PHOTOREFRACTIVITY OF PERYLENE BISIMIDE-SENSITIZED POLY(4-(DIPHENYLAMINO)BENZYL ACRYLATE)

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Abstract

Photorefractive (PR) polymers and composites have attracted much attentions because of their promising applications include there-dimensional displays, holography and image amplification. Recently, a photoconductive polymer of poly(4-(diphenylamino)benzyl acrylate) (PDAA) has been utilized for fast response PR application because of a fast hole mobility. In this study, enhanced photorefractive performances are reported for a PR composite of perylene bisimide (PBI)–sensitized poly(4-(diphenylamino)benzyl acrylate), 2-(4-(azepan-1-yl)benzylidene)malononitrile (7-DCST), and (4-(diphenylamino)phenyl)methanol (TPAOH). By only changing the ratio between PDAA and TPAOH, the PR properties could be enhanced drastically. The addition of a large amount of the TPAOH photoconductive plasticizer was found to produce a preferred hole manifold that reduces the disordered state. Green laser with the wavelength of 532 nm is used because it optimizes the PR performance according to the previous study by our group. Surprisingly, a significant enhancement in PR performance can be obtained only by reducing the PDAA concentration and increasing the amount of TPAOH. A photorefractive performance with a minimum response time of 11 ms, a maximum external diffraction efficiency of 41.6%, a maximum sensitivity of 117 cm^2 J^{-1}, and a maximum optical gain of 296 cm^{-1} were obtained with an external electric field of 55 V μm^{-1} for PDAA/7-DCST/TPAOH/PBI (30/30/39.9/0.1 by wt.).