colour change during the oxidation and reduction processes. The electrooptical properties of these films are studied. 10 refs.

JORDAN

Accession no.769335

Item 320

Chinese Journal of Polymer Science 17, No.5, 1999, p.435-40 EPOXY/(METHYL METHACRYLATE) INTERPENETRATING POLYMER NETWORK FOR NONLINEAR OPTICS

Ling-zhi Zhang; Zhi-gang Cai; Quan-dong Ying; Zhao-xi Liang

Zhongshan, University

An interpenetrating polymer network (IPN) consisting of a thermally crosslinked epoxy-based polymer incorporating acryloyl groups, and PMMA formed by TDI/methyl methacrylate with hydroxyl groups in the side chain was synthesised and characterised. The poled/cured IPN showed only one glass transition temperature and was transparent and homogeneous. The IPN had a secondorder non-linear optical coefficient of 1.72 x 10 to the minus 7 esu and it showed long-term stability of the second-order non-linear optical coefficient at 25C for more than 1000 h. 15 refs.

CHINA

Accession no.768122

Item 321

Chinese Journal of Polymer Science 17, No.5, 1999, p.417-22

SYNTHESIS OF A NOVEL SELF-ASSEMBLING NLO POLYMERIC FILM

Shou-fa Han; Dao-rong Dai; Ze Li; Gang Wu; Rongben Zhang

Chinese Academy of Sciences

A chromophore (N-(4-nitrophenyl)-(L)-prolinol) was bound to a structurally controlled cage-like crosslinking organosilicon polymer to prepare a modified non-linear optical polymeric film by in-situ poling and a sol-gel process. This modified film had a better thermal stability than a doped non-linear optical polymeric film and the reasons for this were discussed. The coefficient of second harmonic generation for the modified polymeric film was 2.0 x 10 to the minus 8 esu when measured by IR dichroism. The modified film had a low decay of the second harmonic generation signal, retaining 94% of the initial value after 50 days at room temperature. These properties were comparable with those of the doped film, so the modified film also had the main advantages of the doped film. 18 refs.

CHINA

Accession no.768119

Item 322 Advanced Materials 12, No.3, 3rd Feb.2000, p.167-81 **POLYMER NETWORK-STABILISED LIQUID CRYSTALS** Dierking I Darmstadt, Technical University

A review is presented on the manufacture, structure, electrooptical properties and applications of polymer network-stabilised liquid crystals obtained by polymerising a bifunctional photoreactive monomer dissolved in a liquid crystalline phase. Consideration is given to the effect of polymerisation conditions on morphology, transfer of anisotropic liquid crystalline order to the network, influence of network morphology on network-stabilised nematics, ferroelectric smectics and cholesterics and the relationship between polymerisation conditions, network morphology and electrooptical properties. 87 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.766469

Item 323

Patent Number: US 6001958 A 19991214 CROSSLINKABLE POLYMER, PARTICULARLY FOR OPTICAL AND NON-LINEAR OPTICAL USE, MATERIALS OR DEVICES USING THE SAME, AND METHOD FOR PREPARING THE POLYMER

Tapolsky G H; Chan Y P; Meyrueix R; Lecomte J-P; Dickens M

Flamel Technologies

The invention relates to a crosslinkable polymer for use in optics and non-linear optics, which comprises at least one chromophore, characterised in that it has, on at least two of its ends, at least one reactive end group of a different chemical type from the group predominantly used in polymerisation and the preparation of a polymer skeleton. The reactive end group comprises at least one CC, CN, CS, SS or NS double bond and/or triple bond, and/or an epoxy group and/or a thiol group of a derivative of the groups, and the polymerisation groups are selected from at least one of the following groups: urethane, ester, amide, imide, ether, carbon-carbon, sulphide, silane and siloxane, urethane and ester groups being particularly preferred. Application in optical and opto-electronic materials and devices.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.766453

Item 324

Polymer News 24, No.10, Oct.1999, p.343-8 **PHOTOCHEMICAL REACTIONS AND PHOTOPHYSICAL PROCESSES** Hrdlovic P

Slovak Academy of Sciences

Liquid crystalline (LC) polymers are widely used in high tensile strength fibre materials such as Kevlar and Lydar, which can be found in products such as replacement asbestos, motorcycle helmets and flame protection suits. However, there is growing research and development interest in using other functional properties of LC polymers for optical and electro-optical uses. LC polymers are organic materials that combine liquid crystalline molecules with polymer backbone. The LC structural unit can be part of the backbone itself to form the main chain liquid crystalline (MCLC) polymers. These units can be attached to the backbone as pendants to form side chain liquid crystalline (SCLC) polymers. MCLC polymers are more viscous than SCLC polymers and therefore are less functional for electro-optic applications. However, for photosensitive applications MCLC polymers are of equal importance because the activity can occur in the polymerisation process itself. Many effects that are observed in LC polymers are in fact photo-activated processes. The photo-activity can occur in the polymer backbone through the polymerisation process or in the liquid crystalline mesogen by isomerisation processes which can change the phase or the alignment of the LC molecule. By adding other functional groups to the polymer backbone, it is possible to provide additional optical effects. 17 refs.

SLOVAK REPUBLIC; SLOVAKIA Accession no.765059

Item 325

Journal of Materials Science Letters 19, No.2, 15th Jan. 2000, p.147-9 ELECTRO-OPTIC PROPERTIES OF POLED GUEST-HOST ORGANIC POLYMER DCNP/PEK-C THIN FILMS

Shi W; Fang C; Pan Q; Sun X; Gu Q; Xu D; Yu J Shandong,University; Academia Sinica

A guest-host system composed of 3-(1,1-dicyanothenyl)-1-phenyl-4,5-dihydro-1H-pyrazole, as a chromophore molecule, and polyetherketone was prepared and thin films obtained from solutions thereof by spin coating onto an indium-tin oxide glass substrate. The electrooptical properties of these films poled at about 180C just bekow the Tg were investigated and their orientational order parameter, macroscopic second-order non-linear polarisability and electro-optic coefficient determined. 10 refs.

CHINA

Accession no.764319

Item 326

Macromolecular Rapid Communications 21, No.1, Jan.2000, p.1-15 SECOND-ORDER NON-LINEAR OPTICAL POLYMERS

Samyn C; Verbiest T; Persoons A KU Leuven

This comprehensive review sets out an overview of the non-linear optical properties of polymers and their advantages and disadvantages in electrooptic and frequency doubling devices. Secondly, polymers which have been used for the purpose, and the more recent uptake of such polymers as polyimides and polymaleimides have been examined and discussed. The third section of the review speculates on the use of new polymer systems which have been developed, and their problem solving potential is examined. 116 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.763900

Item 327

Patent Number: US 6005137 A 19991221 HALOGENATED ACRYLATES AND POLYMERS DERIVED THEREFROM

Moore G G I; McCormick F B; Chattoraj M; Cross E M; Liu J J; Roberts R R; Schulz J F 3M Innovative Properties Co.

The halogenated acrylates and polyacrylates provide materials having tailorable optical and physical properties. The polymers may be used as in optical devices, such as optical waveguides and interconnecting devices. USA

Accession no.763181

Item 328

Advanced Materials 12, No.1, 7th Jan.2000, p.51-3 PHOTOLUMINESCENCE, ELECTROLUMINESCENCE, NONLINEAR OPTICAL, AND HUMIDITY SENSITIVE PROPERTIES OF POLYDIETHYNYLBENZENE PREPARED WITH A NICKEL ACETYLIDE CATALYST Zhan X: Yang M: Lei Z: Li Y: Liu Y: Yu G: Zhu D

Zhan X; Yang M; Lei Z; Li Y; Liu Y; Yu G; Zhu D

Zhejiang, University; Chinese Academy of Sciences

Details are given of the photoluminescence, electroluminescence, nonlinear optical, and humidity sensitive properties of polydiethynylbenzene. Doping and conductivity of polydiethynylbenzene are also discussed. 14 refs.

CHINA

Accession no.762098

Item 329

Macromolecular Chemistry & Physics 200, No.12, Dec.1999, p.2629-35 SYNTHESIS AND NONLINEAR OPTICAL PROPERTIES OF HIGH GLASS TRANSITION POLYIMIDES

Van den Broeck K; Verbiest T; Van Beylen M; Persoons A; Samyn C

Leuven, University

Non-linear optical(NLO) properties with Tgs as high as 275C were prepared by covalent bonding of a chromophore to the backbone of hydroxyl polyimides via a Mitsunobu reaction. NLO side chain polyimides with different polymer backbones and different chromophores were prepared and characterised by second harmonic generation. Poled films of the polymers exhibited a very good NLO response that was stable at elevated temps. 24 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.761974

Item 330

Molecular Crystals & Liquid Crystals Vol.327, 1999, p.23-6 **POLING BEHAVIOUR OF ELECTRO-OPTIC POLYMERS WITH PERFLUORINATED CHROMOPHORES**

Park K H; Shin D-H; Lee S-D; Lee C J; Kim N Seoul, National University

A fluorinated perfuorobutyl side chain modified benzoxazole NLO chromophore was synthesised and the poling behaviour of the NLO polyester produced therefrom was examined. The method used was by a second harmonic generation and a simple reflection measurement. The electro-optic coefficient of the polyester was measured in the range 8-10pm/V at 1.3um. 3 refs.

KOREA

Accession no.761843

Item 331

Molecular Crystals & Liquid Crystals Vol.327, 1999, p.1-4 **MOLECULAR ALIGNMENT RELAXATION IN POLED NONLINEAR OPTICAL POLYMER**

BEARING A HETEROCYCLIC AZO CHROMOPHORE

Kang J S; Hong H T; Choi D H Kyung Hee,University

Second-order nonlinear optical copolymers were synthesised to study effects of temperature on the temporal stability of the electro-optic effect. A heterocyclic azo chromophore was synthesised bound to a methacrylate and naphthalate backbone. Corona poling was used to give the relationship between the second harmonic signal and sample temperature. This work showed that the decaying behaviour of the second harmonic signal was traced at a different temperature which is in the vicinity of the glass transition temperature. 3 refs.

KOREA

Accession no.761840

Item 332

Industrial & Engineering Chemistry Research 38, No.12, Dec.1999, p.4675-81 STUDY ON THE MISCIBILITY OF SELECTED BLENDS OF METHYL METHACRYLATE-BENZYL METHACRYLATE COPOLYMERS Joohyeon Park; Kookheon Char; Park C W Seoul, National University; Florida, University

The blend compatibility of the above copolymers with different monomer compositions was studied in order to investigate their potential use as plastic optical fibres. Copolymers with variable comonomer composition were first synthesised and the blend compatibility between them was investigated by solution blending and melt blending. The results obtained by proton NMR, ellipsometry and DSC indicated that the copolymers synthesised in this study were random copolymers, with their refractive index and the Tg varying linearly with monomer content. While the solution-blended samples indicated immiscibility between copolymers with large differences in their monomer composition, melt-blended samples indicated miscibility, showing single Tg and homogeneity by SEM. The difference between the results of solution blends and melt blends could be attributed to the slow kinetics of phase separation and the intensive shear energy input during melt blending. These results suggested that the random copolymers were appropriate materials for application in the coextrusion method of Park and Walker for the fabrication of gradient-index plastic optical fibres. 24 refs.

KOREA; USA Accession no.761353

Item 333 Polymer 41, No.4, 2000, p.1325-35 EFFECT OF POLYMER STRUCTURE ON THE MORPHOLOGY AND ELECTRO-OPTIC PROPERTIES OF UV CURABLE PNLCS Kim B K; Cho Y H; Lee J S Pusan,National University

Films of polymer network liquid crystals were prepared using a UV curable polyurethane acrylate and a nematic liquid crystal mixture. Because the oligomers were highly viscous and immiscible with the liquid crystal, reactive diluents were used. The influence of the length of the polyurethane segment, the molecular weight and functionality of the polyol (polypropylene glycol), and the type of hard segment were studied in terms of the morphology, the voltage-transmittance relationship, the off-state transmittance-temperature relationship, and the thermal properties of the films. Increasing the prepolymer molecular weight increased the polymer-liquid crystal phase separation, decreased the threshold and driving voltages, and gave a smaller nematic-isotropic transition temperature depression. Increasing the functionality and decreasing the molecular weight of the polypropylene glycol resulted in smaller domain sizes, smaller decay times, increases in the threshold and driving voltages, a longer rise time, and a greater depression of the nematicisotropic transition temperature. 33 refs.

KOREA

Accession no.760693

Item 334

Patent Number: EP 970978 A1 20000112 RADIATION-CURABLE LIQUID RESIN COMPOSITION SUITABLE FOR COATING OPTICAL FIBRES AND OPTICAL FIBRE COATED THEREWITH

Yamamoto A; Kozakai S; Iwasaki S Shin-Etsu Chemical Co.Ltd.

This composition contains an organopolysiloxane, which has a (meth)acryl group at either end of the chain, contains at least 15 mol % of aromatic hydrocarbon groups based on all the organic groups, and is free of urethane bonds, a compound having at least one ethylenically unsaturated group in the molecule and a photopolymerisation catalyst. It has a low viscosity and cures to a product having a low Young's modulus, which changes little at low temperatures. JAPAN

Accession no.760397

Item 335

Advanced Materials 11, No.16, 10th Nov.1999, p.1387-91

PHOTOINDUCED MOTIONS IN AZOBENZENE-BASED AMORPHOUS POLYMERS: POSSIBLE PHOTONIC DEVICES

Natansohn A; Rochon P

Kingston, Queen's University; Kingston, Royal Military College

The photoinduced orientation and randomisation processes in films of azobenzene-based amorphous polymers are discussed, together with their possible exploitation in reversible optical storage, waveguides and gratings, and as photorefractive materials. 26 refs. CANADA

Accession no.760021

Item 336

Journal of Applied Polymer Science 74, No.14, 27th Dec.1999, p.3522-34 STRUCTURE, GROWTH, AND MORPHOLOGY IN PARA NITROANILINE DISPERSED POLYMETHYL METHACRYLATE GUEST-HOST NLO COMPOSITES

Saujanya C; Dhumal A; Mitra A; Radhakrishnan S India,National Chemical Laboratory

The structure, growth and morphology of composite films made by dispersing p-nitroaniline(PNA) in PMMA were investigated with respect to different crystallisation methods, composition and application of electric field. The wide-angle X-ray diffraction scans showed large variations in intensity of different reflections and the occurrence of a new crystalline structure, possibly due to complex formation between PNA and PMMA. The presence of this complex was further confirmed by IR spectroscopy and thermal analysis. In a certain range of composition (30 to 40% PNA), spherulitic morphology was observed, which otherwise consisted of needleshaped crystals dispersed in amorphous matrix. The transparency of these films also depended strongly on the crystallisation conditions and highly transparent films could be obtained, even at high PNA content, by application of electric field. These results could be explained on the basis of the intermolecular interaction between PNA and PMMA, as well as preferential growth direction and orientation of the PNA crystals. 29 refs. INDIA

Accession no.760004

Item 337

Macromolecular Symposia No.142, Aug.1999, p.61-71 SYNTHESIS OF NONLINEAR POLYMERS WITH LARGE PHOTOCONDUCTIVE SENSITIVITY AND TRANSPARENCY

Pyun S Y; Moon H; Lee J K; Kim N; Park S Y Seoul,National University; Korea,Institute of Science & Technology

Novel non-linear optical (NLO) chromophore, 2-(3-(2-(4methyl-sulphonylphenyl)vinyl)carbazol-9-yl)ethanol is synthesised and subsequently reacted with methacryloyl chloride to give a photoconducting NLO monomer (M1). 2-Methylacrylic acid 2-(3-(diphenylhydrazonomethylcarbazol-9-yl)ethyl ester (M2) is also synthesised as a comonomer to enhance the carrier mobility of the NLO polymer. Photoconducting NLO polymers, P1 and P2, are obtained by the copolymerisation of M1 with methyl methacrylate and M2, respectively. These polymers are well soluble in organic solvents and show glass transition at 177 and 196 deg.C, respectively. Polymer films of P1 and P2 are optically clear, and are transparent at wavelengths longer than 420 nm. The electro-optic coefficient (r33) of poled P1 films is measured to be ~5 pm/V at 632.8 nm. The photoconductive sensitivities of P1 and P2 are 6.2 x 10 -14 S.cm-2/mW.cm-2 and 5.6 x 10-11 S.cm-1/mW.cm-2. 12 refs. KOREA

Accession no.759450

Item 338

Patent Number: US 5938987 A 19990817 METHOD AND ARRANGEMENT FOR PRODUCING A BASIC ELEMENT OF A MULTI-ELEMENT OPTICAL CABLE Paivinen T NK Cables OY

A coating tool is used to form a tubular sheathing around a single optical fibre or a fibre bundle formed of several optical fibres; a pulling device is placed after the coating tool for pulling the sheathing and the fibres forward as a unit. In order to produce a stable product, the tension of the fibres passed to the coating tool is kept continuously at a controlled level. The direction of travel of the fibres and the sheathing is kept straight before and at the pulling device; the pulling device is spaced from the coating tool at a distance depending on the production rate of the production line, so that desired sliding of the fibres inside the sheathing is provided at the pulling device.

