Symposium 21

Electronics and Optics Related Polymers

S21-545

Fabrication of oriented layers for optoelectronic devices by zone casting

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Adam Tracz , Tomasz Makowski , Sylwia Masirek , Wojciech Pisula , and Yves H. Geerts Achievement of macroscopic scale long-range order (and thus orientation) in organic conductors and semiconductors is of a great importance in their applications in electronics and optoelectronics. Among others, metal-free discotic liquid crystalline phthalocyanines have a great potential as charge and exciton carriers. In this work, we show the fabrication of highly oriented thin layers of metal-free (2 (3), 9 (10), 16 (17), 23 (24)- tetra (2-decyltetra- decyloxy)-phthalocyanine, by applying a special, but facile and effective solution casting technique – zone casting. A solution is continuously supplied onto a substrate withdrawn at a controlled rate, whereby a meniscus is formed between a flat nozzle and the substrate, from which the solvent evaporates from the surface. For the first time, highly oriented and uniform films were obtained on glass support from solution. The films are composed of uniaxially aligned columns with monodomain like order over several square centimeters. Interestingly, in contrast to zone cast layers of an alkylated hexa-peri-hexabenzocoronene derivative (HBC-C12) the columns of phthalocyanine do not run parallel but perpendicular to the casting direction as evidenced by AFM, UV-Vis spectroscopy and X-ray diffraction. The pronounced alignment and high order make these thin solution-processed films promising for application in optoelec

S21-1388

Anti-Reflective Coatings for LCD Screens

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Although metal halide anti-reflective (AR) coatings are widely used by manufacturers of electronics equipment, high application temperatures mean that they can only be applied to glass substrates, meaning that screens made from plastics materials cannot be used. A new, easily applied anti-reflective coating has been designed which can be applied to both plastic and glass substrates. The single layer coating applied to an acrylic substrate has proven to be better performing than current commercial single layer anti-reflective coatings. This performance has been achieved from an amorphous fluoropolymer solution which is dip coated onto the substrate. This was shown to be the preferred application method, as those applied by spin coating produced films with intractable defects. The most important property of an antireflective coating is film thickness, as films are required to have a quarter wavelength optical thickness to give the lowest possible reflection. Ideally a single layer film should have a ¼ wavelength thickness to allow the reflections from the front surface and back surface of the film to destructively interfere. Theoretical film thickness can be calculated to provide an indication of final film thickness, which can be determined by techniques such as ellipsometry, interferometry, atomic force microscopy and spectral reflectance. The goal for a single layer coating is to have a reflection of less than 1%. New application techniques and coating systems are being investigated, including multiple layer AR coatings.

S21-246

Electrically conducting nanoparticles by grafting polypyrrole onto the surface of specially modified silica nanoparticles

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Electrically conducting PPy grafted silica nanoparticles were prepared by in situ grafting of polypyrrole onto the surface of specially modified silica nanoparticles containing C=C bonds. The functionally modified silica nanoparticles were synthesized by a new one-pot base catalyzed reaction of vinyltriethoxysilane (VTEOS) and tetraethoxysilane (TEOS) in ethanol. Core-shell structure was confirmed for the synthesized modified silica nanoparticles by TEM with shell composition being carbon rich and, the core, being Si and oxygen rich. The average diameter of 230 nm was measured for the particles with narrow particle size distribution. Using TGA and FTIR, a high density of the C=C bonds was confirmed for the shell. Investigations carried out on the reaction conditions showed that the core-shell structure can be obtained using 90/10 molar ratio of the reactant silane compounds at 40°C during 30 min of reaction time in ethanol. In situ PPy grafting was performed on pyrrole monomers being soaked by the modified silica nanoparticles in aqueous solution of FeCl3 as the oxidizing agent during 3 h. Studies carried out by TEM showed a smooth and uniform shell of grafted PPy being formed on the surface of the silica core without any free homopolymer of PPy. Analysis of SEM images showed an increase in the average diameter size for the particles, around 8 nm, with a narrow particle size distribution for the particles after grafting. Grafting was confirmed by FTIR and TGA/DSC analysis showed 10 wt % of grafted PPy on the silica surfaces. The PPy grafted silica nanoparticles were then dip-coated on a glass slide and electrical conductivity measurements showed 7 S/cm of conductivity for the particles. On the other hand, static water drop contact angle measurements showed a contact angle of 169° for the PPy grafted silica nanoparticles coated on the surface of the glass slide.

S21-318

CONDUCTIVE PP COMPOSITES WITH CNT-PANI HYBRID

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Nanostructured carbon, such as fullerenes and carbon nanotubes (CNT), offer promising industrial potential. Electric conductivity is one of the key properties causing the strong commercial interest in this material. Extraordinary mechanical properties with excellent stability support this trend. Prices of carbon nanotubes have met a rapid fall accelerating industrial development. In spite of these driving forces the wide realization of commercial thermoplastic compounds has been slow. The use of CNT is not a straightforward process. To reach good dispersion is a crucial problem. An excellent test for this is the percolation threshold. Although theoretical results shows loading much less than one percent to enough to reach the breakthrough we can reach this phenomenon with much higher loadings in thermoplastic systems.Another type of materials, inherently conductive polymers (ICP) has been a subject of scientific and industrial research and development over three decades. In many applications the most promising candidate is polyaniline (PANi).We have developed new technology to produce conductive hybrid materials using CNT and PANi. The hybrid materials were produced by polymerisation of PANi in presence of nanotubes. In this in-situ polymerization the mass ratio between CNT and PANi controlled. A key challenge in the system is to control the morphology of polymer. If the polymer forms separate lumps on nanotubes the intended synergy of the two types of conductive materials disappears. In our system the polymer forms a thin layer on tubes and forms conductive bridge between separate tubes. Hybrid materials were compounded with polypropylene and samples were produced by injection moulding. To improve dispersion various compatibilizators were used. In our system the ester derivates of gallic acids give promising results.

S21-417

Recording of high efficiency holographic gratings in photopolymers initiated by luminescent dyes

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S21-466

Polymer dispersed liquid crystal films based on poly(meth)acrylic copolymers

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Polymer dispersed liquid crystal (PDLC) films are perspective composite materials for application in display technics, glasses with an adjustable transparency, TV systems, an optical fiber and in other electro-optical devices. The principle of PDLC operation is based on their ability to pass light under action of an external electric field and to become opaque in a usual condition. Thus the size of LC droplets plays the fundamental role in regulation of electro-optical properties of PDLC systems. In this work the polymer films were prepared by photopolymerization a mixture of 2-ethyl hexyl acrylate (EHA) -methacrylic acid (MAA) and EHA-acrylic acid (AA) with liquid crystal E-7 purchased from Merck Company. The crosslinkers such as ethylene glycol dimethacrylate, ethylene glycol diacrylate and a chain transfer agent dodecylmerkaptane were used as the molecular weight (MW) regulators. It is established that liquid crystal droplets are formed with the sizes no more than 0.8 microns in a system with AA while the size of droplets exceeds 1 micron at copolymerization of EHA-MAA. The PDLC films on the base of copolymer EHA-AA possess a higher on-state transmissions and a smaller threshold voltage in comparison with EHA-MAA films. Threshold voltage is defined as the electric field required to achieve 90% of transmittance. Influence of monomer mixture composition EHA-AA on the LC droplets size is investigated and shown that equimolar composition is optimal. Introduction of MW regulators in photo curing composition EHA-AA leads to the further reduction of the droplets sizes, narrowing of size distribution, to increase on-state transmissions of PDLC, and also to decrease in a threshold voltage and a rise time. The experimental values of a threshold voltage of the films modified by regulators are 1.6-4.5 V/µm, rise times are 1-3 ms, and a decay time is 0.7 ms.

