UV light-induced thermal and optical properties of functionalized polymers with strong push-pull azo chromophores in side chain

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Aminoazobenze (B2) and pseudostilbene-type (B1, B3-B5) azobenzene polymer thin films were deposited on glass substrates by spin coating. The azo polymers were thermally and optically investigated in their two isomeric forms: trans and cis. First, scanning thermal microscopy (SThM) and photothermal radiometry (PTR) were used for thermal conductivity (κ) examination of azo polymers in trans state. Spectroscopic ellipsometry (SE) was used to obtain transmittance spectra (T). Azo polymers were then illuminated with UV light of 405 nm and 300 mW/cm2 for 100 min while successive T were recorded. Hereby, different optical dynamics of trans-cis isomerization for investigated azo polymers were observed. The B1-B3, and B5 samples are characterized by a long return time to the trans state (weeks). In contrast the B4 sample has a return time of approximately 1 hour. Once more κ was determined using SThM in cis phase. Additionally, for B4 azo polymer, thermal conductivity dynamics along the trans-cis-trans transition were followed. We observed a decrease of the κ value (by 44%, 39%, 28%, 21%, 25% for B1-B5, respectively) between the cis and trans state for all investigated azo polymers. The differences in optical and thermal properties changes, induced by UV illumination, between particular azo polymers can be attributed to the different substituents in their polymeric system, as well as the type of charge transport according to the type of azobenzene (amino or pseudostilbene). Additionally, atomic force microscopy (AFM) was used to examine and compare the surface topography of azo polymers in the trans and cis state.