FINLAND; SCANDINAVIA; WESTERN EUROPE Accession no. 758926

Item 339

Patent Number: US 5938986 A 19990817 METHOD AND APPARATUS FOR MANUFACTURING A GRADED REFRACTIVE INDEX PLASTIC OPTICAL-FIBRE Nakamura T

Sumitomo Wiring Systems Ltd.

A plastic optical fibre is provided having a desired length and graded refractive index. A base polymer is mixed with a non-polymerisable compound having a higher refractive index to obtain a material which is then transformed continuously into a fibre in a fibre-preparing unit. A plurality of diffusion tanks are each provided with a solution, each solution having a level of viscosity different from one another. the fibre is then dipped successively into the solution in the order from a lowest viscosity level to a higher viscosity level. During this process the nonpolymerisable compound and polymerisable compound diffuse inside the fibre and form a graded refractive index distribution. The polymerisable compound is then polymerised and hardened in a drying-and-heating unit. The fibre thus obtained is drawn and coated with a cladding.

JAPAN Accession no.758925 Item 340

Reactive & Functional Polymers 42, No.1, 15th Sept.1999, p.73-86 SYNTHESIS OF PHOTOCONDUCTING NONLINEAR OPTICAL SIDE-CHAIN POLYMERS CONTAINING CARBAZOLE DERIVATIVES

Kim D W; Moon H; Park S Y; Hong S I Seoul, University

Photoconducting nonlinear optical side-chain polymers containing carbazole derivatives were prepared. Two multifunctional monomers were prepared, 2-methylacrylic acid 6-(3-(2-cyano-2-(4-nitrophenyl)-vinyl)carbazol-9-yl) hexyl ester (M1) and 2-methyl-acrylic acid 6-(3-(2-(4-nitrophenyl)-vinyl)-carbazol-9-yl)hexyl ester (M2), these possessed photoconductivity and nonlinear optical properties (NLO). Polymers (P1, P2) were then obtained by copolymerising these monomers with methyl methacrylate. A charge transporting monomer, 2-methylacrylic acid 6-(3-diphenyl-hydrazonomethyl)-carbozolyl-9-yl)hexyl ester (M3) was also prepared and copolymerised with M1 or M2 to give photoconducting NLO polymers (P3, P4) with enhanced photoconductivity. Spectroscopy and gel permeation chromatography analyses was used to determine polymerisation. High optical quality films could be made by spin coating the polymers. 26 refs.

SOUTH KOREA Accession no.758370

Item 341

Macromolecular Chemistry & Physics 200, No.10, Oct.1999, p.2309-19 **NOVEL POLYAMIDES FOR SECOND-ORDER NONLINEAR OPTICS WITH SIDE-CHAIN AZO-NLO-PHORES**

Nemoto N; Miyata F; Kamiyama T; Nagase Y; Abe J; Shirai Y

Sagami Chemical Research Center; Tokyo,Institute of Polytechnics

The syntheses of two kinds of polyamides by condensation polymerisation using 3-(N-methyl-4-((4-methylsulphonylphenyl)azo)anilino)-1-propyl 3,5diaminobenzoate and 5-(3-(4-(4-(N,N-dimethylamino) phenylazo)phenyl)sulphonylpropyl)oxyisophthalic acid or 5-(3-(N-methyl-4-((4-methylsulphonylphenyl) azo)anilino)-1-propyl)oxyisophthalic acid is reported. The thermal, linear optical and second-order NLO properties of these polyamides are also described. 8 refs. JAPAN

Accession no.757739

Item 342

Journal of Polymer Science: Polymer Chemistry Edition 37, No.20, 15th Oct.1999, p.3854-60

SYNTHESIS AND PROPERTIES OF POLYSILOXANE-BASED ELECTROOPTIC MATERIALS

Wu S; Zeng F; Li F; Zhu Y; Li J South China, University of Technology

A new functionalised polysiloxane material is synthesised. The polysiloxane-based electrooptic material with sidechain charge-transporting functionalities and non-linear optical chromophores is investigated through a three-step synthetic route. Elementary analysis and NMR spectra indicate that the polymer has a high degree of substitution. Detailed physical properties show that the polymer has a glass transition of around 91 deg.C, and its photoconductivity and electrooptic coefficient increase with the increasing applied electric field. Photorefractivity of the system is demonstrated through the asymmetric energy transfer in a two-beam coupling experiment. 26 refs.

CHINA

Accession no.757004

Item 343

Patent Number: US 5958584 A 19990928 RADIATION-CURABLE, OPTICAL GLASS FIBER COATING COMPOSITION AND OPTICAL GLASS FIBER DRAWING METHOD Petisce J R DSM NV

Provided is a radiation-curable, optical glass fibre coating composition containing at least one radiation-curable oligomer or monomer, and at least one chromophoric indicator selected so as to be susceptible to destruction of its chromophoric characteristic upon exposure to radiation and present in an amount which becomes substantially colourless when exposed to a level of radiation sufficient to cure said radiation-curable, optical glass fibre coating composition, wherein said at least one chromophoric indicator has a colour which is distinguishable from a base colour of said radiationcurable, optical glass fibre coating composition in cured form. The invention further provides a coated optical glass fibre and a method of making a coated optical glass fibre and a method of making a coated optical glass on a fibre drawing tower. Also provided is a cable and telecommunications system.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.755597

Item 344

Macromolecules 32, No.9, 4th May 1999, p.2903-9 LOW-LOSS PASSIVE OPTICAL WAVEGUIDES BASED ON PHOTOSENSITIVE POLY(PENTAFLUOROSTYRENE-CO-GLYCIDYL METHACRYLATE) Pitois C; Vukmirovic S; Hult A; Wiesmann D; Robertsson M Stockholm,Royal Institute of Technology; IBM Zurich Research Laboratory; Ericsson Components AB

Low loss optical waveguides were fabricated from fluorinated copolymers designed to incorporate photochemical amplification based on acid catalysis. Core and cladding layers were made, for single-mode channel waveguides, from the poly(pentafluorostyrene-co-glycidyl methacrylate) copolymer series and, for multimode ridge waveguides, from poly(tert-butyl methacrylate-co-glycidyl methacrylate) as the cladding and poly(pentafluorostyreneco-glycidyl methacrylate) as core layer. Reactivity ratios were obtained for the pentafluorostyrene and glycidyl methacrylate monomers in free radical copolymerisation. Variation of the copolymer composition allowed precise control over the refractive index measured at 589, 633 and 1550 nm. These amorphous copolymers were photocrosslinked by contact printing and developed by wet etching to produce high quality ridge waveguides with very smooth top surfaces. Low loss single-mode waveguides exhibit averaged losses over eight channel waveguides as low as 0.39 dB/cm at 1320 nm and 0.42 dB/cm at 1550 nm. Thermal properties (DSC Tg and TGA thermal stability) were examined and optical losses were measured after two different annealings at 200 and 250C for 1 hour. 24 refs.

SCANDINAVIA; SWEDEN; SWITZERLAND; WESTERN EUROPE

Accession no.754752

Item 345

Journal of Polymer Science: Polymer Chemistry Edition

37, No.19, 1st Oct.1999, p.3715-22 SYNTHESIS OF NONLINEAR OPTICAL MALEIMIDE COPOLYMER BY POLYMER REACTION AND THEIR ELECTRO-OPTICAL PROPERTIES

Gi Heon Kim; Chang Dae Keum; Sung Jin Kim; Lee Soon Park

Kyungpook,National University; Tokyo,Institute of Technology

Thermally-stable poly(alpha-methylstyrene-comaleimide)(MSMI) and poly(alpha-methylstyrene-co-4carboxyphenyl maleimide)(MSCM) substrate polymers were prepared by free radical polymerisation of comonomers. The introduction of a Disperse Red 1(DR1) chromophore to the maleimide units of MSMI substrate polymer by the Mitsunobu reaction was dependent on the reaction solvent. The degree of substitution of DR1 into the MSMI polymer was found to be 91.1 mol % and 0.4 mol % by UV spectrometers in the THF and DMF solvent, respectively. DR1 chromophore was, however, substituted in the MSCM polymer at 33.0 mol % by Mitsunobu reaction in the THF solvent. Both substrate and non-linear optical(NLO) polymer exhibited high thermal stability due to the incorporation of maleimide units in the polymer chain. The Tg and initial decomposition temp.(Ti) of the NLO polymer were in the range of Tg of 185C and Ti 310 to 345C. The electrooptical coefficient of MSMI-THF was higher than that of MSCM-DR due to an increased degree of substitution of DR1 chromophore. 12 refs.

JAPAN; KOREA

Accession no.754116

Item 346

Chemistry of Materials 11, No.9, Sept.1999, p.2554-61 ENHANCEMENT OF ELECTROOPTIC COEFFICIENT OF DOPED FILMS THROUGH OPTIMIZATION OF CHROMOPHORE ENVIRONMENT

Banach M J; Alexander M D; Caracci S; Vaia R A Cincinnati,University; Dayton,University,Research Institute; US,Air Force Research Laboratory

The dependence of electrooptical coefficient on electronic properties of the host polymer and specific chromophorehost interactions was examined. The chromophores used were Disperse Red 1 and 4-(dicyanomethylene)-2-methyl-6-(p-(dimethylamino)styryl)-4H-pyran and the polymers were polycyclohexyl methacrylate, poly(tert-butyl methacrylate), PMMA, polyvinyl pyridine, PS and styrene-methyl methacrylate copolymer. The results obtained demonstrated the potential associated with modification of guest-host interactions in chromophoredoped polymer films for the development of highly nonlinear, stable electrooptical materials. 42 refs. USA

Accession no.754106

Item 347

Chemistry of Materials 11, No.9, Sept.1999, p.2285-8 PROGRESS TOWARD DEVICE-QUALITY SECOND-ORDER NLO MATERIALS. III. ELECTROOPTIC ACTIVITY OF POLYMERS CONTAINING E,E,E-(4-(N,N-DIALKYLAMINO)PHENYL)PENTADIENYLIDENE-3-PHENYL-5-ISOXAZOLONE CHROMOPHORES

Fang Wang; Harper A W; Lee M S; Dalton L R; Hua Zhang; Altao Chen; Steier W H; Marder S R Southern California, University; Arizona, University

PMMA doped with the ethyl form of the above chromophore and thermosetting PUs derived from difunctionalised and trifunctionalised analogues of this chromophore were prepared and evaluated for use as electrooptical materials. It was shown that polymeric materials characterised by electrooptical coefficients higher than those of the dominant commercial material lithium niobate were obtained with chromophores based on polyene bridges and isoxazolone acceptor segments. 29 refs. USA

Accession no.754095

Item 348

Journal of Macromolecular Science A 36, No.10, 1999, p.1503-19 SYNTHESIS AND ELECTRO-OPTICAL PROPERTIES OF POLY(2-ETHYNYLPYRIDINIUM TOSYLATE) HAVING PROPAGYL SIDE CHAIN

Yeong-Soon Gal; Won-Chul Lee; Seok-Joo Lee; Jong-Wook Park; Jang-Myoun Ko; Jong-Han Chun Kyungil,University; Korea,Advanced Institute of Science & Technology; Chungju,National University; Taejon,National University of Technology

A conjugated ionic polymer was prepared by the polymerisation of 2-ethynylpyridine with propargyl tosylate in refluxing methanol. The polymerisation proceeded well in homogeneous manner to give a relatively high yield of polymer. The resulting poly(2-ethynylpyridinium tosylate)s having propargyl side chains(poly(EPT-P)) were hygroscopic and soluble in water, methanol, DMF and DMSO. The intrinsic viscosities of the polymers were in the range 0.08 to 0.29 dL/g. Instrumental analyses using NMR, IR and UV-visible spectroscopies and elemental analyses indicated that the resulting poly(EPT-P) had a conjugated ionic polymer backbone carrying N-propargyl-2-pyridinium tosylate. Thermal and electrooptical properties of the polymers were also studied. 48 refs.

KOREA

Accession no.754075

Item 349

Revue Generale des Caoutchoucs et Plastiques No.779, Sept.1999, p.33/8

French

MICROPROCESSING: PROCESSES, EQUIPMENT AND APPLICATIONS Pommereau C

Injection and compression moulding processes and machinery for the production of plastics microcomponents are examined, and applications of this technology in the manufacture of components for the telecommunications, medical and related sectors are described.