S21-584

Polymer Processing in OLED Application

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Electronic devices based on organic semiconductors such as organic light emitting diodes (OLEDs) have attracted much interest as possible inexpensive and flexible alternatives to inorganic devices. Moreover, the employment of electroluminescent polymers opens the possibility of fabrication of flexible displays by low cost processing. Despite considerable improvement in device properties, a better understanding of the inorganic/polymer interfaces is crucial to further development of optoelectronic organic devices. This work outlines our findings in understanding and optimizing the injection and transport mechanisms of charge carriers in OLEDs obtained by polymers processing. In order to obtain a better injection from the inorganic anode, we have developed a two step process. We have first performed several treatments on Indium Tin oxide (ITO) layers to increase its surface energy and to obtain a better spreading of the polymeric hole transporting layer. Then we have introduced a polymeric hole injection layer to decrease the hole injection barrier at the anodic interface. The effects of electrical, chemical and morphological properties of ITO layers in regulating the hole injection at the ITO/polymer interface has been studied. For each OLED with treated ITO, the anode potential barrier height decrease is been estimated using the thermoelectrical injection model. In addition, we have reported on the employ of several kinds of polymer composites (PEDOT:PSS) as hole injection layer to increase the stability and the charge injection in OLEDs. The dispersions have been employed to manufacture OLEDs with structure ITO–PEDOT:PSS–PF6–Alq3–Al. Devices electrical and optical properties have been extensively investigated and discussed in function of PEDOT:PSS ratio. We have found that the hole barrier at the ITO–PEDOT:PSS interface plays a key role in electrical transport and in setting the external quantum efficiency.

S21-785

New process for polymers and nanoparticles dry patterning in electronic applications

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Recently the organic electronic on plastic substrate is becoming a big challenge due to the increasing interest in many fields such as cellular phones, personal digital assistants, notebooks, lighting. The employment of semiconductor polymers in several electronic applications opens the possibility of flexible displays by low cost and continuous roll processing. However in several applications a patterning of the employed materials is need and the introduction of traditional wet patterning process could induce defects and definition loss in the deposited layers. In order to perform a dry patterning of organic materials and nanoparticles, we have developed a new photomechanical process [1]: combining a photolithographic step with the deposition of an elastomeric polymer and the subsequent peeling, a dry patterning of organic layers has been obtained. The process is employable to pattern polymeric (spinned) materials as well as low molecular (evaporated) materials as well as ink-jetted materials as well as sprayed materials and so on. Moreover, in order to obtain a uniform distribution of nanoparticles like nanotubes or nanorods or nanocrystals and so on, we have introduced a “sound-casting” step in our process [2]. The new step consists of subjecting the nanoparticles to a continuative ultrasounds during the entire deposition process. The widened process can be employed to perform new innovative devices. For example, a new device could be manufactured by obtaining an uniform distribution and the subsequent patterning of carbon nanotubes onto the cathodes of a Field Emission Display (FED). In this way, an uniform light emission long a large area display could be obtained. This procedure can be also applied to create TFTs which use carbon nanotubes or to create OLEDs with anodes made of carbon nanotubes Some examples to demonstrate the big potentialities of our patented methods will be shown.[1] Italian Patent RM2007A000414[2] Italian Patent RM2007A000557

S21-803

Azo containing polymer as active layer in memory cell prototypes

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We present a novel device in which a thin film of an azobenzene containing polymer is embedded between two Aluminum contacts. This device shows a previously unreported behavior: it is characterized by three different states of conduction, one of which is unrecoverable, and the other two being mutually attainable. We thus predict a twofold application for our device: as Write Once Read Many and as Write Many Read Many memory device.The physics underlying the switching has been analyzed, and we do believe that the commutation can be addressed to an electrically induced trans-to-cis isomerization of the molecules, which varies their spatial arrangement inside the film. This opinion is supported by two considerations: (1) the molecule shows photoisomerization properties, and (2) electrically induced isomerization has already been demonstrated, both theoretically and experimentally. The presence of the unrecoverable state is due to the formation of J-aggregates which inhibits a complete recovery of the initial conformation.The transport has also been analyzed, and we recognize it could be modeled as a Nearest Neighbor Hopping transport, with a hopping range variation associated with the switching. This transport model is therefore coherent with the hypothesis of conductance switching induced by trans-to-cis isomerization: the isomerized molecules change their spatial arrangement reducing the distance between themselves, and consequently the hopping distance.Moreover, a novel structure has been elaborated in which the device is encapsulated, with the aim of characterizing the cycling and retaining properties of the device. Encapsulation of organic devices results necessary in order to reduce performance degradation induced by aging and oxygen contamination.To conclude, transport and switching dependence on thickness will be characterized by realizing an appropriate series of devices.

S21-815

A Novel Mechano-Opto-Electrical Measurement System for Transparent Conductive Film Characterization

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In this presentation ,we will describe a new highly integrated data acquisition system to determine the true stress, true strain , birefringence and electrical conductivity of transparent conductive film characterization. This unique system is fully instrumented to measure the true stress and strains using high speed video capture system coupled with continous force measurement. It also allows simultaneous measurement of birefringecne using spectral birefrignence measurement as well as electrical conductivity. It is specifically designed to investigate the performance characteristics of newly developed conductive transparent polymer films undergoing large uniaxial deformation at elevated temperatures. Examples will be provided during the presentation

S21-990

Fabrication of 1D Photonic crystals based on hollow all-polymer fibers

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Hollow microstructured optical fibers are attractive for a broad range of applications due to their high-power laser guidance ability and low losses. In such fibers the hollow core is surrounded by a solid multilayer structure. The polymer based fibers present many advantages such as the high refractive index contrast and the low temperature processing. The problem of manufacturing such fibers by heating and drawing a preform is considered. Several set of polymers have been experimented for the fabrication process, where in addition to the difference in refractive index, the similarity of processing temperature of each polymer is important. Fibers were drawn from PS/PMMA and PVDF/PC preforms. Biodegradable systems based on cellulose butyrate and hydroxypropyl cellulise polymers were also investigated. The multilayers polymer preforms were obtained using two different techniques: a solvent spinning deposition process and a rolling technique using multilayer films. For each approach, the parameters affecting the process are discussed. The effects of factors determining the drawing process are also discussed, with a special attention on the resulting optical properties.

