Pulsed recording of anisotropy and holographic polarization gratings in azo-polymermethacrylates with different molecular architectures

Recording of anisotropy and holographic polarization gratings using 532 nm, 4 ns light pulses has been carried out in thin films of polymers with the same azobenzene content (20 wt %) and different molecular architectures. Random and block copolymers comprising azobenzene and methylmethacrylate (MMA) moieties as well as statistical terpolymers with azobenzene, biphenyl, and MMA units have been compared in terms of recording sensitivity and stability upon pulsed excitation. Photoinduced anisotropy just after the pulse was significantly higher in the case of the block copolymers than in the two statistical copolymers. The stability of the recorded anisotropy has also been studied. While a stationary value of the photoinduced anisotropy (approximately 50% of the initial photoinduced value) is reached for the block copolymer, photoinduced anisotropy almost vanished after a few hours in the statistical copolymers. Polarization holographic gratings have been registered using two orthogonally circularly polarized light beams. The results are qualitatively similar to those of photoinduced anisotropy, that is, stability of the registered grating and larger values of diffraction efficiency for the block copolymer as compared with the random copolymers. The recording of holographic gratings with submicron period in films several microns thick, showing both polarization and angular selectivity, has also been demonstrated. Block copolymers showed a lamellar block nanosegregated morphology. The interaction among azo chromophores within the nanosegregated azo blocks seems to be the reason for the stability and the photoresponse enhancement in the block copolymer as compared with the statistical ones.