MAINZ,INSTITUT FUER MIKROTECHNIK; BATTENFELD GMBH; DR.BOY GMBH; FERROMATIK MILACRON GMBH EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.752793

Item 350

Journal of Materials Chemistry 9, No.9, Sept.1999, p.2251-8 PHOTOCONDUCTIVE PROPERTIES OF PVK-BASED PHOTOREFRACTIVE POLYMER COMPOSITES DOPED WITH FLUORINATED STYRENE CHROMOPHORES Hendrickx E; Yadong Zhang; Ferrio K B; Herlocker J A; Anderson J; Armstrong N R; Mash E A; Persoons A P; Peyghambarian N; Kippelen B Arizona,University

Nine anisotropic chromophores, with different degrees of fluorination, were prepared and the effect of the chromophore's ionisation potential on charge-transfer complexation, photoconductivity and response time in photorefractive polymer mixtures based on polyvinyl carbazole was studied. (2,4,7-Trinitrofluoren-9ylidene)malonitrile(TNFDM) or C60 provided the sensitisation. Evidence of strong complexation between TNFDM and the chromophore was found. At high electric fields, the photoconductivity decayed during illumination and reached a limiting value that correlated with the chromophore's ionisation potential. A build-up of C60radical anions was observed simultaneously. The strong decline in photoconductivity correlated with an increase in the photorefractive grating build-up time. 15 refs. USA

Accession no.751103

Item 351

Journal of Materials Chemistry 9, No.9, Sept.1999, p.1905-20 FROM MOLECULES TO OPTO-CHIPS: ORGANIC ELECTRO-OPTIC MATERIALS

Dalton L R; Steier W H; Robinson B H; Chang Zhang; Ren A; Garner S; Chen A; Londergan T; Irwin L; Carlson B; Fifield L; Phelan G; Kincaid C; Amend J; Jen A

Washington, University; Southern California, University; Northeastern University

A review of the literature on organic electrooptical materials is presented, covering applications of electrooptical materials (from cable television to gyroscopes), Pockell's effect, application of electrooptical materials in simple device structures, polymeric modulators versus lithium niobate modulators, molecular hyperpolarisability, translation of hyperpolarisability into macroscopic electrooptical activity, stabilising electrooptical activity by lattice hardening, controlling optical loss in electrooptical materials, fabrication of buried channel waveguides, mode matching of polymeric electrooptical waveguides to silica fibres, vertical and horizontal integration of modulators with very large scale integration semiconductor electronics, fabrication and evaluation of prototype devices, and field test performance and comparison with the competition. 155 refs.

USA

Accession no.751082

Item 352

Journal of Materials Chemistry 9, No.9, Sept.1999, p.1865-73 **HIGHLY STABLE, FUNCTIONALIZED**

POLYIMIDES FOR SECOND ORDER NONLINEAR OPTICS

Saadeh H; Yu D; Wang L M; Yu L P Chicago,University

Attempts to develop polyimides functionalised with nonlinear optical(NLO) chromophores for applications in second-order non-linear optical devices are described. Several general synthetic approaches to these materials are outlined. Detailed physical characterisation indicated that these materials were quite promising in stabilising the dipole orientation. Large optical non-linearity was observed in a few of the systems in which a NLO chromophore exhibiting large mu beta value was incorporated. A synthetic challenge was, however, to incorporate these NLO chromophores exhibiting better mu beta values into polyimide backbones (because of the sensitivity of these chromophores towards chemical manipulation). A possible solution involving using palladium-catalysed coupling reaction is discussed and an example presented. 23 refs.

USA

Accession no.751079

Item 353 Journal of Coatings Technology 71, No.891, April 1999, p.53-7 STUDY OF UV-CURABLE COATINGS FOR OPTICAL FIBERS Gexing Shen; Xiouning Qu; Wanneng She; Xiaomeng Yu; Qunzhen Sun; Hanning Chen

Hubei Research Institute of Chemistry

Three types of UV-curable prepolymers, urethane acrylate(UA), polysilicone acrylate(SA) and epoxy acrylate(EA), were prepared. These prepolymers were mixed in different proportions to modify the properties of an optical fibre coating. The component-property and structure-property relationships of the mixed coatings were studied. When the proportion of the SA:UA:EA mixture was 5:4:3, it was used for a single coating, while a ratio of 6:5:2 was used for a primary buffer coating. These mixture coatings were applied to optical fibres. 11 refs. CHINA

Accession no.748396

Item 354

Chemistry of Materials

11, No.8, Aug.1999, p.2218-25

CONVENIENT MODULAR APPROACH OF FUNCTIONALIZING AROMATIC POLYQUINOLINES FOR ELECTROOPTIC DEVICES

Hong Ma; Jen A K Y; Jianyao Wu; Xiaoming Wu; Sen Liu; Ching-Fong Shu; Dalton L R; Marder S R; Thayumanavan S Northeastern University; Taiwan,National Chiao-Tung University; Washington,University; Arizona,University A method was developed for manufacture of second-order non-linear optical(NLO) side-chain aromatic polyquinolines. This method utilised the ease of incorporation of NLO chromophores into the pendent phenyl moieties of parent polyquinolines at the final stage via a mild Mitsunobu reaction, which resulted in the synthesis of NLO polyquinolines with a broad range of polymer backbones and great flexibility in the selection of chromophores. The NLO side-chain polyquinolines synthesised possessed high Tg, good processability and high thermal stability. The results obtained for electrooptic activity, optical loss and long-term stability of the poling-induced polar order demonstrated the advantages of this design approach. The suitability of these polymers in the development of electrooptical devices was demonstrated. 47 refs.

TAIWAN; USA

Accession no.748384

Item 355

Kobunshi Ronbunshu

56, No.6, 1999, p.361-9 Japanese

NONLINEAR OPTICAL PROPERTIES OF THE MAIN-CHAIN TYPE LIQUID CRYSTALLINE POLYMERS Asada T; Tanaka H

Kyoto,University

The second harmonic generations(SHG) of liquid crystalline main chain type polymers were investigated. The sample polymers were copolymers of 2-hydroxy-6naphthoic acid and 4-hydroxybenzoic acid in various composition ratios. The SHG of the film samples was markedly affected not only by the polymerisation conditions but also by the preparation conditions of the films. SHGs for the samples processed by mechanical stretching and for electrically poled samples were compared. The non-linear optical coefficients (d(exp)) of the electrically poled samples evaluated by the Maker-Fringe method were 2 to 2.5 times larger than those of the mechanically oriented sample whose d(exp) was about 5 pm/V. The high SHG of the main chain-type NLO polymers mainly originated from the additivity of hyperpolarisability of the individual unit due to head-totail bonding. To improve the conversion efficiency, the effect of piling mechanically oriented films was investigated. Quasi-phase matching was also performed by piling mechanically oriented films. 21 refs. JAPAN

Accession no.748334

Item 356 Polymer 40, No.22, 1999, p.6157-67 SYNTHESIS AND CHARACTERISATION OF NOVEL POLYIMIDE-BASED NLO MATERIALS FROM POLYHYDROXY-IMIDES CONTAINING ALICYCLIC UNITS. II

Kim E H A; Moon I K; Kim H K; Lee M-H; Han S-G; Yi M H; Choi K-Y Hannam,University; Korea,Research Institute of Chemical Technology

A series of polyimide-based second-order nonlinear optical (NLO) materials are synthesised from polyhydroxy-imides containing alicyclic units, followed by the Mitsunobu reaction with NLO chromophores. The resulting polymers are highly soluble in aprotic polar solvents such as DMF, DMAc, NMP, etc. The NLO polyimides exhibit the inherent viscosity range of 0.22-0.50 dL/g. Molecular structural characterisation for the resulting polymers is achieved by 1H-NMR, FT-IR and UV-visible spectroscopies. The glass transition temperature for the resulting NLO polyimides is in the range of 161 deg.C-233 deg.C and most of them showed high thermal stability. The polymer solutions can be spin coated on the indium-tin oxide (ITO) glass or quartz disc substrates to form the optical quality thin films. The electro-optic coefficients (r33) at the wavelength of 1.3 mu for polymer thin films poled around the glass transition temperature are in the range of 2-6 pm/V. Long-term thermal stability of the dipole alignment is observed up to ca. 140 deg.C. 13 refs.

KOREA

Accession no.748017

Item 357

Patent Number: US 5928574 A 19990727 **METHOD OF MAKING OPTICAL FIBRE** DiMarcello F V; Huff R G; Kranz K S; Walz F W Lucent Technologies Inc.

Fibre bow can be greatly reduced if the fibre being drawn from a heated optical fibre preform is caused to run through a tubular cooling chamber, which extends from the draw furnace and comprises a tube having an inner diameter of less than 35 mm, preferably less than 20 mm. The cooling chamber preferably includes an upper cooling chamber with a transition element providing a smooth transition between the two chambers and is desirably free of turbulence-causing air leaks and/or geometrical features.

USA

Accession no.744732

Item 358

Journal of Materials Science Letters 18, No.11, 1st June 1999, p.833-6 SYNTHESIS AND CHARACTERISATION OF (60) FULLERENE-BASED NONLINEAR OPTICAL POLYACRYLONITRILE DERIVATIVES Xiao L; Chen Y; Cai R; Huang Z-E; Qian S Fudan,University

Nonlinear optical (NLO) materials have gained increasing interest, particularly in the past decades, for their realised

and potential applications in many fields of photonics, optical communication and laser technology. Along with metallophthalocyanines and mixed metal clusters, C60 and other fullerenes have emerged as promising candidate materials for the nonlinear optical applications owing to their intrinsic NLO properties which primarily originate from their large pi-electron conjugations and strong electron affinity. However the ability to fabricate NLO devices based on C60 has been limited due to poor processability and multiaddition of organic group. Therefore, the main key to the development of C60-based NLO materials is to synthesise highly soluble C60 derivatives with excellent NLO properties under very mild conditions. The highly soluble (60) fullerene-based polyacrylonitrile (PAN) derivatives with different C60 contents are synthesised using a previously reported onepot experiment procedure, and initial results of an investigation into their third-order nonlinear optical response by optical-heterdyne-detected optical-Kerreffect (OHDOKE) technique are described. 13 refs. CHINA

Accession no.744384

Item 359

Patent Number: US 5856384 A 19990105 POLYCYCLIC AROMATIC COMPOUNDS HAVING NONLINEAR OPTICAL PROPERTIES Garito A F; Yamada S; Panackal A Pennsylvania,University

Devices and materials containing certain stable, polycyclic aromatic compounds exhibit sensible, second order nonlinear optical effects. In general, useful polycyclic aromatic compounds possess electron-donating and electron-withdrawing chemical functionality but no centre of inversion symmetry on either the molecular or crystalline unit cell level.

USA

Accession no.743787

Item 360

Polymer Bulletin 42, No.4, April 1999, p.403-9 **SYNTHESIS AND PROPERTIES OF NONLINEAR OPTICAL POLYMERS BASED ON POLY(ETHER IMIDES) FOR ELECTROOPTICAL DEVICES**

Hyung-Jong Lee; Myung-Hyun Lee; Min-Cheol Oh; Seon Gyu Han Korea,Electronics & Telecommunications Research

Institute

Non-linear optical polyether-imides(PEIs) with adequate thermal stability were synthesised by direct coupling of hydroxy PEIs and NLO chromophores with a quantitative yield. The resultant amorphous NLO PEIs exhibited good solubility in common organic solvents, providing opticalquality thin films by spin coating. The Tgs of the polymers were at about 180C. The electrooptical coefficient of PEIdisperse red 1 was 12.3 pm/V with an electrical poling field of 100 V/micrometre and it decayed about 10% over 10 months at 90C under atmospheric conditions. 11 refs. KOREA

Accession no.743301

Item 361

Journal of Polymer Science: Polymer Chemistry Edition

37, No.14, 15th July 1999, p.2355-61 CROSSLINKABLE POLYMERS FOR OPTICAL WAVEGUIDE DEVICES. II. FLUORINATED ETHER KETONE OLIGOMERS BEARING ETHYNYL GROUP AT THE CHAIN END Lee H-J; Lee M-H; Oh M-C; Ahn J-H; Han S G Korea,Electronics & Telecommunications Research Institute

Fluorinated ether ketone oligomers bearing a crosslinkable ethynyl group at the chain end are investigated for low-loss polymer optical waveguide devices. These oligomers are designed to achieve low birefringence and were synthesised by the reaction of 4,4'-(hexafluoroisopropylidene)diphenol with an excess decafluorobenzophenone, followed by reaction with (phenylethynyl)phenol or ethynylphenol. The molecular weights and polydispersities of the oligomers determined by GPC with polystyrene standard are in the range of 6600-8500 g/mol and 1.79 -2.04, respectively. By spin coating and thermal crosslinking, the polymer solutions easily provide good optical quality thin films. The cured films show good chemical resistance and high thermal stability up to 460 deg.C under nitrogen. At 1.55 mu m wavelength, the refractive index and birefringence of the films show in the range of 1.5104-1.5172 and 0.0078-0.0014, respectively. The propagation loss of the singlemode channel waveguide is measured to be less than 0.5 dB/cm at 1.55 gm. 14 refs.

KOREA

Accession no.743132

Item 362

Chemistry of Materials 11,No.6,June 1999,p.1406-8 SIDE-CHAIN NON-LINEAR OPTICAL POLYMERS CONTAINING A STYRYLFURAN-BASED CHROMOPHORE WITH LARGE ELECTRO-OPTIC PROPERTIES Song S; Lee S J; Cho B R; Shin D-H; Park K H; Lee C J; Kim N Korea,University; Korea,Institute of Science & Technology

The synthesis of methyl methacrylate and maleimide copolymers containing 5-(5'-(p-diethylaminostyryl) furfurylidene)-N,N'-diethylthiobarbituric acid in the side chain is described. These copolymers were characterised

by solubility, weight-average molec.wt. and Tg measurements and UV-visible spectroscopy and exhibited a specified electro-optic coefficient and good heat stability. 12 refs.

KOREA

Accession no.741348

Item 363

Patent Number: US 5911023 A 19990608 POLYOLEFIN MATERIALS SUITABLE FOR OPTICAL FIBRE CABLE COMPONENTS Risch B G; Holder J D

Alcatel Alsthom Compagnie Generale d'Electricite

Optical fibre cable components, such as buffer tubes, filler rods or jackets, are produced using a polyolefin having a high melt flow index. The advantages of using materials with a high melt flow index are most evident when processing thermoplastic materials, such as nucleated copolymers of ethylene and propylene at high line speeds (shear rates) of over 50M/min. The components exhibit improved crystallinity, crystallisation rates, crush resistance, reduced post-extrusion shrinkage, improved gel compatibility and improved excess fibre length control.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.741171

Item 364

ACS Polymeric Materials Science & Engineering.Volume 80.Conference proceedings. Anaheim, Ca., Spring 1999, p.404-5.012 SYNTHESIS AND PROPERTIES OF ALUMINIUM PHTHALOCYANINE SIDE-CHAIN POLYIMIDE FOR THIRD-ORDER NONLINEAR OPTICS

Sakai Y; Ueda M; Yahagi A; Tanno N Yamagata,University (ACS,Div.of Polymeric Materials Science & Engng.)

A side-chain third-order nonlinear optical polyimide was prepared by the reaction of poly(hydroxyimide) with aluminium phthalocyanine in the presence of silver triflate. The polymer was characterised using infrared spectroscopy, UV-vis spectroscopy, thermogravimetric analysis, and elemental analysis. The Z-scan technique was used to study its non-linear optical properties, and to measure the third-order nonlinear susceptibility. 8 refs. IAPAN

Accession no.738958

Item 365

Patent Number: US 5905833 A 19990518 OPTICAL FIBRE CABLE HAVING AN IMPROVED FILLING MATERIAL WITHIN ITS CORE Sheu J J Lucent Technologies Inc. Optical fibres and filling material are disposed within a tubular member disposed within a sheath system, which may include longitudinally extending strength members in addition to a plastic jacket. The filling material comprises at least two different hydrocarbons, as an oil constituent, and/or two different fumed silicas, as part of a thickening agent. The hydrocarbon(s) may be a synthetic oil, such as a poly-alpha-olefin, a mineral oil or mixture thereof, the combination of oils being used to help low temperature properties and better incorporate a gelling system, which may include a copolymer. A copolymer is used mainly to reduce oil separation. The filling material is capable of passing a standard for Compound Flow (Drip) Test for Filled Optical Cable and has a critical-yield stress of less than about 0.002 psi.