S21-1118

Spectroscopic ellipsometry analysis of polymer-like thiophene thin films grown by plasma deposition

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Deposition of polymer-like thin films deposited by plasma polymerization is of substantially interest for creation of materials with new physical properties. Over the past decades several deposition techniques have been developed to obtain chemically stable and high conductive polymers. Among all these techniques, plasma polymerization process has the advantage of in depth homogeneity of the grown polymer. Another important aspect of this technique is the possibility to use as precursors organic substances which cannot be polymerized in classical sense.In this work we present a description of the polythiophene deposition by plasma polymerization. The optical properties of the obtained thin films are characterized by spectroscopic ellipsometry, which gives the optical properties in the 250-1250 nm range. Discussions regarding the evolution of the polymer film deposited at several times and the optical band gap of such material are presented. Also, by using FTIR spectrometry, the integral intensities of some specific absorption bands are used to monitor the corresponding bond population in relation with the sample volume passed by IR beam.

S21-270

Investigating the morphology & conductivity of polyaniline films prepared in aqueous and non- aqueous media

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Polyaniline (PANI) has been considered as one of the most potential conductive polymers for various electrochemical, electronic & protective applications such as batteries, sensors, controlling systems, organic display and protective coating because of its facile synthetic process, good environmental stability, easy conducting control and cheap production in large quantities. Polyaniline has good conductivity but its morphology & structure is poor. One of the methods for improving polyaniline morphology is preparation of polyaniline film in non-aqueous media with additives.In this research, Polyaniline was synthesized by chemical methods using KIO3 as oxidant (dopant) and H2SO4 in aqueous & non aqueous media (Such as ethyl acetate ,ethylene glycol mono methyl ether, ethyl methyl ketone) in presence of additives such as poly vinyl acetate (PVAc), poly vinyl alcohol (PVA) & poly ethylene glycol (PEG). In order to preparation of film, N-Methyl Pyrrolidionone (NMP) solvent was used. Then, The effects of these media & additives on the morphology & conductivity of polyanline films were investigated by Scanning Electron Microscopy (SEM) & Four point probe. From results, it was found that morphology & conductivity of polyaniline films are dependent on kind & concentration of media & additives. When additive concentration is increased, conductivity will be decreased. Most conductivity was resulted when ethyl acetate was used as media. The kind of media & additive concentrations have influence on uniformity of film morphology. Whatever additive concentrations are higher, particle size will be smaller & morphology will be more uniform. Also, morphology of Polyaniline film prepared in non-aqueous media was more uniform than those prepared in aqueous media.

S21-373

Syntheses and fluorescence properties of two side-chain polysiloxanes containing pyrene groups

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Pressure-sensitive paint(PSP) based on the luminescence quenching of some material by oxygen has been increasingly used for the surface pressure measurement in aerodynamic testing. Pyrene and its derivatives are often used as active luminophores in PSP because of high oxygen quenching efficiency and low temperature coefficient. The PSPs with pyrene as the pressure sensor and silicone polymer as the binder often lack stability due to loss of pyrene from the matrix by evaporation or sublimation. For improving the stability of active luminophores, pyrene groups are introduced into polysiloxanes by hydrosilylation. The two polymers containing different pyrene derivatives, 1-decenyl-4-(1- pyrenyl) butanoate(DCPB) and 4-(1-pyrene)butyl-9-decenoate(PBDE), are synthesized. The polymers structures are confirmed by FTIR and 1HNMR. The photophysical properties of the monomers and polymers in toluene are studied by using Hitachi F-2500 Fluorescence Spectrometer. The results show that the spectrum of the polymer is different from that of the monomer when the monomer and polymer contain the same functional group. Distinct differences are observed in the fluorescence emission spectra of polymers depending on the functional group attached to pyrene. The polysiloxane synthesized by DCPB is attached to pyrene with the functional group –COO–. The oxygen queching sensity(OQS) of its is as high as 59% at the monomer emission(ME) and 54% at the excimer emission(EE), and that of the other with –OOC– is about 37% at ME and 56% at EE. The results show that side-chain polysiloxane containing pyrene groups with –COO– has higher oxygen quenching performance than the other with –OOC–. With the decreasing of the concentration, the changes of fluorescence intensity and OQS are both increasing at ME and decreasing at EE. Key words: pyrene derivatives, fluorescence quenching, luminophor, pressure-sensitive paint, polysiloxane

S21-382

Synthesis and electrorheological properties of polyaniline/BaTiO3 composite particles

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Abstract: Electrorheological Fluids (ERFs) are suspensions of polarizable particles in insulating oil, which exhibited a dramatic change in rheology in the presence of an electric field. The performance of semi-conducting polymer-based ERFs is still insufficient with respect to a successful development of application devices. Barium titanate is an inorganic ionic compound with high dielectric constant, Barium titanate-based ERFs have a high electrorheological effect, but it becomes badly in anhydrous. By modifying the surface of BaTiO3 with organic polymer to form core-shell composed particles, it may be promising candidates as dispersed particles for ERFs. In this paper, Polyaniline-coated barium titanate composite particles were synthesized by surface grafting polymerization, in which five silane coupling agents with different terminal groups were used. The structure of composite particles were charactered by SEM, XRD, FT-IR and TGA, the electrorheological properties were tested by rotational rheometer equipped with a high-voltage direct-current power source. The results show that polyaniline was coated on the surface of barium titanate particles to form the shell-core structure. The yield stress of the electro- rheological fluids based on polyaniline-coated barium titanate composite particles is higher than that of based on polyaniline and barium titanate. Compared with PANI-based ERFs, the composite particles-based ERFs have lower field-off viscosity due to the molecular interaction. The yield stress of the ERFs, as well as density of the complex particles, was affected by the groups at terminal of silane coupling agents. Key words: rheology; composites; core-shell polymers; conducting polymers

S21-387

Doping of Poly(9,9 n-dihexyl 2,7 fluorene) with poly[2-methoxy, 5-(2-ethylhexoxy)-1,4-phenylene vinylene] and Poly(9,9 di n-dihexyl 2,7fluorenediylvinylene-alt-1,4 phenylenevinylene)

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The fluorescence (PL) and electroluminescence (EL) behaviors of the blue emitter poly(9,9 n-dihexyl 2,7 fluorene)(PDHF) doped with 3-methyloxy 5- hexyloxy1,4phenylenevinylene) (MEH PPV) and Poly(9,9 di n-dihexyl 2,7fluorenevinylene-alt-1,4 phenylenevinylene)(PDHF PPV) were explored aiming to obtain white emission. Firstly the absorption and fluorescence emission of the pure polymers were studied in solution of varying concentrations and in the solid state as well. The absorption profile remained essentially unchanged, for each polymer. The emission of PDHF was also independent of the concentration whereas those of MEH PPV and PDHF PPV showed a red shifting with concentration increases. The doping of PDHF with MEH PPV showed a strong energy transfer (Forster type) from the first to the latter, in agreement with the spectral overlap of the two polymers. The addition of PDHF-PPV to this blend, forming a ternary system, brought about several changes in the PL, the most relevant was the increase of the emission in the blue part of the spectrum, indicating that PDHF-PPV is emitting in this region, as seen in dilute solution. The EL spectra of samples with larger content of MEH-PPV showed a strong red shifting, with complete suppression of the blue emission, and lower contents of this red emitter displayed green light emission. With further addition of PDHF-PPV in adequate amounts was able to adjust the CIE coordinates emitting in the white.

