Carbazole-Based Azo Polymer: Characterization and Surface Relief Grating Formation

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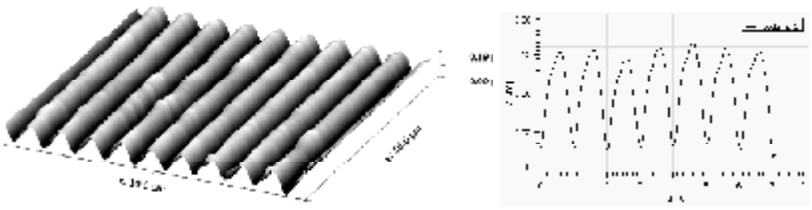
Recently polymer materials with azo dyes become attractive materials for holographic recording due to possibility of surface relief grating fabrication with high diffraction efficiency and resolution. It has been reported that large surface modulations can be obtained on azo polymer films upon exposure to an interference pattern of laser beams.

In this study, novel type of carbazole-based azo polymer have been synthesized through a polymerization azo-coupling scheme. As carbazole-based polymer the epoxypropilcarbazole (EPC) 90% and as azo dye the Disperse Orange 3 (DO) 10% were selected respectively. DO was purchased as a commercial product with dye content 90% from Sigma-Aldrich Company. FTIR characterization of synthesized copolymer EPK:DO has proved the introduction of azo group in polymer matrix confirmed by the peak at 1580 cm^{-1} in the IR spectrum corresponding to the N = N stretching frequency. Copolymer film was prepared as thin film spin-coated at glass substrate. The film thickness was measured with microinterferometer MII-4 and was 140 nm. The transmittance spectra for obtained films coated on glass substrates were measured over the range 200 – 900 nm. The broad absorption band in the range 420-580 nm with λ_{max}=460 nm is assigned to strongly absorbing azobenzene groups. The surface-relief-grating (SRG) formation process was studied for obtained thin films. An interferometric holographic recording was used to expose linear grating. The interference pattern of DPSS laser beams was produced by two spatially symmetrical s-polarized beams (λ=532 nm and power density 120 mW/cm^2). It was shown that s/s-polarization condition is not efficient for SRG formation process. While using two circularly polarized interfering beams (left-circularly polarized: right-circularly polarized LCP:RCP) good quality SRG were direct produced without any chemical treatment and with diffraction efficiency more than 20%. Fig. shows atomic force microscopy image of the recorded sinusoidal surface relief structures with spatial period 1 μm. The depth of the grating was in the range from 80 nm to 130 nm.



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