USA

Accession no.738877

Item 366

Patent Number: US 5904983 A 19990518 CORROSION-RESISTANT OPTICAL FIBRES AND WAVEGUIDES

Chan M G; Inniss D; Katz H E; Kuck V J; Schilling M L Lucent Technologies Inc.

The optical fibre includes a core-cladding assembly surrounded by a thin quasi metal oxide film, preferably 10 nm in depth. Over time, particularly under the influence of elevated temperatures, the initially deposited reagents of the thin film oxidise or hydrolyse, removing the organic components, and bonding a quasi metal oxide film on the surface of the cladding. The resulting film significantly retards corrosion by blocking environmental fluids from reacting with flaws in the cladding surface of the fibre, thus improving the mechanical performance and reliability of the optical fibre. The thin film also protects the fibre from incidental abrasions. Alternatively, the quasi metal oxide reagents are deposited into a protective polymer layer of the fibre or a filling compound of a fibre cable, rather than directly onto the cladding surface, the same protective effect being achieved when the reagents diffuse through the polymer layer or filling compound to the core-cladding surface.

USA

Accession no.738739

Item 367

Patent Number: EP 924274 A2 19990623 RADIATION-CURABLE OLIGOMERS, RADIATION-CURABLE COMPOSITIONS, COATED OPTICAL GLASS FIBRES, AND RIBBON ASSEMBLIES Montgomery E I; Noren G K DSM NV

An inner primary coating composition comprises at least one radiation-curable oligomer having a number-average molec.wt. of at least 2,000 and containing a polyester backbone, carbon-containing side chains, each having from about 3 to 30 carbon atoms and being connected to the polyester backbone, and at least one radiation-curable functional group bound to the polyester backbone, and, optionally, at least one diluent monomer. The side chains comprise at least about 5% of the number-average molec.wt. of the oligomer. The oligomer is present in an amount sufficient to provide a coating having the functional capability of releasing from a surface of an optical glass fibre as a coherent layer.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE Accession no.738232

Item 368

ACS Polymeric Materials Science & Engineering.Volume 80.Conference proceedings. Anaheim, Ca., Spring 1999, p.183-4. 012 **NOVEL POLYMERS FOR SINGLE-LAYER LIGHT-EMITTING DIODES** Zhonghua Peng; Jianheng Zhang Missouri-Kansas City,University (ACS,Div.of Polymeric Materials Science & Engng.)

Poly(phenylenevinylene)s containing rigid oxadiazole units as main-chain substituents were synthesised and characterised by UV vis spectroscopy. The polymers were soluble in common organic solvents and were highly fluorescent. Single-layer LED devices were prepared by spin-coating polymer solution onto coated glass substrates. Uniform orange emission, easily observable under normal lighting conditions, was obtained under forward bias. Efficiencies up to 20 times that of polyphenylenevinylene were achieved. 17 refs. USA

Accession no.737753

Item 369

Patent Number: US 5773486 A 19980630 METHOD FOR THE MANUFACTURE OF OPTICAL GRATINGS Chandross E A; Paczkowski M A; Simoff D A

Lucent Technologies Inc.

The specification describes techniques for the manufacture of optical gratings in optical fibres. The grating pattern is written into the core of the fibre without removing the fibre coating. Coating compositions with high transparency to the actinic (writing) radiation but which are UV curable are described in detail. The coating compositions contain a UV photoinitiator that absorbs sufficient UV radiation to effectively cure the polymer but is relatively transparent to UV radiation used for writing the grating. The photoinitiator is one or more compounds selected from a specified group of aliphatic and cycloaliphatic ketones.

USA

Accession no.737225

Item 370

Journal of Materials Science 34, No.7, 1st April 1999, p.1513-7 SECOND-ORDER NONLINEAR OPTICAL

PROPERTIES OF A SERIES OF POLYESTERS CONTAINING PUSH-PULL AZOBENZENE CHROMOPHORE IN THEIR SIDE CHAIN

Shen Yuquan; Qiu Ling; Li Zao; Zhang Xinxin; Zhao Yuxia; Zhai Jianfeng; Delaire J A; Nakatani K; Atassi Y Academia Sinica; CNRS

The values of the second harmonic coefficients(d33) of a series of polyester non-linear optical polymers, differing in their electron withdrawing substituent, were measured experimentally. The observed order of contribution of the substituents towards the d33 value was rationalised by a frequency factor dependence. Very high photostability and the highest d33 value among the series of polymers were found for the polyester with 2,4-dinitro substituents in the side chain. A possible influence of intermolecular interaction was also indicated. 10 refs.

CHINA; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE Accession no.733320

Item 371

Industrial & Engineering Chemistry Research 38, No.5, May 1999, p.1759-74 PROBING STRUCTURE-PROPERTY RELATIONSHIPS IN THIRD-ORDER NONLINEAR OPTICAL POLYMERS: THIRD HARMONIC GENERATION SPECTROSCOPY AND THEORETICAL MODELING OF SYSTEMATICALLY DERIVATIZED CONJUGATED AROMATIC POLYIMINES Chen-Jen Yang; Jenekhe S A; Meth J S; Vanherzeele H Rochester,University; DuPont Central Research & Development

Results are presented of a study in which picosecond third harmonic generation spectroscopy in the range 0.9 to 2.4 micrometres and sum-over-states theoretical modelling were used to investigate the third-order non-linear optical properties of a series of nine conjugated aromatic polyimines designed to elucidate structure-third-order susceptibility relationships in conjugated polymers. 124 refs.

USA

Accession no.733237

Item 372

Macromolecular Chemistry & Physics 200, No.5, May 1999, p.1150-6 STUDY OF NONLINEAR OPTICAL RESPONSE OF TRANS-(CH)N WITH A CHAIN LENGTH DEPENDENT SCREENED POTENTIAL Siregar R E; Tjia M O Indonesia,Padjadjaran University; Bandung,Institut Teknologi A chain length dependent screening factor was introduced in the Ohno potential for the study of non-linear optical effects in trans-(CH)N within the general scheme of the Pariser-Parr-Popple pi electron model without the restriction of zero differential overlap. It was shown that a calculation employing the much simpler scheme of single electron configuration interaction produced the 1/ N behaviour of the low-lying excited energies of polyenes which agreed well with experimental results. It was also found that all the important features of the third harmonic generation(THG) spectrum known for N = 10 could be obtained in the same scheme on the basis of four lowlying excitation states. The third-order static polarisability calculated for varying N exhibited a growth following the power law N to the power of b, with b 3.23 for N 10 or less. The excited state THG spectrum calculated for N = 10 also showed the general feature and enhancement factor consistent with those obtained previously by different researchers. 26 refs.

INDONESIA

Accession no.733224

Item 373

Reactive & Functional Polymers 40, No.2, 15th May 1999, p.177-84 NONLINEAR OPTICAL POLYMERS WITH NOVEL BENZOXAZOLE CHROMOPHORES. V. LINEAR AND CROSSLINKED POLYURETHANES USING NITROTHIOPHENE AND NITROPHENOL AS ELECTRON ACCEPTORS

Ki Hong Park; Jong Tae Lim; Sangyup Song; Yong Suk Lee; Chul Joo Lee; Nakjoong Kim Korea,Institute of Science & Technology

Two diol monomers, with benzoxazole-based non-linear optical(NLO) chromophores, one of which had an additional hydroxyl group as a crosslinkable moiety and the other had a nitrothiophene group as an electron withdrawing unit, were synthesised. The diol monomers were polymerised with 4,4'-methylenebis(phenyl isocyanate) to give NLO PUs, respectively. Linear PU with hydroxyl groups could be crosslinked between side chain chromophores themselves after poling using an additional crosslinking agent such as tetramethyl-1,3xylylene diisocyanate. Temporal stability of electrooptical coefficient of a crosslinked PU was improved compared with that of a linear PU. The second harmonic generation coefficient(d33) of linear PU with benzoxazole-thiophene chromophores was 94 pm/V and non-resonant d33 value was 17.1 pm/V calculated by two-level model equation. 19 refs. (Pt.IV, ibid, p.169-75)

SOUTH KOREA

Accession no.731999

Item 374

Reactive & Functional Polymers 40, No.2, 15th May 1999, p.169-75

NONLINEAR OPTICAL POLYMERS WITH NOVEL BENZOXAZOLE CHROMOPHORES. IV. SYNTHESIS OF MALEIMIDE-STYRENE AND MALEIMIDE-METHACRYLATE COPOLYMERS

Ki Hong Park; Jong Tae Lim; Sangyup Song; Mi Gyung Kwak; Chul Joo Lee; Nakjoong Kim Korea,Institute of Science & Technology

Four non-linear optical(NLO) maleimide copolymers were synthesised by radical copolymerisation of Nphenylmaleimide and methacrylate-based or styrenebased monomer with benzoxazole chromophores, respectively. The copolymers had high Tgs of 158C and exhibited good thermal stability. The most transparent film was prepared from an alternating copolymer(PMIBz 2) derived from N-phenylmaleimide and styrene-based NLO monomer. The second harmonic generation coefficient and electro-optical coefficient(r33) of a poled PMIBz 2 was 45 pm/V (at 1.064 micrometres) and 6.1 pm/V (at 1.3 micrometres), respectively. The temporal stability of R33 of PMIBz 2 was superior to that of only methacrylatebased copolymer. 12 refs.

SOUTH KOREA

Accession no.731998

Item 375

Journal of Polymer Science: Polymer Chemistry Edition

37, No.9, 1st May 1999, p.1321-9 SYNTHESIS AND PROPERTIES OF A SECOND-ORDER NONLINEAR OPTICAL SIDE-CHAIN POLYIMIDE

Sakai Y; Ueda M; Fukuda T; Matsuda H Yamagata,University; Japan,National Institute of Materials & Chemical Research

A thermally stable aromatic polyimide with side chain second-order non-linear optical chromophores was developed. The polyimide was prepared by the ringopening polyaddition of 4,4'-(hexafluoroisopropylidene) diphthalic anhydride with a new diamine having two Nethyl-N-(4-((6-chlorobenzothiazol-2-yl)diazenyl)phenyl)-2-aminoethanol units as the non-linear optical chromophore, followed by poling during or after the thermal imidisation process. The corona poling process of the non-linear optical-substituted poly(amic acid) to the polyimide was also studied in detail by measuring the second harmonic generation from the polymer films. 19 refs.

JAPAN

Accession no.731818

Item 376

Journal of Polymer Science: Polymer Chemistry Edition 37, No.9, 1st May 1999, p.1245-54 CHARACTERISATION OF A SIDE CHAIN POLYMER FOR SECOND-ORDER NONLINEAR

OPTICAL PROPERTIES

Sharma P R S; Zhou P; Frisch H L; Van Wagenen E A; Korenowski G M

New York, State University; Printing Developments Inc.; Rensselaer Polytechnic Institute

Characterisation of copolymers of methyl methacrylate and 2-propenoic acid,2-methyl-,2-((((4-methyl-3-(((2methyl-4-nitrophenyl)amino)carbonyl) aminophenyl)carbonyl)oxy)ethyl ester (PAMEE) exhibiting non-linear optical properties was reported. 58 refs.

USA

Accession no.731810

Item 377

Acta Polymerica 50, No.4, April 1999, p.156-62 GRAFTED CARBON FIBRES AND THEIR PHYSICO-CHEMICAL PROPERTIES. IV. GRAFTING OF CYANO-BIPHENYL CONTAINING LIQUID-CRYSTALLINE MONOMERS ONTO MODIFIED CARBON FIBRES

Selimovic M; Bismarck A; Pfaffernoschke M; Springer J Berlin, Technical University

A simple, reproducible, already introduced grafting method of methacrylic monomers onto carbon fibres is applied to cyanobiphenyl containing liquid crystal monomers. Development of liquid crystalline phases was faster and more uniform in the presence of carbon fibres. Applying a voltage to the grafted carbon fibres caused phase transitions of the liquid crystals. By varying spacer length of the grafted liquid crystal polymers the physicomechanical properties, e.g. wetting and electrokinetic behaviour (zeta potential) were significantly influenced. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.731807

Item 378

Polymer Preprints. Volume 40. Number 1. March 1999. Conference proceedings.

Boston, Ma., March 1999, p.160-1. 012

A TRIFUNCTIONALISED HIGH MU BETA CHROMOPHORE AND ITS 3D POLYURETHANE NETWORK WITH ENHANCED NLO ALIGNMENT STABILITY FOR ELECTRO-OPTIC DEVICE APPLICATIONS

Ren A S,Chen M; Lee M S; He M; Dalton L R; Zhang H; Sun G; Garner S M; Steier W H Southern California,University; Washington,University (ACS,Div.of Polymer Chemistry)

Organic second-order nonlinear optical (NLO) materials have been an important area of research for the past two

decades. Numerous studies of molecular hyperpolarisability and macroscopic nonlinearity (r33) have focused on the structural properties of the chromophores and their underlying interactions. Over the years, much progress has been made in achieving large bulk nonlinearity for poled polymeric materials. Polymeric materials demonstrating comparable nonlinearity to the conventional inorganic crystals, LiNbO3, have emerged recently. These materials show promise for a number of photonic devices vital to the evolution of new technologies, such as ultra-high bandwidth telecommunications and information processing. Much research effort has been directed toward device applicable polymeric electro-optic (EO) materials. The design of a hydroxyl derivatised acceptor and synthesis of the chromophore with three hydroxyl groups at the two ends of the molecule are described. 8 refs. USA

Accession no.730010

Item 379

Polymer Preprints. Volume 40. Number 1. March 1999. Conference proceedings. Boston, Ma., March 1999, p.156-7. 012 A NOVEL TRILINKABLE HIGH MU BETA NLO CHROMOPHORE FOR POLYMERIC ELECTRO-OPTIC MATERIAL WITH ENHANCED THERMAL STABILITY Zhang C; Ren A S; Dalton L R

Southern California, University (ACS, Div. of Polymer Chemistry)

Organic second-order nonlinear optical (NLO) materials have been pursued for over 20 years. Among many of the requirements that device quality electro-optic materials have to simultaneously satisfy, the thermal stability requirement has been paid the most attention. The general way to solve the thermal stability problem is to covalently incorporate functionalised NLO chromophores into polymer systems by two different approaches. A very promising FTC chromophore which was based on a thienostilbene bridge and 2-dicyanomethylene-3-cyano-4,5,5-trimethyl-2,5-dihydrofuran acceptor was previously reported. To further increase the thermal stability of FTC material by adding a third point of attachment, a trihydroxy functionalised donor-bridge was developed. The trilinkable version of FTC derived from the donorbridge and the acceptor has unfortunately very low solubility in solvents like dioxane, chloroform. To address the solubility problem, a dibutyl-substituted version of 3-cyano-5,5-dibutyl-2-dicyanomethylene-4-methyl-2,5dihydrofuran has recently been developed. The chromophore made from the donor-bridge and this new acceptor has shown great solubility in common organic solvents and allows for further improving thermal stability of FrC electro-optical material. The synthetic methodology of the trifunctionalised thienostilbene donorbridges, the synthesis and physical properties of the new

trilinkable chromophore are reported. A polymerisation scheme for incorporation of the new tri-linkable high chromophore is also proposed. 8 refs.