S21-425

The study of fillers effect on electromechanical properties of High Temperature Vulcanized silicone rubber

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Fillers are used to enhance both electrical and mechanical properties of silicone rubber which is widely in use for insulation applications.HTV (High Tempreture Vulcanized) silicone rubber was melt mixed with two different fillers and the mechanical and dielectric properties of composites were investigated. Lead Zirconate Titanate (PZT) was used as ceramic powder to increase relative dielectric permittivity with higher rate than organo Montmorrillonite which improved mechanical properties essentially. The composites wre characterised by X-Ray Diffractometer and Scan Electron Microscopy. Besides, The stress-strain curves of specimens were compared and were demonsrated the improved elastic modulus and tensile strength of composites. In addition, Several nonlinear elastic models were employed to represent the mechanical behavior of the silicone composites and the best model was selected for future analysis. Furthermore, according to frequency dependent dielectric constants of specimens, PZT was improved dielectric properties of composites more than organ Montmorillonite. Then, silicone composites are better choiced than pure silicone in insulation applications.

S21-430

SYNTHESIS OF NEW POLYACRYLATES CONTAINING SIDE-CHAIN STILBENE MOIETIES

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In the past decade a great attention has been paid to the functionalized stilbene polymers due to the unexpected photochemical/physical properties of the chromophore and implicitly, of the macromolecular backbone, widely exploited for inducing liquid-crystalline, and non-linear optical behavior or electroluminescent response [1-2].Our work being devoted to the covalent anchoring of stilbene in polyurethanes [3] and polyacrylates [4], the aim of this study is to continue research on the latter polymers based on two novel unsaturated monomers. Thus, we synthesized an urethane acrylic monomer (trans-4-(2-methacryloyl oxyethylcarbamoyloxymethyl)stilbene) to be further free radically copolymerized with methyl methacrylate. Also, an optically active one, (S)-N-acryloylphenylalanine acid 4-styryl-benzyl esther served as co-monomer in the copolymerization process with (S)-N-acryloylphenylalanine to obtain polymers with amino acid sequences in each repeating unit, which can produce chiroptical effects as indicative of significant conformational homogeneity. These copolymers were characterized by spectral methods (1HNMR, UV/vis, FTIR spectroscopy) including fluorescence spectroscopy. The photoisomerism and fluorescent emission of the stilbene in polymer solutions and thin films together with their optical properties were also discussed. The presence of stilbene on the same polymeric backbone create the possibility of synthesizing optically active and photoluminescent polymers potentially suitable for applications in biology, medicine, analytic techniques and optical devices.AcknowledgementsAuthors express their gratitude to the Ministry of Research and Education for the financial support (PNCDI -II-Nr. 78/2007)1.A. M. Peeler and co. Polym. Prepr. 40 (1999) 540;2.D. Yu and co. Polym. Prepr. 35 (1994) 32;3.E. C. Buruiana and co. J Pol Sci Part A, Polym Chem, 40 (2002) 1918;4.E. C. Buruiana and co. EPJ, 43, (2007), 4316.

S21-433

ATOM TRANSFER RADICAL POLYMERIZATION OF TRIAZENE-(METH)ACRYLATES AND THEIR COPOLYMERS

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In recent years, a series of triazene polymers tailored for laser- induced polymer processing have been intensively investigated to be exploited in microlithography [1] and photoresist technique [2], owing to the intrinsic qualities of photo removable triazene chromophore to undergo a photochemical decomposition with the release of molecular nitrogen. In most cases, these photopolymers revealed superior ablation, i.e. low ablation threshold, high ablation rates and high quality structuring without debris [3], and the absence of carbonization of the irradiated areas which is very pronounced for polymers with similar absorption coefficients at 308 nm (Kapton). Consequently, novel polymers based on the triazene function and new UV-laser applications of them have been developed [4], for which it is very important to have good film forming properties in a range of solvents. As a continuation of our effort to accomplish a better understanding of the effect of the triazene chromophore on the polymer properties, in this paper we report the synthesis of new acrylic copolymers with triazene moieties (-N=N-N-) on the backbone using the ATRP process by comparison with those previously reported [5]. We try to discuss the effect of synthesis conditions of triazene polyacrylates as a new class of functional materials with promising potential for processes following the laser structuring compared to the UV-light, temperature and other acid sensitive triazene polymers, where a flexible production of small number is the goal. Acknowledgements Authors express their gratitude to the Ministry of Research and Education for the financial support (PNCDI -II-Nr. 78/2007). References [1]. K. Morigaki et al. Langmuir 19 (2003) 6994. [2]. P. Gupta et al., Macromolecules 37 (2004) 9211. [3]. T. Lippert, Adv. Polym. Sci. 168 (2004) 51. [4]. R. Fardel et al. Appl. Phys. Lett. 91 (2007) 061103. [5].E.C. Buruiana et al. J. Polym. Sci. Part A: Polym. Chem. 44 (2006) 5271.

S21-441

Photochromic behavior of some polymers with incorporated azobenzene moieties

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Photochromic properties of some polymers films containing azobenzene chromophores were investigated using electronic absorption and fluorescence spectra. Under exposure to UV light, photoisomerization of azobenzene moieties occurs by the changes in the intensity of the trans-azo absorption band. The cis-trans relaxation of the azobenzene moieties has been analyzed in a temperature range above and below the glass transition both in polymer matrix and solution. The kinetic behavior was described by monoexponential functions in solution and biexponential expression required when the azobenzene derivative is incorporated in polymer matrix. The photoresponsive behavior of a low weight molecular compound in solution was discussed for comparison. The activation energy for thermal cis-trans isomerization of azobenzene chromophores was found to be of the same order of magnitude with that found in another azobenzene derivatives.

S21-594

Fabrication of Patterned Conducting Polymers on Insulating Polymeric Substrates by Electric-Field-Assisted Assembly of Conducting Polymers and Pattern Transfer

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In this work, an electric field was used to assemble a conductive polymer, polyaniline (PANi), onto the patterned template. The employment of electric fields avoids complicated chemistry methods and provides the potential to achieve high throughput and high rates. After assembly, it has been demonstrated that by compression molding or solution casting, patterned PANi can be transferred to polymeric substrates, such as NBR rubber sheet or polyurethane film completely. The conductivity of PANi lines on the PU film was measured as 0.87 S/cm. This simple one-step assembly process for conductive polymers and pattern transfer demonstrates a promising nanomanufacturing approach for high performance flexible nanoelectronics and biosensors.

