Light Responsive and Photopatternable Fluorescent Liquid Crystalline Polyethylene – Based Composites.

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Responsive liquid crystalline (LC) polymeric systems with external physical, chemical and electrical stimuli capable of being highly sensitive to external fields and changing their optical properties have been extensively developed over the last decade.

This paper deals with the light-controllable and photopatternable fluorescent polymer composites based on stretched porous polyethylene films containing switchable dye-doped and photopolymerizable liquid crystals. Porous stretched polyethylene films with pores size in the range 50-500 nm were used as polymer matrixes. Photochromic nematic and cholesteric mixtures based on commercial liquid crystals doped with different azobenzene and merocyanine dopants were prepared. Highly birefringent deeply coloured flexible films possessing strong dichroism were obtained by introduction of the photochromic LC mixtures into the stretched polyethylene films. Polarized spectral data and dichroism calculations showed that the transition moment of dye-containing side groups of photopolymerized monomers and the liquid crystals director in composite films are oriented along a stretching direction of the porous polyethylene films. Such systems combine the mechanical properties of polyethylene and the unique properties of low-molar-mass liquid crystals, photochromes and fluorescent compounds with a drastic change in their structure and optical properties (birefringence, dichroism, fluorescence etc) under the light irradiation (1, 2).

The different approaches for reversible and irreversible photoregulation of the optical properties of such films containing a small amount (0.5-2.0wt%) of photochromic (azobenzene, cynnamoyl, and diarylethylene derivatives) and fluorescent perylene compounds have been developed (3).

Optical, photooptical, and fluorescent properties of polyethylene-based composites filled with LC photopolymerizable mixtures are presented and discussed. A possibility of photopatterning of such photoactive polyethylene films was demonstrated. The composite films show a high fatigue resistance during the alternating cycles of the UV-visible light irradiation.

A novel family of the hybrid-materials developed in the work can be considered as the very promising photoactive media for the potential applications in optical and optoelectronic devices, display technology, for recording and storage of optical information.

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References:

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