USA

Accession no.730008

Item 380

Polymer Preprints. Volume 40. Number 1. March 1999. Conference proceedings.

Boston, Ma., March 1999, p.51-2. 012

INVESTIGATION ON NEW POLYURETHANES AND INCORPORATION OF A SOLUBLE HIGH MU BETA CHROMOPHORE FOR ELECTRO-OPTIC APPLICATIONS

Zhang C; Wang C; Dalton L R; Sun G; Zhang H; Steier W H Southern California, University (ACS, Div.of Polymer Chemistry)

Organic polymeric second-order nonlinear optic (NLO) materials have been of great interest for many years. Development of device quality material has been extremely challenging as all material requirements are critical and interrelated, and optimising one of the properties often causes the attenuation of others. For example, hydroxy functionality makes it possible to covalently incorporate chromophores into PUs, polyesters and other polymers, but causes reduced solubility due to interchromophore hydrogen bonding. High Tg polymers (typically polyimides) are good for high thermal stability, but their harsh synthesis and processing are lethal to most high mu beta chromophores. Substantial studies on PU systems have been conducted, and it has been demonstrated that they have great potential in NLO application due to ease of synthesis and, most of all, their excellent compatibility with all high mu beta chromophores due to the mild synthesis and processing conditions. A synthetic scheme is developed to derivatise the CLD-2 chromophore with a hexyl group. The derivatised chromophore exhibits much improved solubility and is studied in TDI/TEA PU as well as two new PUs. It is shown that the thermal stability of PU NLO materials can be improved by either increasing crosslink density or by using more rigid crosslinkers. The second approach is superior to the first with higher temporal stability, better poling efficiency, and lower optical loss. 6 refs.

USA

Accession no.729954

Item 381

Polymer Preprints. Volume 40. Number 1. March 1999. Conference proceedings. Boston, Ma., March 1999, p.49-50. 012 THERMALLY STABLE POLYENE-BASED NLO CHROMOPHORE AND ITS POLYMERS WITH VERY HIGH ELECTRO-OPTICAL COEFFICIENTS Zhang C; Ren A S; Wang F; Dalton L R; Lee S-S; Garner S M; Steier W H Southern California,University (ACS,Div.of Polymer Chemistry)

Organic second-order nonlinear optical (NLO) materials have received increasing attention for applications in optical signal processing and telecommunication. To obtain device quality material the NLO chromophores have to possess simultaneously high molecular nonlinearity, good thermal and good chemical, low absorption, weak chromophore-chromophore static interaction, and appropriate functionality to allow for covalent incorporation into polymer systems. In the past two years significant progress has been achieved in understanding the correlation between electrostatic interaction and characteristics of chromophores and in the design and synthesis of chromophores that satisfy those criteria. A methodology to synthesise a ring-locked aminophenylpolyenal donor-bridge allowing essentially all acceptors bearing acidic methyl or methylene groups to be coupled is described. This methodology greatly broadens the scope of polyene-bridged chromophores without sacrificing thermal stability and transparency. New chromophores with aminophenyltetraene as donorbridge and a tricyano derivatised furan as acceptor show exceptionally high nonlinearity and have brought r33 coefficients in both guest-host and covalently-attached crosslinked systems to new levels. 4 refs.

USA

Accession no.729953

Item 382

Chimica e l'industria 80, No.5, June 1998, p.597-605 POLYMER DISPERSED LIQUID CRYSTALS. I. CONCEPT, PREPARATION AND MATERIALS Hakemi H A; Santangelo M Sniaricerche

The operation principles and morphological and electrooptical properties of polymer dispersed liquid crystal film devices are examined. The preparation of these devices by polymerisation-, solvent- and thermallyinduced phase separation techniques is discussed, and types of liquid crystals, thermosetting and thermoplastic polymer matrices, supports and spacers used in this technology are reviewed. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.726251

Item 383 Polymer Bulletin 42, No.2, Feb.1999, p.175-81 SYNTHESIS AND PROPERTIES OF NONLINEAR OPTICAL CHROMOPHORES AND POLYMERS CONTAINING 6-

NITROQUINOLINE AS PI-ELECTRON ACCEPTOR

Yong Ha Hwang; Jong Lae Kim; Soo Young Park; Sung Il Hong Seoul,National University

Two non-linear optical(NLO) methacrylate monomers, 2-methyl-acrylic acid 2-(ethyl-(4-(2-(6-nitro-quinolin-2yl)-vinyl)-phenyl)-amino)-ethyl ester and 2-methylacrylic acid 6-(3-(2-(6-nitro-quinolin-2-yl)-vinyl)carbazol-9-yl)-hexyl ester, were synthesised and copolymerised with methyl methacrylate to give NLO polymers, P1 and P2. These polymers were shown to be soluble in organic solvents and showed Tgs at 145C and 114C, respectively. The number-average molec.wts. were 26,600 for P1 and 9300 for P2. The second harmonic generation coefficients of corona-poled films of P1 and P2 measured with 1.064 micrometres Nd-YAG laser were 32.2 pm/V and 17.6 pm/V, respectively. 9 refs. KOREA

Accession no.725280

Item 384

Journal of Polymer Science : Polymer Chemistry Edition

37, No.5, 1st March 1999, p.603-8 NONLINEAR OPTICAL PROPERTIES OF SOME SIDE CHAIN COPOLYMERS BASED ON BENZOXAZOLE CONTAINING CHROMOPHORES

Centore R; Concilio S; Panunzi B; Sirigu A; Tirelli N Napoli,Universita Federico II; Zurich,Eidgenossische Technische Hochschule

Methyl methacrylate was copolymerised with acrylate monomers that contained cyanophenylbenzoxazole units, nitrophenylbenzoxazole units or isomeric nitrobenzoxazolylphenyl units plus hexamethylene spacers and optionally oxybenzoate or tertiary amine units in the side chains. Maximum mole fraction of chromophore was 0.26, decomposition temperatures were 310-325C and Tg values were 101-103C or 76-92C, depending on the arrangement of the phenylbenzoxazole unit. The phase behaviour of all polymers was investigated by DSC, X-ray diffraction and polarising microscopy. Some were amorphous and some showed smectic A liquid crystalline phase behaviour. Nonlinear optical properties were examined by second harmonic generation measurements on thin films (about 1 micrometre thick) electrically poled by corona discharge. Second order susceptibility coefficients and average relaxation times relative to the time stability of the chromophore poling were measured. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; WESTERN EUROPE Accession no.724100

Item 385

Journal of Polymer Science : Polymer Chemistry Edition

37, No.3, 1st Feb.1999, p.277-82

SYNTHESIS AND PROPERTIES OF POLY(1-NAPHTHYLACETYLENE) AND POLY(9-ANTHRYLACETYLENE)

Nanjo K; Karim S M A; Nomura R; Wada T; Sasabe H; Masuda T

Kyoto, University

Poly(1-naphthylacetylene) (PNA) and poly(1anthrylacetylene) (PAA) were prepared from the corresponding monomers using various transition metal catalysts. Tungsten hexachloride-based catalysts produced good yields of dark purple PNA. However, molybdenum and rhodium catalysts resulted in the formation of insoluble red PNAs. Tungsten hexachloride and molybdenum pentachloride-based catalysts produced insoluble PAAs in moderate to good yields. Copolymerisation of 1naphthylacetylene with 9-anthrylacetylene using a tungsten hexachloride-triphenyl bismuth catalyst yielded a soluble copolymer with the largest third-order non-linear optical susceptibilities of all the substituted polyacetylenes so far synthesised. 15 refs.

JAPAN

Accession no.724040

Item 386

Molecular Crystals & Liquid Crystals Vol.318, 1998, p.39-57 NONLINEAR OPTICAL PROPERTIES OF THE MAIN-CHAIN TYPE LIQUID CRYSTALLINE POLYMERS AND ELECTRIC FIELDS Asada T Kyoto,University

The second harmonic generations of liquid crystalline main-chain polymers were investigated. Data are presented for hydroxynaphthoic acid-hydroxybenzoic acid copolymers in various composition ratios. Nonlinear optical properties are discussed. 15 refs. JAPAN

Accession no.723300

Item 387

Patent Number: US 5845034 A 19981201 RADIATION-CURABLE, OPTICAL GLASS FIBRE COATING COMPOSITION AND OPTICAL GLASS FIBRE DRAWING METHOD Petisce J R DSM NV

The above composition contains at least one radiationcurable oligomer or monomer and at least one chromophoric indicator susceptible to destruction of its chromophoric characteristic upon exposure to radiation and present in an amount, which becomes substantially colourless when exposed to a level of radiation sufficient to cure the composition. The indicator has a colour, which is distinguishable from a base colour of the composition in cured form. A cable and communications system is also disclosed.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.721985

Item 388

ACS Polymeric Materials Science & Engineering, Spring Meeting 1998. Volume 78. Conference proceedings.

Dallas, Tx., Spring 1998, p.44-5. 012 THERMOSETTING POLYURETHANES WITH LARGE AND STABLE MACROSCOPIC NONLINEARITIES FOR ELECTRO-OPTIC APPLICATIONS

Chen J; Zhu J; Todorova G; Dalton L R; Garner S M; Chen A; Lee S-S; Chuyanov V; Steier W H Southern California,University (ACS,Div.of Polymeric Materials Science & Engng.)

Organic second-order nonlinear optical (NLO) materials have been intensely pursued for the past two decades. The superior non-linearity, along with the inherent ultra-fast response and large laser damage threshold, suggests that organic NLO materials are ideal for electro-optic and telecommunication applications. Remarkable progress has been made in the design and synthesis of chromophores with exceptionally high mu beta values. Nevertheless, translation of the microscopic non-linearity to large macroscopic non-linearity (r33) is not an easy task. In addition, for a material to be practically used for electrooptic device applications, several criteria must also be fulfilled: good photo-, electro- and chemical stabilities of chromophores, good processability, high temporal stability of chromophore alignment and low optical loss at the operating wavelength. Unfortunately, a material that meets all of the addressed device-quality criteria has not yet been be realised. The synthesis and incorporation of hydroxylfunctionalised AII-1 (APII-2) into rigid three-dimensional PU thermosetting network are reported. Not only has significantly improved temporal stability of dipole alignment been achieved, but also the bulk non-linearity r33 is further increased. Moreover, the optimum loading density of XL APII-2 polymers is 40 wt.%, significantly higher than any other XL NLO polymers. This observation indicates that the deleterious intermolecular electrostatic interactions are less pronounced in this system. Consequently, light scattering optical loss is also greatly reduced. The large non-linearity along with other properties well qualify this material for device application such as Mach-Zelinder modulator. 9 refs.

USA

Accession no.719154

Item 389

ACS Polymeric Materials Science & Engineering, Spring Meeting 1998. Volume 78. Conference proceedings.

Dallas, Tx., Spring 1998, p.42-3. 012 HIGH ELECTRO-OPTIC COEFFICIENT FROM A POLYMER CONTAINING HIGH MB CHROMOPHORES

Wang F; Ren A S; He M; Harper A W; Dalton L R; Garner S M; Zhang H; Chen A; Steier W H Southern California,University (ACS,Div.of Polymeric Materials Science & Engng.)

In the past few years, tremendous effort has been made towards the optimisation of molecular nonlinearity (mu beta). Mu beta values greater than 10,000 x 10 -48 esu (at 1.9 mu) have been achieved for several molecules. However, high molecular non-linearity is only one of the many criteria for a chromophore to be useful for device applications. Others include thermal stability (~300 deg.C), chemical stability, low intrinsic optical loss caused by chromophore absorption and perhaps most importantly, the ability to sufficiently arrange noncentro-symmetrically in polymer matrices to give high electrooptic properties. Examples can be found give good results in one or two aspects of the above mentioned criteria. There are always trade-offs among the many criteria of a chromophore. For example, molecular nonlinearity has often been sacrificed in order to increase the thermal stability of a chromophore, and absorption maxima of chromophores which give high mu beta values above 6000 x 10 -48 esu often exceed 650 nm which can lead to unacceptably high absorptive optical loss. Also, translation of microscopic nonlinearity mu beta to macroscopic non-linearity (r33) is often difficult, and careful molecular design is needed to defeat the electrostatic interactions between chromophores. Preliminary results on a polymer system incorporating a novel NLO chromophore are reported, which addresses most of the criteria for device applications. Results indicate that the new chromophore has excellent solubility which is essential for materials processibility, high chromophore thermal stability (-300 deg.C), relatively low chromophore absorption maximum which results in a low optical loss when doped in PMMA and one of the highest electro-optic coefficients for a polymeric material to date. These attributes make materials based on this new chromophore attractive for electro-optic device applications. 7 refs.

USA

Accession no.719153

Item 390

Journal of Applied Polymer Science 71, No. 7, 14th Feb. 1999, p.1081-7 PHOTOCROSSLINKED POLYMER AND INTERPENETRATING POLYMER NETWORK FOR NONLINEAR OPTICS Lingzhi Zhang; Zhigang Cai; Qingshui Yu; Zhaoxi Liang Zhongshan,University

Glycidyl methacrylate was free radical polymerised and the polymer was chemically modified by reaction of some of the glycidyl groups with 4-nitro-4'-hydroxyl stilbene to give a photocrosslinkable nonlinear optical copolymer. Ring-opening polymerisation of an epoxy resin was initiated by 4-nitroaniline to give an epoxy polymer carrying 4-nitroaniline moieties. Acryloyl groups were introduced by reaction of the hydroxy groups of the epoxy polymer with acryloyl chloride to give another photocrosslinkable polymer. By using the sulphonium salt cationic photoinitiator bis(4-phenylsulphonium) phenylsulphide bishexafluorophosphate, which can induce cationic or/and radical polymerisation, it was possible to crosslink the glycidyl methacrylate copolymer and interpenetrating polymer networks of the two polymers. The poled and photocrosslinked polymer films and interpenetrating polymer network films exhibited relatively stable second order nonlinear optical activity. The influence of stilbene isomerisation in glycidyl methacrylate copolymer films with different crosslink densities on the second harmonic generation stability was also investigated. Owing to the physical entanglements between the networks, the IPN samples had an enhanced temporal nonlinear optical stability compared with photocrosslinked glycidyl methacrylate copolymer networks. Crosslink density of cured films had a great effect on the isomerisation of stilbenes and, hence, the second harmonic generation stability. 21 refs. CHINA

Accession no.718457

Item 391

Macromolecules 31, No.26, 29th Dec.1998, p.9174-80 POLYDIACETYLENES FROM ASYMMETRICALLY SUBSTITUTED DIACETYLENES CONTAINING HETEROARYL SIDE GROUPS FOR THIRD-ORDER NONLINEAR OPTICAL PROPERTIES Sarkar A; Okada S; Nakanishi H; Matsuda H Tohoku,University; Japan,National Institute of

Materials & Chemical Research

Synthesis of a series of asymmetrically substituted diacetylenes containing a thienyl moiety or a quinoyl moiety as one of the side groups directly bound to diacetylene and a urethane group as the other one was carried out. Various spectroscopic techniques, such as FTIR, solid state carbon-13 NMR and visible absorption spectroscopies, and powder X-ray diffraction were used to elucidate the structures of the polydiacetylenes. 30 refs. JAPAN

Accession no.716017

Item 392 Polymer 40, No.8, April 1999, p.1917-22 **BIREFRINGENCE IN STRONG FLOWS OF POLYMER SOLUTIONS** Wiest J M

Alabama, University

The constitutive relation for the refractive index of dilute solutions of flexible polymer molecules is obtained, and calculations of the intrinsic birefringence exhibited in uniaxial elongational flow were presented. The polymer molecules were modelled as chains of beads connected by finitely extensible non-linear elastic springs under the Peterlin approximation. 43 refs.