S21-656

EFFECT OF SURFACE TREATMENT ON ELECTRICAL AND MICROWAVE PROPERTIES OF CARBON BLACK FILLED PET BASED COMPOSITES

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This study aimed to improve the electrical conductivity and microwave properties of conductive polymer composite by altering the surface chemistry of the conductive filler, carbon black. Surface chemistry of the filler was modified by using 1, 2 and 3 wt. % formamide solutions. Electron spectroscopy for chemical analysis (ESCA) was used to characterize the surface chemistry of untreated and treated carbon black. Melt mixing processes were performed by using a twin screw extruder to produce poly(ethylene terephthalate) (PET)/carbon black composites. Test samples were prepared by compression molding and injection molding machine. The electrical property of composites was determined by using two point probe method. In addition, EMI shielding effectiveness and dielectric property of composites were determined by absorption loss, return loss, insertion loss and dielectric constant measurements in the X-band range, respectively. ESCA analysis exhibited the chemical reaction between carbon black and formamide. Treatments with formamide solutions decreased electrical resistivity of composites by changing electrical character of carbon black. Reaction of formamide with carbon black resulted in doping effect. Nitrogen as n-type of dopant atom contributed to the current conduction mechanism and it shifted the percolation threshold concentration from 3 wt. % to 1.5 wt. % carbon black content. In addition, chemical modification of carbon black increased EMI shielding effectiveness and dielectric constant of composites when compared with the composites containing untreated carbon black.

S21-667

Mesoporous Clay Heterostructure derived Conductive Functional Groups for Sensor Packaging Application

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Recently, the discovery of a new class of solid porous materials known as porous clay heterostructures (PCH) has been reported. These materials have been prepared by the surfactant-directed assembly of mesostructured silica within the two-dimensional interlayer galleries of clays. The PCH is an interesting material to use as entrapping system, ethylene scavenger, owing to its structure provides high surface area with uniform and specific pore size. In the present work, the PCH is synthesized within the galleries of Na-bentonite clay by the polymerization of tetraethoxysilane (TEOS) in the presence of surfactant micelles. In addition, a mesoporous clay with organic-inorganic hybrid (HPCH) is modified via co-condensation reaction of TEOS with candidate functional groups (thiol or sulfonic group) to find appropriate functional groups to attack into nanoclay surface for conductivity enhancement of PCH material for sensor packaging. The effect of pH on the formation of mesoporous structure is investigated by varying pH value to 3, 5, 7, 9 and 11. Furthermore, both PCH and HPCH are utilized as ethylene scavenger and blended with polypropylene for producing ethylene scavenging films in food packaging application and also evaluated conductivity of PCH, HPCH/PP nanocomposites. From XRD results, the basal spacing of BTN was 1.16 nm. After treating BTN with cetyltrimethylammonium bromide (CTAB), d-spacing of organoclay-3, 5, 7, 9 and 11 are shown as 3.83, 3.89, 3.87, 3.87 and 3.94 nm, respectively. According to pore characterization, PCHs have surface areas of 421-551 m2/g, an average pore diameter in the supermicropore to small mesopore range of 4.79-5.02 nm, and a pore volume of 0.57-0.66 cc/g.

S21-742

SYNTHESIS OF NEW FUNCTIONAL MALEIMIDE COPOLYMERS

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N-substituted maleimides were synthesized by the reaction of maleic anhydride with the aniline derivatives in two step [1]. Eighteen new maleimide copolymers were prepared by the free-radical copolymerization of N,N–dimethylaminoethyl-methacrylate (DMA) with N-substituted maleimides (RMI): N-(2-methylphenyl)-maleimide, N-(4-methoxyphenyl)maleimide, N-(4-bromophenyl)-maleimide, N-(2-, 3- or 4-chlorophenyl)-maleimide (CMI) in dioxane or benzene at 60°C. The structure of the resulting maleimide copolymers was determined by the IR- and NMR-spectroscopy. The copolymerization of the monomer systems: DMA-2CMI, DMA-3CMI and DMA-4CMI in different monomer feeds was investigated. Azeotropic character of the copolymerization was established. The monomer reactivity ratios in the copolymerization of DMA with CMI by the Kelen- Tüdös method were determined as follows: r1 = 0.983, r2 = 0.889 for DMA-2CMI; r1 = 0.673, r2 = 0.544 for DMA-3CMI and r1 = 0.753, r2 = 0.484 for DMA-4CMI. The thermostability of maleimide copolymers was investigated by thermogravimetric analysis. The chromophor properties of the copolymers were determined by the UV-VIS spectra.[1] . Konsulov, V., B., in Polymeric Materials Encyclopedia: Maleimide Copolymers (N-Substituted), vol. 6, p. 3996-4017, (Ed. J.C. Salamone) CRC Press Boca Raton, N. Y. (1996).

S21-748

CONTINUOUS EXTRUSION OF POLYOLEFINIC FILMS SHOWING MACROMOLECULAR ORIENTATION - DEPENDENT LINEAR DICHROISM

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In previous works focused on intelligent, external stimuli responsive-composite materials, many efforts were devoted to the development of polymeric films whose optical properties were modulable and alterable by both mechanical and thermal stresses.Such films were obtained on a laboratory scale by the very fine and controlled incorporation of moderate amounts (0.02 - 0.5 by weight) of highly conjugated luminescent chromophores in different polyolefinic matrices. In particular, the films after uniaxial deformation showed linear dichroism both in absorption and in emission. The dichroic ratio was determined as strictly dependent on the alignment of dye molecules along the oriented polymeric chains caused by the mechanical stress applied on the composite matrix.In a subsequent phase the same formulation were obtained by the continuous compounding of the components mixture in a co-rotating twin screw extruder with a screw diameter of 24 mm and a length-to-diameter ratio (L/D) of 40. Film obtained through off-line melt-compression moulding confirmed the optical responsive properties showed by laboratory batch-compounded materials.The third logical step here discussed is the direct continuous production of oriented, multi-responsive films on a pilot scale extruder. In this phase the optical properties have been correlated to extrusion parameters, in particular with extrusion temperature, calendering temperature and winding speed of extruded film.

