Network formation in the small polymer particles-liquid crystal composites

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Novel small polymer particles-liquid crystalline composites displaying network formation have been developed by a variation of type and concentration of liquid crystal (LC) and polymer, and also regime of mixing and cooling of the system.

The following materials were used for development of composite gels: liquid crystals 4-pentyl-4'-cyanobiphenyl (5CB), 4-methoxybenzilidene - 4' – butylaniline (MBBA), 4-ethoxybenzilidene-4'-butylaniline (EBBA), the mixture of MBBA and EBBA with molar ratio of 1:1 (commercial mark H-37) and 1:2 (commercial mark H-8); polymers poly(methylmehacrylate) (PMMA), poly(2-methyl-5-vinylprydine) (PMVP), poly(ethyleneglycol) (PEG), poly(vinylalcohol) (PVA); the stabilizer heptixybenzoic acid (HOBA).

The kinetics of network formation has been investigated by the methods of polarized microscopy and small-angle scattering of laser radiation through obtained composites 5CB + PEG + HOBA and H-37+PMVP + HOBA in which the matrix of the first composite has positive optical anisotropy and the matrix of the second has negative one.

In order to obtain the first composite, the mixture of polymer and LC was heated above melting temperature T_m of polymer and temperature of isotropic-nematic transition T_{ni} of L. At intermixing with frequency of 1000 revolutions/minute the drops of polymer in isotropic LC were formed. These drops were transformed to the solid balls at slow cooling of the mixture lower T_m. The network formation was occurred at further cooling lower T_{ni} .

The PMVP particles imbedded in H-37 at its isotropic phase and then the system slowly was cooled below T_{ni} for obtaining of the second composite. At that case, the particles were “frozen” in certain positions in the liquid crystalline phase of H-37, forming the network.

It is shown that the network is formed at some critical concentration: it equals to 7% for the H-37+PMVP + HOBA system while for the 5CB + PEG + HOBA composite it does to 9%. At that case, temperature of isotropic-nematic transition is shifted to low temperatures for the H-37+PMVP + HOBA composite while it remains constant for the 5CB + PEG + HOBA composite.

The basic electrooptical parameters of obtained composites are presented. The possibility of application of these composites is discussed.

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