USA

Accession no.715916

Item 393 Polymer 40, No.7, 1999, p.1709-17 TIME-RESOLVED STUDY OF ELECTRO-OPTIC PROPERTY IN ITACONATE COPOLYMER BEARING AN AMINONITROSTILBENE CHROMOPHORE Dong Hoon Choi

Kyung Hee, University

A second-order non-linear optical itaconate/methyl methacrylate copolymer was synthesised in which an aminonitrostilbene chromophore was bound to the itaconate polymer backbone. The effects of temperature and time on the electrooptical effect were studied. A time resolved investigation of the electrooptical properties of the copolymer was carried out using a pulse poling technique and the molecular origins of the electrooptical effect were discussed. 15 refs.

SOUTH KOREA Accession no.714049

Item 394

Polymer Science Series A 40, No.10, Oct.1998, p.970-4 **ELECTROOPTICAL PROPERTIES OF A DISUBSTITUTED AROMATIC POLYESTER IN MIXED SOLVENTS**

Tsetkov N V; Ksenofontov I V; Didenko S A; Belyaeva E V; Tsvetkov V N

St.Petersburg,State University; Russian Academy of Sciences

Details are given of the electrooptical properties of a disubstituted aromatic polyester in polar solvents. The formation of an effective electrooptical dipole of a polymer chain due to the orientational correlation between the polar groups of a macromolecule and the dipoles of solvent molecules is discussed. 8 refs.

Accession no.711467

Item 395

RUSSIA

Journal of Materials Science Letters 17, No.17, 1st Sept.1998, p.1449-51 POLYDIACETYLENES HAVING QUINOLYL

SIDE GROUPS FOR THIRD-ORDER NONLINEAR OPTICAL MATERIALS

Sarkar A; Okada S; Nakanishi H; Matsuda H Tohoku,University; Japan,National Institute for Materials & Chemical Research

A series of quinoline-containing novel diacetylenes is reported that topochemically polymerise to give polydiacetylenes. Solid state polymerisation of the monomers was carried out using UV or gamma-radiation. 14 refs.

JAPAN

Accession no.709307

Item 396

Macromolecular Chemistry & Physics 199, No.11, Nov.1998, p.2433-7 NEW SECOND-ORDER NONLINEAR OPTICAL (NLO) EPOXY POLYMER TREATED BY SOL-GEL PROCESSING

Chong-Bok Yoon; Hong-Ku Shim Korea,Advanced Institute of Science & Technology

A nitrostilbene compound, 4-(2-(4-nitrophenyl) vinyl)phenylamine, was reacted with the diglycidyl ether of bisphenol A to give a linear prepolymer with nonlinear optical chromophore side chain. The remaining hydroxyl groups of the epoxy prepolymer were further functionalised by reaction with 3-(triethoxysilyl)propyl isocyanate to produce a material capable of crosslinking through a solgel reaction. Crosslinking at 220C was preceeded by corona poling at 100C and accompanied by electric field poling. Second harmonic generation tests on the crosslinked polymer showed high nonlinearity (d33 value 41 pm/V). At room temperature, the poled polymer exhibited no significant decay in nonlinear optical coefficient after several days. Polymer film maintained its nonlinear optical activity over 90% at 100C for 1000 seconds, and slowly decayed to 40% of the original values at 150C. 19 refs. KOREA

Accession no.708638

Item 397

Macromolecules 31, No.22, 3rd Nov.1998, p.7764-9 NONLINEAR OPTICAL POLYMERS. III. NLO POLYIMIDE WITH DIPOLE MOMENTS ALIGNED TRANSVERSE TO THE IMIDE LINKAGE

Tsutsumi N; Morishima M; Sakai W Kyoto,Institute of Technology

A new class of nonlinear optical polyimides is presented for second harmonic generation. The orientational stability of aligned nonlinear optical chromophores which generate the second harmonic light is discussed in relation to the rigid structure of the polyimide backbone. 17 refs. JAPAN

Accession no.707919

Item 398

Journal of Polymer Science : Polymer Chemistry Edition

36, No.16, 30th Nov.1998, p.2881-7 CROSSLINKABLE FLUORINATED POLY(ARYLENE ETHERS) BEARING PHENYL ETHYNYL MOIETY FOR LOW-LOSS POLYMER OPTICAL WAVEGUIDE DEVICES

Hyung-Jong Lee; Eun-Mi Lee; Myung-Hyun Lee; Min-Cheol Oh; Joo-Heon Ahn; Seon Gyu Han; Hae Geun Kim South Korea,Electronics & Telecommunications Res.Inst.

Crosslinkable fluorinated poly(arylene ether)s with high transparency and high thermal stability were investigated for low-loss optical waveguide materials. The polymers bearing phenyl ethynyl moiety at the polymer chain end were synthesised by the reaction of 4,4'-(hexafluoroisopropylidene)diphenol with an excess decafluorobiphenyl, followed by the reaction of 4-phenyl ethynyl phenol. Chemical resistance, thermal stability and sharp-cleaving property were improved. 20 refs. SOUTH KOREA

Accession no.705652

Item 399

Journal of Materials Chemistry 8, No.11, Nov.1998, p.2353-5 POLY(5-TERT-BUTYL)BENZOTHIOPHENE: A SOLUBLE FORM OF POLYISOTHIANAPHTHENE WITH A LARGE NONLINEAR OPTICAL RESPONSE Drury A; Burbridge S; Davey A P; Blau W J Dublin,Trinity College

A soluble form of polybenzothiophene, poly(5-tertbutyl)benzothiophene, was produced and chemically characterised. NMR spectroscopy indicated that there was a large quinoidal character contribution to the ground state of the polymer. The third-order non-linear optical properties of the polymer were investigated and it was found that the response was relatively large in the near-IR region. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; IRELAND; WESTERN EUROPE Accession no.704926

Accession no. 7049.

Item 400

Advanced Materials for Optics & Electronics 8, No.5, Sept.-Oct.1998, p.247-62 MOLECULAR DESIGN AND PROPERTIES OF SIDE CHAIN LIQUID CRYSTALLINE POLYMERS FOR APPLICATIONS IN OPTOELECTRONICS Kajzar F; Noel C CEA; LETI; ESPCI

Several side chain liquid crystalline polymers were synthesised for quadratic non-linear optical applications. The active chromophore was a charge transfer biphenyl derivative which possessed mesogenic properties. The liquid crystalline behaviour of these polymers was established by DSC, optical microscopy and X-ray diffraction. The active chromophores were oriented by the standard corona poling technique and the degree of axial ordering was determined as a function of poling conditions by linear optical absorption. Growth of the second-harmonic generation(SHG) signal was used to probe the induction of polar order. These experiments clearly indicated that liquid crystallinity resulted in an enhancement of the polar order over that of isotropic materials. The second-order NLO susceptibility tensor components d31 and d33 were measured by the SHG technique. The d33/d31 ratio was found to be much larger than 3, in agreement with molecular statistical models. Values of d33 up to 30-35 pm/V were obtained at 1064 nm basic wavelength. These values were essentially not resonance-enhanced, as the chromophore absorption occurred below 350 nm. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.704911

Item 401

Polymer Bulletin 41, No.4, Oct.1998, p.455-61 CHARACTERISATION OF CHLORO-FLUORINATED POLYARYLENE ETHERS FOR OPTICAL WAVEGUIDE APPLICATION Han K; Suh D H; Rhee T H Samsung Electronics; Hanyang,University

Details are given of the synthesis of optical polymers from hexafluoroisopropylidinediphenol and decafluorobiphenyl. Optical properties such as refractive index and absorption behaviour in the near IR region of the polymers were characterised. Embedded optical waveguides were fabricated by using fluorinated and chloro-fluorinated polyarylene ethers. 10 refs.

KOREA Accession no.702929

Item 402

Synthetic Metals 95, No.2, 15th June 1998, p.101-5 LINEAR AND NONLINEAR OPTICAL SPECTRA OF POLYAZOMETHINES FABRICATED BY CHEMICAL VAPOR DEPOSITION

McElvain J; Tatsuura S; Wudl F; Heeger A J California,University at Santa Barbara; Fujitsu Laboratories

Third-harmonic generation(THG) measurements were conducted on vapour-deposited thin films of two polyazomethines, poly(nitrilo-1,4-phenylenenitrilomethylidyne-1,4-phenylenemethylidyne) (PNPP) and poly(nitrilo-2,5-azinylnitrilomethylidyne-1,4phenylenemethylidyne) covering pump energies from 0.6 to 1.4 eV. The THG data showed the presence of a strong three-photon resonance centred near 0.9 eV for both samples, an additional weaker structure being observed for the PNPP near 1.2 eV. The peak values of the thirdorder susceptibility were determined and off-resonance values were found to be nearly an order of magnitude smaller. The THG spectrum was also obtained for an oriented PNPP film grown on an obliquely evaporated silica pattern. An enhancement by nearly a factor of three in the peak non-linear optical susceptibility was observed relative to that of the unoriented PNPP film, demonstrating that a moderate degree of molecular orientation was achieved. 14 refs.

JAPAN; USA

Accession no.702811

Item 403

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.238-46. 6E

HIGH PERFORMANCE HALOGEN-FREE FLAME RETARDANT INSULATION TO MEET STRINGENT EUROPEAN TELECOMMUNICATION SPECIFICATIONS

Lien K Enviro Care Compounds AS

(Institute of Materials)

With the rapid advances in IT/communication technology, indoor telecommunication cables have the potential for flame, smoke and toxic, irritant and corrosive gases to be spread throughout buildings. In the past five years there has been an increasing usage of halogen-free flame retardant compounds in telecommunication cables. Emphasis is placed on the development of the insulation compound 1092 for indoor telecommunication copper cables. A review of European telecommunication specifications for FR insulation is presented. Due to more stringent flame spread tests specified for telecommunication cables, there is a need for insulation compounds with better FR performance, and maintaining good high-speed extrusion performance. Crush resistance, strip force, electrical and mechanical properties, ease of colouring, long-term ageing and field experience are also reported. The findings from flame retardant properties on ready-made compound and from full scale tests are discussed.

NORWAY; SCANDINAVIA; WESTERN EUROPE Accession no.701821

Item 404

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.207-12. 6E FIPEC PROJECT (FIRE PERFORMANCE OF ELECTRICAL CABLES)

Van Hees P; Breulet H; Vercelotti U; Grayson S

Sweden,National Testing & Research Institute; ISSEP; Centrol Eletrotecnico Sperimentale Italiano; Interscience Communications Ltd. (Institute of Materials)

An overview of the FIPEC project (Fire Performance of Electrical Cables) is presented. The project is sponsored by the European Commission DG XII and by national sponsorship. The objectives of this project are given together with a summary of the technical content of the work programme. The FIPEC project studies both small, full and real scale tests on cables and establishes models for the predictions of flame spread of cables. Finally, the envisaged time plan of the project is given.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SCANDINAVIA; SWEDEN; UK; WESTERN EUROPE Accession no.701818

Item 405

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.185-94. 6E DEVELOPMENT OF A COST-EFFECTIVE INTERNAL TELEPHONE CABLE HAVING GOOD FIRE RETARDANCY AND THE LOWEST POSSIBLE HALOGEN CONTENT

McKienan N; Mikkola E; Robinson J E; Rutherford P Wessel Cable; VTT; Borealis; Telecom Eireann (Institute of Materials)

In 1996, Telecom Eireann awarded a contract for the supply of telephone cables for an industrial building. The premises were to be serviced via underground CPUT and CPT PE cable with an internal run limited to less than 5 m. As part of the planning process, a qualitative design review was completed. Preliminary data regarding the placement of the cables and potential fire sources indicated that fire hazard was a risk that needed to be mitigated. The system supplier issued a specification for an indoor telephone cable constructed to a standard which would ensure limited hazard in case of fire. Throughout the years, internal telephone cables used conventional PVC as both insulation and jacket. Such cables are known in case of fire for their rapid generation of large amounts of smoke, emission of dangerous acidic fumes and active propagation of the fire. The initial concept was a PVC construction defined as having a PVC compound for cable insulation and another for sheathing, subject to BS6746. The cable was to be tested initially for resistance to flame propagation and flammability, determination of toxicity combustion fumes and smoke, and degree of smoke density. Due to the poor performance of the conventional cable against these criteria a new cable concept was defined. It was initially decided to combine conventional PVC insulation with a hydrate filled low smoke zero halogen (LSZH) jacket. The concept was redefined to a full zero halogen cable design. 9 refs. BELGIUM: EUROPEAN COMMUNITY: EUROPEAN UNION: FINLAND; IRELAND; SCANDINAVIA; WESTERN EUROPE Accession no.701816

Item 406

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.165-74. 6E **FIRE CHARACTERISTICS OF PLASTICS IN TELECOMMUNICATION** Kokkala M VTT Building Technology (Institute of Materials)

Traditionally, fire safety has been achieved and controlled by setting detailed requirements for components in a system. Today, the key term is 'performance-based', i.e. aiming at setting requirements guaranteeing sufficient performance of the whole system allowing flexibility in the use of the components. A brief review is presented of key parameters characterising the fire behaviour of materials and products made thereof. The problems of setting performance-based requirements appropriate to telecommunications applications of plastics is also discussed. 17 refs.