S21-773

Polymer/QDs nanocomposites for OLED devices

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Polymer electronics is considered a promising technology for large flexible flat panel displays. In this framework organic light-emitting devices (OLEDs) have been identified as a dominant new technology. A significant challenge of OLED technology remains the identification and synthesis of polymers and inorganic materials nanocomposites with enhanced performances. The main goal of our project is the synthesis of a class of electroluminescent nanocomposites to be used as light emitting layer to improve the OLED performances, i.e. efficiency and lifetime. We prepared nanocomposites of poly(3,4-ethilenedioxithiophene):poly(styrene-sulfonate) (PEDOT-PSS) and cadmium sulfide (CdS) quantum dots (QDs). PEDOT:PSS blends are composites suitable for OLED devices since they are characterized by high transparency in the visible range, high work function and excellent thermal stability. On the other hand CdS QDs show photoluminescence tunability over the visible spectral range. CdS QDs were prepared by thermolysis of a cadmium thiolate precursor. The precursor was dispersed in dimethyl sulfoxide and the solution was heated at 180°C for a minimum of twelve hours when a colour change of the solution from white opalescent to yellow was observed. The nanocomposites PEDOT-PSS/CdS were then prepared by mixing the polymer to the CdS solution. X-Ray powder diffraction (XRD), Nuclear Magnetic resonance (NMR) and X-ray photoelectron spectroscopy (XPS) have been used to characterize the CdS nanoparticles. The optical properties of the QDs and the nanocomposites were studied using absorption and photoluminescence (PL) spectroscopy. The CdS size can be controlled by varying the annealing conditions. Keeping the annealing temperature constant, longer annealing times produce bigger nanoparticles that shows up as a darker solution under UV illumination. The PEDOT-PSS/CdS nanocomposites are being currently investigated as emitting layer in OLED devices.

S21-776

Influence of tert -copolymer structure and the conditions of heat treatment on type and quality of the image in chemically amplified resist

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Polymeric materials used in microelectronics as the resists should possess high radiation sensitivity in a combination to high resolution and etching stability. Such requirement has appeared possible to be achived at use the chemically amplified resist. It is necessary to be photoacid generator (PAG) in a resistive composition besides of polymeric component for realization of the chemical amplify mechanism. The polymeric basis becomes soluble in polar solvent after post exposure bake (PEB) under action of Brönsted acid formed from PAG after an irradiation. We studied the ter-copolymer methylmethacrylate (MMA)-methacrylic acid (MAA)- ethoxyethyl methacrylate = 27 : 20 : 53 w.% (I) and the copolymer MMA-MAA- tert-butoxycarbonyloxystyrene = 20 : 20 : 60 w. % (II) in resistive compositions with sulfonium salt Cyracure ® UVI 6974 of the following composition: SbF-6[Ar2 –S+ -C6 H4 –S- C6 H4 -S+ -Ar2] SbF-6 + [Ar –S- C6 H4 –S+ -Ar2] SbF-6 = 90 : 10 as a PAG. The rate of dissolution resists films in a water solution of tetraethylammonium hydroxide (TEAH) was investigated after exposure of UV light (254 nm) and PEB. The nonlinear dissolution both exposured and nonexposured resists for copolymer (I) is established, that testifies to surface induction effect. This effect amplifies with increase in temperature of PEB and decrease in concentration of developer. The linear dissolution for a copolymer (II) is observed. Obtained data testify that the resist (I) is characterized by higher contrast of the positive image in comparison with the resist (II). It is established, that the type of the image in both resists depends from temperature of PEB at the developing in the alkaline solution. In particular, resist (I) becomes negative at bake temperatures above 1200C, and the temperatures above 1400C are necessary for transition to negative type of the image for resist (II).

S21-881

Photophysical study of a series of oligofluorenes and their carbazole containing copolymers

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Oligofluorenes with and without carbazole units were studied aiming to evaluate the effect of the chain length on the photophysical properties.The oligomers contained 1-7 monomeirc units . The carbazole insertion had the purpose of emission redshifting and evaluating its effect on decay times.The oligomers were characterized by mass and elemental analysis.The measurements included emission spectra, decay times and phosphorescence.Time resolved ultrafast streak camera analysis were performed to evaluate the solid state properties as frozen solutions (77K) or cast films at ambient temperature.The emission spanned from 416 nm (3.04 eV) to 425nm (3.00eV), depending on the chain length, and the carbazole copolymers showed a batochromic shift, in relation to the homopolymers. Decay times varied between 300-500ps. Delayed fluorescence was not observed in any material. Phosphorescence was observed only in frozen solutions with emission around 580 nm, with a delay of 100ms and a decay time of 1s.The obtained results lead to the conclusion that the presence of the carbazole group did not alter in a significant way the photophysical properties of polyfluorene, which was interpreted in terms of the high energetic level of the carbazole singlet state, bringing about an energy transfer in a descendent process to the fluorene moieties.

S21-890

The search for white Organic Light Emitting Diode using a polymeric conductive blend

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Conjugated polymers have attracted much research interest in science and technology in the past years as electro-active materials for many applications like organic transistors, solar cells and polymer light-emitting diodes (PLED). One of the most important light-emitting fields is the white emission due to their application in full color displays, backlighting and even general lighting. Usually, depending on the characteristics of the organic active layer, the emission can be either restricted to a relatively narrow band in the optical spectrum, leading to a quasi-monochrome light source, or to be distributed over the visible part of the electromagnetic spectrum, leading to a white emission. Some methods have been used to generating white emission as doping and/or use of polymeric blends. In this work we present a successful three layer PLED with an emissive layer formed by a blend with MEH-PPV / Poly(9,9 di n-dihexyl 2,7fluorenediylvinylene-alt-1,4 phenylenevinylene) / (PMMA/PMMant) with a host matrix of Poly(9,9 n-dihexyl 2,7 fluorene). PEDOT:PSS and butyl-PBD are used as hole and electron transport layers, respectively. The PLED shows a driving voltage near 7 V and a brightness of 6 cd/m2 at 15 V (current density of 22 mA/cm2). At low driving voltages the emission is near white with CIE (x,y) color coordinates of (0.3, 0.3) moving towards blue emission at high applied voltages (CIE color coordinates of (0.21, 0.20)). This result is discussed taking into account the independent emission from each polymer. Considering the opto-electrical behavior, a model to improve the emission is proposed.

S21-893

Improvement of Europium based Organic Light Emitting Diode structure using a polymeric conductive host

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Since the discovery of the electroluminescence properties of anthracene and the successfully first Organic Light Emitting Diode (OLED) at low applied voltage, the research in this field has been strongly increased. High brightness and good external efficiency associated with low cost and simple fabrication processes makes OLEDs promising candidates to a large area of electroluminescent device applications. The incorporation of rare-earth complexes with europium have been studied aiming to obtain an efficient and sharp electroluminescence, taking advantage of the high quantum efficiency of the lanthanide ions. Nevertheless, there are some constraints that need to be addressed. The most important is to obtain an efficient light emission and in order to to achieve this property, several device structures and fabrication processes have been addressed. In this work an OLED structure using europium(III)-tris(1-(2-thieneyl)-4,4,4-trifluoro-1,3-butanedione)-bipyridine – [Eu(TTA)3bipy] as emitting material imbibed in Poly(9-vinylcarbazol) as host conductive matrix was built in an hybrid structure, with hole transport layer (PEDOT:PSS) and emitting layer deposited by spin coating and electron transport layer (butyl-PBD) thermally evaporated. The obtained result is a strong Eu3+ emission with an intense 612 nm line. The optical power is about 0.4 uW (at 612 nm line) and the device support high applied voltages (up to 40 V). The nominal driving voltage is near 20 V with a low electrical current (less that 10 uA) giving a wall plug efficiency near 5x10-3%. The device carrier confinement and the related electroluminescence behavior are discussed. Based on this model, further improvements are proposed.

