Sym. I : Polymers for Electronics

NLO

D-TUE-10

POLYMERIC MATERIALS FOR SECOND-ORDER NONLINEAR OPTICAL DEVICES, NAKJOONG KIM, KI HONG PARK (Center for Electronic Material and Devices, Korea Institute of Science and Technology, P.O.Box 131, Cheongryang, Seoul 130-650, KOREA, Tel: 82-2-958-5291, Fax: 82-2-958-5309, E-mail: kimn@kistmail.kist.re.kr

Nonlinear optically (NLO) active polymeric materials have better processability compared to inorganic crystal materials, but their thermal and long term stability of NLO activity must be improved for practical device applications. Especially, the gradual decay of second-order NLO coefficient of poled polymers has been one of the most important issues. We have demonstrated the remarkable stability enhancement of NLO coefficient by an introduction of crosslinkable polymer matrix such as polyglycidyl methacrylate copolymers having self-crosslinkable moieties[1] or polymaleimide copolymer having high glass transition temperature[2-3]. Furthermore, we recognized that not only the thermal stability of polymer matrix but also that of NLO chromophores itself are important issues to be studied. Especially, if a high glass temperature polymer matrix is used, the corresponding chromophore endurable at high poling temperature is absolutely demanded. Therefore, our current study focuses on the development of novel NLO chromophores with good thermal stability. The combinations of thermally stable polymer matrix with thermally stable chromophores could have provided the promising second-order NLO materials.

D-TUE-11

OPTICAL SECOND-HARMONIC GENERATIONS OF LIQUID CRYSTALLINE MAIN-CHAIN POLYMERS ANO THEIR APPLICATION FOR EO DEVICES, TADAHIRO ASADA (Dept. of Polym. Chem., Grad. School of Eng., Kyoto Univ., Kyoto, 606-8317, Japan)

The second harmonic generations (SHG) of liquid crystalline main-chain type polymers were investigated. The sample polymers are copolymers of 2-hydroxy-6-naphthoic acid(HNA) with 4-hydroxy-benzoic acid(PHB), in various composition ratios. The SHG of the film samples was greatly affected by preparation conditions of the films. SHGs for the film samples processed by mechanical drawing at various conditions were investigated.. The nonlinear optical coefficients dexp evaluated by Maker Fringe method of the film sample is around 5pm/V. Periodically inverted-polarized films are obtained by piling the thin films so that their machine directions direct alternatively. Trials of Quasi-Phase Matching of periodically inverted-polarized films show very effective to improve SH efficiency. A method that can control SH efficiency by appication of electric field is proposed .

D-TUE-12

ELECTRO-OPTIC DEVICES MADE OF SIDE CHAIN POLYMERS WITH A SOFT AND A RIGID BACKBONE, M. H. LEE, H. J. LEE, M.-C. OH, J.-H. AHN, S. G. HAN and H. G. KIM (Photonic Switching Section, ETRI, P.O.Box 106, Yusong, Taejon 305-600, Korea)

For the fabrication of electro-optic polymer devices, we have investigated poled side chain polymers with different backbones. The nonlinear optical chromophores used in this work were 4-Dimethyl-Amino-4-Nitro-Stilbene (DANS) and Disperse Red 1 (DR1). PMMA was used as a soft backbone and polyimide as a rigid backbone. We measured the refractive indices and electro-optic coefficients for the different poling fields. In the case of a DANS-PMMA side chain polymer, it exhibits small birefringence before poling whereas large birefringence after poling. Therefore, the polymer is applied for the single TM mode guiding devices. However, in the case of a DR1-Polyimide side chain polymer, the initially large birefringence was reduced after poling. Therefore, the polymer is applied for the polarization controlling devices which should be operated for the single TM and the single TE modes. Details of considerations and photonics applications will be discussed in the talk.

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LCD

D-TUE-13

HELICAL POLYACETYLENE SYNTHESIZED UNDER CHIRAL NEMATIC LIQUID CRYSTAL K. AKAGI, G. PIAO, S. KANEKO, I. HIGUCHI and H. SHIRAKAWA (Inst. of Mat. Sci., Univ. of Tsukuba, Tsukuba 305-8573, Japan), M. KYOTANI (Nat. Inst. of Mat. Chem. Res., Tsukuba, 305-0046, Japan)

We synthesized for the first time helical polyacetylene under asymmetric and anisotropic reaction field consisting of chiral nematic (N*) liquid crystals. (*R*)- and (*S*)-2,2'-bi-naphthol derivatives were synthesized as chiral dopants which were added into an equimolar mixture of two kinds of nematic liquid crystals. Liquid crystal mixture thus prepared showed an enantiotropic N* phase. By employing the mixture as a solvent, acetylene polymerizations were carried out with Ziegler-Natta catalyst, $Ti(O\text{-}n\text{-}Bu)_4$ - Et_3Al. Polyacetylene films showed not only clockwise or counter-clockwise helical structure of fibrils in scanning electron micrograph, but also negative or positive Cotton effect in the region corresponding to $\pi \rightarrow \pi^*$ transition of polyene chain in circular dichroism spectrum. By virtue of its high electrical conductivity of 1.5×10^3 S/cm after iodine doping, the present helical polyacetylene might be a candidate of molecular solenoid that has never been cultivated before.