FINLAND; SCANDINAVIA; WESTERN EUROPE Accession no.701814

Item 407

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.117-26. 6E **ENVIRONMENTAL REVIEW** Haigh S J British Telecommunications plc (Institute of Materials)

Sustainable development is accepted as the most important strategy for the future of our world. Businesses have a number of possible options available to them, but more are turning towards sustainability as the key to their future. Telecommunications can not only benefit from that approach but are also able to assist in its achievement. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.701809

Item 408

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.97-106. 6E OPTICAL FIBRE SYSTEMS ON OVERHEAD PHASE CONDUCTORS

Lewis R; Whittingham D; Shaw M; Sibbald I BICC Communications Technology Centre; BICC Communications plc; Rolls-Royce plc (Institute of Materials)

Deregulation of telecommunications has led to a dramatic increase in the need for high speed optical fibre systems as new operators build new networks to compete for market share. Privatisation of the electricity supply industry has enabled the overhead electricity distribution network to be utilised for such systems, as it offers established wayleaves and an opportunity for rapid optical cable deployment. Earthwires have been used in some regions for many years to carry optical fibre cables but the explosion in demand and lack of earthwires in many systems has led to a requirement for installing optical fibre systems on phase conductors. The product and material development and type approval of BICC Communications' latest optical products for use on phase conductors in overhead power lines are described. 11 refs. EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.701807

Item 409

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.87-96. 6E SIMULATIONS OF SURFACE DISCHARGE DAMAGE ON SELF-SUPPORTING FIBRE OPTIC CABLES

Vaughan A S; Robbie D A; Hosier I L; Sutton S J Reading, University; National Grid Co.plc (Institute of Materials)

Addition of all-dielectric self-supporting (ADSS) fibre optic cables to a power transmission network is an attractive means of expanding telecommunication capabilities. However, early attempts to apply this concept to power systems in Europe were not always successful. Cable designs use polymeric sheathing which often fail after less than a year in service, due to discharge activity. The proximity of the optical cable to the electrical conductors means that a potential gradient exists along its length and, under appropriate conditions, small surface currents flow to earth. These potentials and currents, which result from capacitive coupling between the optical cable and the power lines, are analysed and it is shown that dry banding may occur. It is this that gives rise to the observed degradation. Whilst arcs can affect materials both by chemical and thermal means, in polymers, thermal effects are likely to dominate. The arc is chosen as an energy source, which could be replaced for the purpose of simulation by a carbon dioxide infrared laser. It is shown how localised degradation processes can be investigated by using the laser to deposit known amounts of energy at a given rate into a material. Such experiments can form the basis of a screening procedure in which different materials are ranked in terms of their relative ability to withstand a localised, energetic event. This process can be modelled computationally using finite difference beat flow techniques, both in one and three dimensions with cylindrical symmetry. Although a range of different systems is considered, emphasis is placed on PE. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE Accession no.701806 Item 410

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.81-6. 6E **TEMPERATURE AND AGEING RELATED ATTENUATION IN FIBRE OPTIC CABLES, AND POSSIBLE IMPACT ON DENSE DWDM** Kiss G Bellcore (Institute of Materials)

Temperature related ageing and thermal expansion/ contraction effects are found to produce localised high attenuation in optical fibre cables at termination points. Losses are higher at 1550 nm than 1310nm, indicating that they are caused by bending. Damaged cable is found to exhibit high loss at low temperature only, leading to erratic and difficult-to-diagnose service outages. Installations particularly at risk are Dense Wavelength Division Multiplexed (DWDM) systems replacing 1310 nm systems on existing fibre plant. Not all cables are equally at risk. Numerous options exist for prevention and remediation. 3 refs.

Accession no.701805

Item 411

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.75-80. 6E **PASSIVE COMPONENTS IN POF DATA COMMUNICATIONS** Fuster Martinez G; Kalymnios D North London,University (Institute of Materials)

Moulded components are developed for constructing a simple 1 x 2 coupler/splitter for use with 1 mm POF. It is based on the principle of overlapping the ends of three fibres, and the assembly is simple enough for end user implementation. Using high NA (0.5) fibres, an excess loss of around 3 dB is obtained with hand polishing, reducing to around 2 dB with hot plate finish. The development of a small size moulded mode scrambler, which utilises corrugations for achieving mode equilibrium with short lengths of high NA POF, is also reported. 14 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.701804

Item 412

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.65-74. 6E PLASTIC OPTICAL FIBRES: PROPERTIES AND AGEING BEHAVIOUR

Apone S; Bracco M; Chiantore O; Montangero P

CSELT; Torino,Universita (Institute of Materials)

Plastic optical fibres (POF) are of ever-increasing interest in the telecommunication field for possible in-building and domestic application, although their attenuation is quite high (100-200 dB/km). Generally the short distance communications (200 m) such as local area network (LAN) and network termination area of 'fibre to the home' (FTTH) are characterised by a large number of optical connections and junctions which are always troublesome in practical operations. POF could simplify the connecting process between fibres and devices, since they carry the benefits of large core size (typically 1 mm) and high numerical aperture. Another advantage of the POF approach is the low cost due to availability of cheap devices like plastic-packaged 650 nm LEDs and silicon photodiodes for transmitter and receiver, respectively. The optical, thermal and mechanical properties of a commercial step-index POF are studied, together with how these properties change under accelerated ageing conditions. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.701803

Item 413

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.55-64. 6E ELECTRO-OPTIC POLYMER MODULATOR FOR HIGH-SPEED OPTICAL COMMUNICATIONS

Shi Y; Wang W; Bechtel J H TACAN Corp. (Institute of Materials)

Electro-optic (EO) modulation and switching have traditionally been performed by inorganic materials such as LiNbO3 and GaAs. However, new EO polymers have made the plastics attractive for lightwave modulation and switching due to several distinctive characteristics: high EO coefficients, ultra-fast nonlinear optical responses, low dielectric constants, compatibility with semiconductor substrates/circuits, flexibility in thin film/waveguard processing and ability to control chromophore alignment directions in a single thin film. These properties promise EO devices with low driving voltage, broad bandwidth, on-wafer integration of semiconductor driving circuits/ receivers, low-cost fabrication and diversified device applications. In addition, EO coefficients over 55 pm/V almost twice as large as that of LiNbO3 have been achieved in polymers containing highly nonlinear chromophores. TACAN has conducted extensive research on EO polymer modulators and their applications in externally modulated optic fibre transmitters. Through the discussion of EO polymer modulator design, fabrications, testing and some preliminary applications, an attempt is made to provide a brief review of the current status of TACAN's EO polymer modulator development and its perception of the viability of these modulators in telecommunications. 23 refs.

USA

Accession no.701802

Item 414

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.46-54. 6E FLUORINATED POLYIMIDE OPTICAL COMMUNICATION COMPONENTS Sasaki S; Matsuura T; Sawada T; Kobayashi J NTT Opto-Electronics Laboratories (Institute of Materials)

Several optical communication components are developed using fluorinated polyimides with high thermal stability, high optical transparency in the visible and the nearinfrared light region and controllable refractive indices. Optical interference filters are fabricated which are widely used in optical fibre communication systems using a fluorinated polyimide with the same thermal expansion coefficient as the dielectric multilayers. Thin optical waveplates are fabricated to eliminate the polarisation dependence of optical waveguides using rod-like fluorinated polyimide. Single-mode optical waveguides with low optical loss and high thermal and moisture stability are also fabricated using two kinds of fluorinated polyimides. Fluorinated polyimide waveguides are used to fabricate thermo-optic switches. 13 refs. JAPAN

Accession no.701801

Item 415

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.36-45. 6E **ADVANCED POLYMER WAVEGUIDE TECHNOLOGY FOR PASSIVE TELECOMMUNICATION COMPONENTS** Eldada L; Poga C; Glass C; Blomquist R;

Norweeod R A AlliedSignal Inc. (Institute of Materials)

An advanced polymeric waveguide technology is developed for affordable passive integrated optical elements that address the needs of the telecommunications industry. High-performance organic polymers are engineered that can be readily made into single-mode optical waveguide structures of controlled modal profiles. These materials are formed from highly crosslinked acrylate monomers with specific linkages that determine properties such as flexibility, toughness, loss and environmental stability. These monomers are intermiscible, providing for precise adjustment of the refractive index from 1.3 to 1.6. In polymer form, they exhibit state-of-the-art loss values, high thermal stability, high humidity resistance, little refractive index variation with humidity, low refractive index dispersion, low polarisation dependent loss and low birefringence. Waveguides are formed photolithographically, with the liquid monomer mixture polymerising upon illumination in the UV via either mask exposure or laser direct writing. A wide range of rigid and flexible substrates can be used, including glass, quartz, silicon, glass-filled epoxy and flexible plastic films. The devices described include a variety of passive routing, coupling and filtering elements, mostly geared toward wavelength division multiplexing applications. 14 refs.

USA

Accession no.701800

Item 416

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.28-35. 6E TECHNOLOGY OF HOT EMBOSSED THERMO-OPTIC SWITCHES IN PLASTICS WITH PASSIVE FIBRE COUPLING

Pompe G; Johnck M; Kalveram S; Lehmacher S; Rudolph S; Neyer A Dortmund,University (Institute of Materials)

A technology for producing digital thermo-optic switches in polymers with SIGA-technology is presented. A material system suitable for replication technology and waveguide fabrication is found. The waveguides have a temperature stability of 130 deg.C and an insertion loss of 0.6 dB/cm at 1300 nm and 1.2 dB/cm at 1550 nm. A heat sink is incorporated during the hot embossing step. Self-aligning, high resolution evaporation masks are developed. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.701799

Item 417

Plastics in Telecommunications VIII. Conference proceedings.

London, 14th-16th Sept.1998, p.18-27. 6E **POLYMERIC THERMO-OPTIC WAVEGUIDE SWITCHES FOR OPTICAL COMMUNICATIONS** Diemeer M B J; De Dobbelaere P M C; Flipse M C Akzo Nobel Central Research; Akzo Nobel Electronic Products Inc.; Akzo Nobel Photonics (Institute of Materials)

Optical space switches based on the thermo-optic (t.o.) effect in polymeric optical waveguides have now reached the commercial stage. The application of these switches in optical communications is in network protection and network reconfiguration systems, The requirements for these applications include polarisation and wavelength

independence, low insertion loss, low cross talk, low drive power with step-like (digital) response, millisecond switching times and small size. In addition, the reliability of the component must meet the demanding requirements of telecommunications applications. It is shown that polymeric t.o. space switches can meet all functional requirements due to the exceptional thermal and t.o. effects of polymers combined with their tunability and processing versatility. Polymer specific failure mechanisms are reviewed. Reliability verification tests demonstrate that polymers can be designed such that they can be used with confidence in waveguide switches for optical communication systems. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; USA; WESTERN EUROPE Accession no.701798

Item 418

Plastics in Telecommunications VIII. Conference proceedings. London, 14th-16th Sept.1998, p.1-10. 6E **CURRENT STATUS OF PLASTICS IN PHOTONICS** Cross G H Durham,University

(Institute of Materials)

The telecommunications industry continually seeks to more fully utilise the potential bandwidth available from optical fibre transmission. Increasing the data transmission rates using time domain multiplexing and wavelength division multiplexing requires devices that perform switching, routing and filtering and there is a choice of materials from which to fabricate these devices. If these functions are to be performed by devices fabricated from polymers, then there must be a clearly identified advantage over other materials systems. Suggestions are given as to the potential advantages of polymers over other materials in certain applications areas and an account is given of the limitations that must be addressed for successful implementation. The discussion is set against the backdrop of current research and development in the area. 42 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.701796

Item 419

Journal of Applied Polymer Science 70, No.6, 7th Nov.1998, p.1165-72 PI-CONJUGATED SOLUBLE NICKEL-POLYYNE COPOLYMER: SYNTHESIS AND THIRD-ORDER OPTICAL NON-LINEARITY Mujie Yang; Lingjun Zhang; Ziqiang Lei; Peixian Ye;

Jinhai Si; Qiguang Yang; Yougui Wang Zhejiang,University; Chinese Academy of Sciences; Beijing,Academia Sinica Nickel-polyyne copolymers with triphenylphosphine and tributylphosphine ligands, and modified pi-conjugated nickel-containing copolymers were synthesised and characterised using infrared spectroscopy. The nickelpolyyne copolymers were soluble in tetrahydrofuran, chloroform, and toluene. Their third-order non-linear optical properties were investigated using a degenerate four-wave mixing technique. The influence of the ligands attached to the nickel atoms, the structure, and the length of pi-conjugation between the two metal centres in the main chain on the hyperpolarisability of the nickelpolyyne polymers are discussed. 21 refs. CHINA

Accession no.700197

Item 420

Patent Number: US 5762847 A 19980609 METHOD FOR THE REUTILIZATION OF AN OPTICAL CABLE

Kamps R; Pfandl W; Zapf F; Schneider R Siemens AG

Disclosed is an optical cable having at least one light waveguide with a coating and other component parts in the form of protective sheaths of plastic material as well as potentially tensile elements and filling compounds. The cable can be recycled into pellets having inorganic fillers and glass acting as reinforcing elements since the other component parts contain only polyolefins and small amounts of glass or inorganic fillers.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.697604

Item 421

Macromolecules

31, No. 16, 11th Aug. 1998, p.5206-14 SYNTHESIS AND CHARACTERISATION OF HINDERED POLYPHOSPHAZENES VIA FUNCTIONALISED INTERMEDIATES. EXPLORATORY MODELS FOR ELECTRO-OPTICAL MATERIALS

Allcock H R; Ravikiran R; Olshavsky M A Pennsylvania,State University

Several cosubstituent polyphosphazenes were synthesised. The nonlinear optical chromophore disperse Red 1 (DR-1) was linked covalently to the polymer backbone through spacer groups. These polymers had high chromophore loading (one DR-1 per repeat unit), had Tg values near 100C and were high refractive index materials (about 1.71 by ellipsometry). The syntheses were achieved via unconventional reactions that involved functionalised poly(organophosphazenes). Disperse Red 1 was linked to the polymers by two different methods (via a propyl 4-hydroxybenzoate unit or a t-butyldimethylsilyl-protected aryloxysiloxane unit) that generated either an ester- or an ether-linked system. Data from proton, carbon-13 and phosphorus-31 NMRs, GPC, DSC, UV-visible spectroscopy and optical birefringence are presented. 55 refs.

Accession no.696647

Item 422

Polymer 39, No.20, 1998, p.4977-81

SYNTHESIS AND CHARACTERISATION OF 1,3-BIS(DICYANOMETHYLIDENE)INDANE (BDMI)-BASED NONLINEAR OPTICAL POLYMERS

Sam-Shajing Sun; Cheng Zhang; Zhixin Yang; Dalton L R; Garner S M; Antao Chen; Steier W H Southern California,University

New polymers containing non-linear optical chromophores of aminophenylenethienylidene (APT) electron donor bridge systems coupled with a strong electron acceptor, 1,3-bis(dicyanomethylidene)indane (BDMI) were synthesised by coupling the aldehydic APT precursor polymers with acceptor BMDI in acetic anhydride. The aldehydic APT precursor polymers were synthesised by condensation or radical polymerisation where the aldehydic group of APT was found intact. The thermal stability of the BDMI-based polymers was up to 500C, depending on the chromophore loading density. The electrooptical coefficient of a polymer with 30% by weight chromophore loading was 10 pm/V. 12 refs.

USA

Accession no.696589

Item 423

European Polymer Journal 34, No.8, Aug.1998, p.1125-32 NOVEL SYNTHESIS OF SIDE-CHAIN ELECTRO-OPTIC POLYIMIDES WITH HIGH AZO CHROMOPHORE DENSITY Hong Mai Yu Quan Shan: Ding Chan; Yang Mai Wa

Hong Ma; Yu-Quan Shen; Ping Chen; Yong-Mei Wang; Ji-Ben Meng Nankai,University

A series of electro-optic polyimides containing azobenzene side-chains were synthesised by utilising diazonium coupling to aniline-containing polyamic acid in non-aqueous solvent. Polymers of high thermal stability, and with a chromophore density, determined using nuclear magnetic resonance spectroscopy, of up to 100 mol% were obtained, resulting in a large electro-optic coefficient. The prepolymer polyamic acids were soluble in many organic solvents and had good film-forming properties. 14 refs.