S21-926

Synthesis and Electrochromic Properties of Aromatic Polyamides with Main-Chain 4-(Dimethylamino)triphenylamine Units

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A new triphenylamine-based aromatic diamine monomer, 4,4’- diamino-4”-(dimethylamino)triphenylamine, was synthesized in high purity and high yields from readily available reagents. A series of novel 4-(dimethylamino)triphenylamine [(NMe2)TPA]-functionalized aromatic polyamides were readily prepared from the newly synthesized diamine monomer with various aromatic dicarboxylic acids via the phosphorylation polyamidation reaction. These polyamides are readily soluble in many organic solvents and can be solution-cast into tough and amorphous films. The polyamides showed glass-transition temperatures (Tg) in the range of 277-298 oC (by DSC). Decomposition temperatures for 10% weight loss all occurred above 500 oC in both air and nitrogen atmospheres. The polymer films showed reversible electrochemical oxidation accompanied by strong color changes with high coloration efficiency, high contrast ratio, and rapid switching time. The polymers also displayed low ionization potentials as a result of their (NMe2)TPA moieties. Cyclic voltammograms of the polyamide films on the indium-tin oxide (ITO)-coated glass substrate exhibited a pair of reversible oxidation waves with very low onset potential of 0.35 V (vs Ag/AgCl) in acetonitrile solution. References: 1.Monk, P. M. S.; Mortimer, R. J.; Rosseinsky, D. R. Electrochromism: Fundamentals and Applications; VCH: Weinheim, Germany, 1995. 2.Cheng, S.-H.; Hsiao, S.-H.; Su, T.-H.; Liou, G.-S. Macromolecules 2005, 38, 307. 3.Liou, G.-S.; Hsiao, S.-H.; Su, T.-H. J. Mater. Chem. 2005, 15, 1812. 4.Liou, G.-S.; Hsiao, S.-H.; Chen, H.-W. J. Mater. Chem. 2006, 16, 1831. 5.Liou, G.-S.; Hsiao, S.-H.; Huang, N.-K.; Yang, Y.-L. Macromolecules 2006, 39, 5337.

S21-939

Novel Anodic Electrochromic Aromatic Polyamides with Pendent Dimethoxytriphenylamine moieties

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A series of novel aromatic polyamides with pendent 4,4’-dimethoxy- substituted triphenylamine (TPA) units were prepared via the direct phosphorylation polycondensation from new dicarboxylic acid monomer, N,N-bis(4-carboxyphenyl)-N’,N’-di(4-methoxyphenyl)-1,4- phenylenediamine (4) and various aromatic diamines. These polyamides were amorphous and readily soluble in many organic solvents. All the polymers could be solution-cast into flexible films. All the polyamides exhibited excellent reversibility of electrochromic characteristics by continuous five cyclic scans between 0.0 to 1.14 V, with a color change from the original pale yellowish neutral form to the green and then to blue oxidized forms. References 1. Su, T. H.; Hsiao, S. H.; Liou, G. S. J. Polym. Sci. Part A: Polym. Chem. 2005, 43, 2085. 2. Chang, C. W.; Liou, G. S.; Hsiao, S. H. J. Mater. Chem. 2007, 17, 1007. 3. Chang, C. W.; Liou, G. S. Org. Electron. 2007, 8 (6), 662.

S21-967

Effect of Plasma Treatment on PTC and NTC Behavior of Nylon-12/Carbon Black Nano Composites for High Melting Temperature Resistance Positive Temperature Coefficient

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In this study, the carbon black was added into nylon-12 to produce high temperature polymeric positive temperature coefficient (HTPPTC) component. The effect of carbon black content, plasma treatment of nylon-12 on the PTC intensity of component was investigated. And then, the various kind properties of composites such as electricity, physical and mechanical properties were tested. In this investigation, it suggested that the best blended condition (plasma wattage: 40W) of nylon12/CB composites was analyzed by PTC intensity. The composites that possessed good high melting temperature and good PTC behavior could be produced successfully, and the PTC component with low-impedance.

S21-979

Photophysical properties of conjugated-non-conjugated multiblock copolymer

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The synthesis, structural characterization and photophysical properties of copolymers built by conjugated PPV type units of variable length and an aliphatic spacer are described.The bandgap as expected, varied according to the effective conjugation extension. The aliphatic spacer provided good film forming capability and solubility. The materials, were soluble in chloroform and other common organic solvents and characterized NMR,FTIR,GPC,UV-vis and DSC. Isomerization of the cis- to trans- configuration was needed to ensure the adequate photophysical properties. In combination with the conjugation length itself aggregation phenomena was investigated, ground state dimmers or higher associated forms were detected.

S21-1236

Electrical properties of some partial aliphatic polyimide films

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Polyimides represent a class of high performance polymers which exhibit favorable balance of physical and chemical properties for specific microelectronic applications. The low dielectric constant and dielectric loss factor are essentially properties for these applications. The literature presents new investigations which diversifies the complex polyimide structures, possessing these characteristics. In our data, the reduction in dielectric constant is achieved by introducing voids into polyimide thin films, by replacing the polymer having a dielectric constant ~3.0 with air which has a dielectric constant of 1. As compared to the conventional polyimides which are wholly aromatic, partially aliphatic polyimides offer a unique combination of qualities which counteract some of the shortcomings of the conventional ones, such as poor processability. Thus, cross-linked partial aliphatic polyimides have been prepared by thermal imidization process of the corresponding poly(amic acid)s. The precursors were synthesized by the polycondensation reaction of a partial aliphatic dianhydride and two aromatic diamines. Epiclon (5-(2,5-dioxotetrahydrofurfuryl)-3-methyl-3-cyclohexene-1,2-dicarboxylic acid anhydride) has been used as a raw material for polyimides to enhance solubility and to render other new properties. The dielectric constant and electrical conductance of obtained polyimides were experimentally measured over a large domain of frequency. At optical frequencies, the dielectric constants were determined from ellipsometric data by applying the Maxwell relationship. The dissipation factor values reveal low energy loss under the form of heat in the studied dielectrics. The results show that obtained polymeric materials are good insulators for microelectronic applications.

S21-1311

Hybridization of Nafion membranes by functionalized polysiloxane domains: effect of morphology on vapour water uptake and ionic conductivity.

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Polymer electrolyte fuel cells (PEFCs) are increasingly acquiring consideration for high efficiency power generators. The main requirement of fuel cell membranes is high proton conductivity, chemical stability and retention of mechanical strength over long periods of time. At present only perfluorosulfonic acid membranes, such as Nafion, meet these requirements. These membranes, however, are highly susceptible to a loss of absorbed water at temperatures above 80 °C and/or at low water activity, which reduces their proton transport capability and, accordingly, their efficiency in hydrogen fuel cells. A strategy to overcome these drawbacks is the incorporation of dispersed nanostructured hygroscopic oxides, such as SiO2 within the hydrophilic clusters morphology of the Nafion. In the present work polysiloxane-modified hybrid membranes were prepared by two different routes: 1) Introduction in a pre-swelled Nafion membrane of a sol–gel precursor solution, consisting of pre-hydrolyzed mixture of tetraethoxysilane and mercaptan functionalized organoalkoxysilane and, 2) Recasting of a solution containing solvated Nafion and pre-hydrolysed siloxane precursors. The mercaptosilane modifier was used to provide additional source of acidic sites through the oxidisation of the mercaptan groups to sulfonic acid groups. The physical and chemical properties of the hybrid membranes were examined by TGA, FT-IR and SAXS analysis. Water vapor sorption and proton conductivity were evaluated in the range 40-100°C and at water activity between 0.4 and 0.9. It was found that the first method does not affect significantly the ionic structure of Nafion but it improves the proton conductivity at low activity. The second method alters the intrinsic ionic structure of Nafion, resulting in a substantial increase in the amount of water absorbed and in the related ionic conductivity.

S21-1322

Characterization, morphology and thermal properties of PADB/dEPDM blends obtained by mechanical process

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The preparation and study of polymer blends are a fascinating area of materials research. The initial motivation to study the manufacture of blends was try to reduce the limitations that some polymers present, such fragility and low impact resistance. In the case of intrinsically conducting polymers it is necessary to improve the mechanical properties and the processability while retaining the electrical conductivity. Conductive rubber composites are widely used for different applications such as electrostatic charge dissipation (ESD), touch control switches and electromagnetic interference (EMI) shielding. These materials need to attain the desired electrical properties as well as adequate mechanical properties. In this work, conductive elastomeric blends based on ethylene-propylene-diene-monomer rubber devulcanizated (dEPDM) by microwave and polyaniline doped with dodecylbenzenesulfonic acid (PADB) were obtained by mechanical process. The conductivity, morphology and thermal stability of the obtained mixtures were analyzed by direct current conductivity measurements, scanning electron microscopy, X-rays diffraction, thermogravimetric analysis and dynamic mechanical thermal analysis. The onset of the conductivity at low contents of conducting polymer indicates a low percolation threshold for the blends. Also, the blend composition has a great influence on the morphology and crystalline structure of the films obtained.

S21-1324

Microwave absorbers processing by impregnation of fiber glass fabrics substrates with polyurethane and silicone matrix/polyaniline

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The technological progress occurred along the history is attributed to the options offered by the new materials developed by man. The material properties have been ameliorating constantly, looking for the quality requirements in service, with low cost and efficiency in production. These continuous searches for improvements also diversifies its functions, making them more than merely passive material and turn them active materials with integrated functions. Conductor and semiconductor materials have been studied extensively aiming their uses in microelectronic area attending requirements of elimination and/or shielding of the equipment against spurious radiations to the control of the deleterious effects of this radiation band in living beings. Then the processing of radar absorbing material (RAM) by using conducting polymer, is directly related to the development of new materials for providing several applications. In the military sector, is necessary to make the detection or visualization of targets by radar difficult; and, for this, there are techniques that provide the reduction of the radio frequency that returns from the target to the radar. This work shows the processing of RAMs by using polyaniline doped with dodecylbenzenesulfonic acid in the impregnation of fiber glass fabrics substrates. For the substrates impregnation' s, mixtures of the conducting polymer were prepared in a polyurethane and silicone matrix, in the ratio of concentration of 15 and 20 % (w/w) under mechanical mixing. The processed materials were evaluated by attenuation of the electromagnetic radiation, via reflectivity measurements by using the waveguide technique, in the microwave frequency band (8 to 12 GHz), and it were characterized with respect to the electric permittivity too. These materials attenuate the energy of the incident radiation between 65 and 90%. The results have also been correlated with observations made through scanning electronic microscopy analyses.

S21-1381

Structure and dielectric properties of polymeric composites with ferroelectric fillers

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The synthesis of novel polymer composites from thermoplastics, such as polypropylene (PP), copolymer of ethylene and butylacrylate (CEBA), as well as from thermosetting cold cured epoxy resin (ED - 20) and hot cured epoxy resin AT1 (powder single-component epoxy, CIBA - GEIGY AB, Sweden) with different fillers, including ferroelectrics and investigations of their properties remain among the actual problems due to increasing applications of these materials in microelectronics, optics, acoustoelectronics, etc. are presented in this research.The simplest type of piezocomposites is three-dimensionally connected polymer matrix randomly loaded with active ferroelectric particles. As ferroelectric fillers the following compounds were used: 1) barium titanate BaTiO3, typical perofskite ferroelectric with Curie point 127°C, 2) triglycine sulphate (NH2CH2COOH)3•H2SO4 ; dielectric constant is 30, Curie point is Tc = 49°C, 3) ferroelectric ceramic lead zirconate titanate - strontium titanate; Tc = 22°C, It has been shown that dielectric properties of polymer composites are a function of the size and concentration of ferroelectric filler particles, since these particles contain a defective outer surface layer with dielectric properties significantly different from those of the bulk ferroelectric. DSC data demonstrate that the heat of ferroelectric phase transition in BaTiO3 particles depends on their size.Dielectric properties of composites were found to depend on the type and properties of polymer matrix, as well as the method and conditions of composite preparation. Composites, cured in measurement cell possess more porous structure, their dielectric constant being lower compared to compression molded samples.Dielectric constant for PP composites in ferroelectric phase is higher compared to that of epoxy resin composites. This is explained by the fact that ferroelectric particles in epoxy matrix are in mechanically compressed state due to chemical contraction dur

S21-1382

The Study on Electroluminescence and Current Characters of PET Films under High DC Fields

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The (poly(ethylene terephthalate)-PET) was widely used as a dielectric material, so the study on its dielectric characters are valuable. The Electroluminescence (EL) and the current characters are effective experimental technology for the dielectric characters of high polymers. In this paper, the home-made equipment set-up was used to test the EL spectra, light intensity and current characters of PET films under high DC Fields. Then the relationships among El spectra, light intensity, current character and the electric fields increased step by step. The result shows that the both the EL and the current increase along with the electric fields, and the phenomena is obvious after the threshold value of the PET (4.0MV/cm). The mean value of dark noise is about 16cps (test temperature : 20℃) and the light intensity might increased to millions cps after the film's pre-breakdown phenomenon, the current is from the order of pA (background current) to µA. The EL has peaks about 300-400nm, 400-460nm, 500-600nm and 680nm, the peaks between 500nm and 600nm is higher. The peak about 680nm increases quickly after the threshold. The excitation of the EL, the carrier mobility, the spectra characteristics of the films were discussed according to the results of the experiment.