CHINA

Accession no.694425

Item 424 Patent Number: US 5759453 A 19980602

OPTICAL MODULE AND FABRICATION PROCESS THEREOF

Kato M

Ricoh Co.Ltd.

This module includes an optical connector element formed of first and second substrates for carrying optical fibres therebetween and a device substrate carrying photodiodes on an upper major surface thereof in correspondence to the optical fibres. The optical connector element is mounted on the device substrate such that end surfaces of the first and second substrates face the principal surface of the device substrate and polygonal projections on the principal surface of the device substrate for positioning engage with corresponding spaces formed between the first and second substrates at the foregoing end surfaces. JAPAN

Accession no.694345

Item 425

Patent Number: US 5720908 A 19980224 METHOD OF MANUFACTURING A CYLINDRICAL OPTICAL-FIBRE MODULE Gaillard P Alcatel Cable

The present invention concerns a method of manufacturing an optical fibre module including a plurality of optical fibres assembled and held together by a flexible resin, the method including a resin-application step in which the flexible resin is applied to the entire set of the fibres which are disposed parallel to one another so that their longitudinal axes lie in substantially the same plane. The resin-application step is followed by: partially crosslinking the resin so as to obtain a ribbon; rolling up the ribbon by bringing together its longitudinal edges so as to give it a shape that is substantially cylindrical; and fully crosslinking the resin so as to maintain the cylindrical shape of the rolled up ribbon.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.693324

Item 426

Macromolecules 31, No.15, 28th July 1998, p.4845-51 AZOCARBAZOLE POLYMETHACRYLATES AS SINGLE COMPONENT ELECTROOPTIC MATERIALS

Barrett C; Choudhury B; Natansohn A; Rochon P Queen's University at Kingston; Canada,Royal Military College

Amorphous polymethacrylates containing both nitroazobenzene and carbazole groups, i.e. poly(nitrophenyl-(3-(N-(omega'-(methacryloxy) alkyl))carbazolyl diazene)s, where alkyl represents propyl, butyl, pentyl, hexyl, octyl, nonyl or decyl (and indicates the spacer length) were synthesised. These structures incorporate both electrooptic activity and photoconductivity into a single multifunctional structural unit. The polymers were cast as thin films and were shown to be suitable for photoinducing birefringence reversibly with polarised light, as well as for the inscription of photorefractive diffraction gratings after electric field poling. Since the polymer series encompasses a range of spacer lengths (from 3 to 10 methylene groups) between the multifunctional side chains and the polymer backbone, these materials are suitable for study of the influence of chromophore mobility on these optical phenomena. The extent of orientational order which could be photoinduced in the films decreased with increasing spacer length, as did the photoconductivity and the photorefractive twobeam optical coupling gain. In thin films of polymers with the highest Tg, a birefringence of 0.065 could be demonstrated, with a time constant of less than 0.8 s. A two-beam optical gain of 0.024/micrometre was also demonstrated in films of the polymer with the highest Tg, although this gain was exceeded by absorption losses. 25 refs.

CANADA

Accession no.690716

Item 427

Antec '98. Volume II. Conference proceedings. Atlanta, Ga., 26th-30th April 1998, p.1265-8. 012 CONDUCTIVE POLYMER FILMS FOR IMPROVED POLING IN NON-LINEAR OPTICAL WAVEGUIDES

Drummond J P; Clarson S J; Caracci S J; Zetts J S Cincinnati,University; Wright-Patterson Air Force Base (SPE)

The use of conductive layers to improve poling in nonlinear optical waveguides is investigated. Research is centred on conductive layers formed from the conducting polymer polyethylene dioxythiophene and its blends. Thin films of these materials are produced by spin casting from polymer solution and are then evaluated for their conductive, thermal and optical properties. These films are subsequently used to produce waveguides and electrooptic (EO) test structures. Results indicate that the conductive layers work successfully as buffer layers and yield improved poling and higher EO coefficients. The conductive layers are also found to exhibit qualities necessary for the construction of optical waveguides. 13 refs.

USA

Accession no.688593

Item 428

Macromolecules 31, No.12, 16th June 1998, p.4049-52 VERSATILE SYNTHETIC APPROACH TO NONLINEAR OPTICAL SIDE-CHAIN AROMATIC POLYQUINOLINES WITH LARGE SECOND-ORDER NONLINEARITY AND

THERMAL STABILITY

Hong Ma; Xijun Wang; Xiaoming Wu; Sen Liu; Jen A K Y Northeastern University

A versatile, generally applicable synthetic methodology for non-linear optical(NLO) side-chain aromatic polyquinolines was developed. The resulting polyquinolines possessed good solubility, processability, large electrooptical coefficients and good temporal stability. The obvious advantages of this method included flexibility in selecting NLO chromophores, ease in controlling the chromophore loading level and the ability to adjust the polymer backbone structures in order to finetune their physical properties for device applications. The obtained NLO side-chain aromatic polyquinolines could be efficiently poled by taking advantage of a pendent phenyl spacer. 26 refs.

USA

Accession no.686370

Item 429

Polymer Plastics Technology and Engineering 37, No.2, 1998, p.261-9 **SYNTHESIS AND OPTICAL PROPERTIES OF NONLINEAR OPTICAL POLYARYLATES**

Noniewicz K; Brzozowski Z K; Hajto J Warsaw,University of Technology; Edinburgh,Napier University

Several polyarylates based on bisbenzylidenoketones were synthesised by interfacial polycondensation. The dispersion of the linear refractive index was measured over the wavelength range from 800 to 2000 nm. The Boling formula was used to calculate the nonlinear optical susceptibility. 11 refs.

EASTERN EUROPE; EUROPEAN COMMUNITY; EUROPEAN UNION; POLAND; UK; WESTERN EUROPE

Accession no.684927

Item 430 Polymer 39, No.17, 1998, p.4147-9 NOVEL SECOND-ORDER NON-LINEAR OPTICAL POLYMERIC COMPOSITES Figure Lip Fong Wang: Yinggru Han

Jianke Li; Feng Wang; Xiaozu Han Changchun,Institute of Applied Chemistry

A non-linear optical chromophore with a five-membered heteroaromatic structure was synthesised. The chromophore was dispersed into two high-Tg polymers, PEK-C and PES-C. The polymers were then spin coated onto indium tin oxide glass and were poled by using a corona poling technique. The relaxation behaviour of poled films was studied by using UV-visible spectroscopy. Good temporal stability was found for all the samples. 7 refs.

CHINA Accession no.683646

Item 431

Macromolecular Chemistry & Physics 199, No.5, May 1998, p.881-8 SYNTHESIS OF NON-LINEAR OPTICAL(NLO) DIACRYLATE MONOMERS AND THEIR PHOTOCOPOLYMERIZATIONS WITH LIQUID CRYSTAL(LC) DIACRYLATE MONOMERS IN MIXED LIQUID CRYSTALLINE STATE

Kato M; Ohara H; Fukuda T; Matsuda H; Nakanishi H Tokyo,Science University; Japan,National Institute of Materials & Chemical Research; Tohoku,University

The photocopolymerisation (photocrosslinking) of mixed liquid crystals consisting of liquid crystalline diacrylate monomers and non-linear optical(NLO) diacrylate monomers exhibiting no liquid crystallinity under contact poling at optimum temp. was investigated with the aim of obtaining thermally stable NLO polymeric materials. The results obtained are discussed with particular reference to the liquid crystallinity of NLO monomers, to blends of NLO monomer and liquid crystalline monomer, and to photocopolymerisation and second harmonic generation measurements. 8 refs.

JAPAN

Accession no.682934

Item 432

Chemistry of Materials 10, No.4, April 1998, p.1010-6 SYNTHESIS AND ELECTROOPTIC PROPERTIES OF A NEW CHROMOPHORE DISPERSED OR GRAFTED IN A CARBAZOLYL METHACRYLATE MATRIX

Maertens C; Detrembleur C; Dubois P; Jerome R; Blanche PA; Lemaire PC Liege,University

A polymer that combined photoconductivity and electrooptical activity was prepared by copolymerisation of 11-(N-hydroxyundecyl)carbazolyl methacrylate and ethyl(E)-2-cyano-3(5-(5-(4-methacryloyloxy)piperidino-2-thienylcarbonyl)-2-thienyl)-2-propenoate as the chromophore. Comparison was made with the chromophore dispersed within the poly(11-(Nhydroxyundecyl)carbazolyl methacrylate) matrix. The electrooptical coefficient was measured by both interferometric and polarimetric techniques, but the interferometric technique was unsuitable because the strong electric field applied to the electrodes changed the film thickness of these low Tg materials. A value of up to 5 pm/V was obtained for the electrooptical coefficient for the dispersed material, which was ten times higher than the corresponding grafted material, and a linear relationship between the poling intensity and the electrooptical coefficient was observed for the two materials. 23 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.680850

Item 433 Polymer 39, No.12, 1998, p.2393-8 NONLINEAR OPTICAL CROSSLINKED POLYMERS AND INTERPENETRATING POLYMER NETWORKS CONTAINING AZO-BENZOTHIAZOLE CHROMOPHORE GROUPS Hong-Quan Xie; Zhi-Hong Liu; Hao Liu; Jun-Shi Guo

Huazhong, University of Science & Technology

A crosslinked PU, a crosslinked epoxy-based polymer and interpenetrating polymer networks composed of the two polymers were synthesised. All contained phenylazobenzothiazole (BT) chromophore groups. The crosslinked polymers and IPNs were characterised by their gel content, IR spectra and DSC. The crosslinked PU and the crosslinked epoxy-based polymer showed glass transition temperatures at 140C and 178C respectively and the IPN showed two glass transitions at 142C and 170C. Thin, transparent poled films of the crosslinked polymers and IPN were prepared by spin coating, followed by thermal curing and corona poling at 160C for 1 h. The poled crosslinked polymers and IPN all showed good stability of non-linear optical (NLO) activity at 120C, with the poled IPN showing better stability of NLO activity than the poled crosslinked polymers. 16 refs. CHINA

Accession no.680061

Item 434

Journal of Materials Chemistry 8, No.4, April 1998, p.913-7 NOVEL NONLINEAR OPTICAL POLYMERS BASED ON POLY(1,4-PHENYLENEVINYLENE) Yoon C-B; Shim H-K

Korea, Advanced Institute of Science & Technology

A poly(1,4-phenylenevinylene)(PPV) derivative containing a non-linear optical (NLO) moiety was synthesised using a methoxy precursor, yielding a rigid structure with good processing characteristics. The PPV derivative, containing a disperse red chromophore, was characterised using spectroscopy and thermal analysis. The object was to prepare high optical quality films for non-linear optical applications. The films showed a high resonant d33 value of 50 pm/V, measured using the second harmonic generation method. The non-linearity was stable at 90C for one month without detectable loss. The film also showed third order NLO properties, and the measured third-order non-linear optical susceptibility was 0.000 000 00025 esu. 28 refs.

KOREA

Accession no.676280

Item 435

Chemistry of Materials 10, No.2, Feb.1998, p.471-3 **HIGH-PERFORMANCE POLYQUINOLINES**

WITH PENDANT HIGH-TEMPERATURE CHROMOPHORES FOR SECOND-ORDER NONLINEAR OPTICS

Jen A K Y; Xiaoming Wu; Hong Ma Northeastern University

A series of high temperature and chemically stable chromophores were covalently attached onto the polyquinoline backbones. These non-linear optical side chain polyquinolines possess high Tg, excellent processability, thermal stability, and electrooptical properties. Poling results are presented. 23 refs. USA

Accession no.671261

Item 436

Journal of Polymer Science : Polymer Chemistry Edition

36, No.2, 30th Jan.1998, p.301-7 SYNTHESIS AND PROPERTIES OF NON-LINEAR OPTICAL SIDE CHAIN SOLUBLE POLYIMIDES FOR PHOTONICS APPLICATIONS

Hyung-Jong Lee; Myung-Hyun Lee; Seon Gyu Han; Hye-Young Kim; Joo-Heon Ahn; Eun-Mi Lee South Korea,Electronics & Telecommunications Res.Inst.

Aromatic polyimides with side chain non-linear optical chromophores were investigated through a facile two-step synthetic route. Various poly(hydroxyimide)s were synthesised by direct thermal imidisation of diaminophenol dihydrochloride salt and aromatic dianhydride monomers. The resulting polyimides bearing phenolic hydroxy groups reacted easily with the terminal hydroxy group on the chromophores via the Mitsunobu condensation to give corresponding polyimides with high optical non-linearities and good solubility in common organic solvents. Detailed physical properties showed that these polyimides have a molecular weight of 31,000 and high Tg above 220 C, ensuring a long-term alignment stability at elevated temperature. Electrooptic coefficients of the electrically poled polymer films were determined. 18 refs.

SOUTH KOREA Accession no.670012

Item 437

Polymer 39, No.2, 1998, p.491-5 SYNTHESIS AND NON-LINEAR OPTICAL PROPERTIES OF AROMATIC ESTER OLIGOMERS AS CHAINED CHROMOPHORES Kimura T; Xuan-Ming Duan; Kato M; Okada S; Yamada S; Matsuda H; Nakanishi H Tokyo,Science University; Tohoku,University; Japan,National Institute of Materials & Chemical Research The synthesis of aromatic ester oligomers, consisting of two to four repeating units of the oxy-1,4phenylenecarbonyl group as novel non-linear optical active chromophores, was described. Some second-order non-linear optical properties were studied for poled polymer films consisting of PMMA doped with 10 or 5 wt% aromatic ester oligomers and 10 wt% p-nitroaniline. Comparison of the second-order non-linear optical coefficient value at the chromophore molar concentration (d subscript 33 (M)) for these polymer films indicated that the d subscript 33 (M) value of the aromatic ester oligomers increased with an increasing number of the oxy-1,4-phenylenecarbonyl group repeating units, and aromatic ester oligomers with more than four repeating units had a higher d subscript 33 (M) value than that of pnitroaniline. All the aromatic ester oligomers had a cutoff wavelength of about 300 nm, which was much shorter than that of p-nitroaniline (about 450 nm). Aromatic ester oligomers were considered to be promising chromophores for second-order non-linear optics. 10 refs.

JAPAN

Accession no.665944

Item 438 Chemistry & Industry No.13, 7th July 1997, p.510-4 **POLYMERIC ELECTRO-OPTIC MODULATORS** Dalton L R Southern California,University,Loker Hydrocarbon Research Institute

This comprehensive article supplies a detailed assessment of the newly developing technology of electro-optics, in which the transmission of light through a material is manipulated using electricity. Information is included on the problems posed in the commercialisation of the technology, its advantages and potential applications. Polymeric electro-optic modulators are being tested as components in a range of devices.

USA

Accession no.647599

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