

ENERGY DYNAMICS ON PHOTO-INDUCED COLOR CHANGE REACTION OF DIARYLETHENYL MOLECULAR SYSTEM

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Recently, there are increasing interests in the development of new organic photochromic molecules for optical data storage device. Diarylethene derivatives are expected to be one of the most promising materials due to their characteristics of ring-cyclization and ring-opening. The effects of the different polymer matrix environments are investigated in the photochromic reactions of the diarylethene derivatives such as cis-1,2-bis(2-methylbenzothiophene-3-yl)-1,2-dicyanoethene (BTCN), 1,2-bis(2-methylbenzothiophene-3-yl)maleic anhydride (BTMA), and 1,2-bis(2-methylbenzothiophene-3-yl)per fluorocycloalkenes (BTF6). The polymer matrixes applied to the molecular systems are PE, PMMA, and PEG-g-polysiloxane. Furthermore, for the practical application view, BTF6/PEG-g-polysiloxane system was chosen due to the highest quantum yield for photochromic efficiency. To obtain the homogeneity of the molecular system, BTF6/PEG-g-polysiloxane was prepared as a covalently bonded compound along with other covalently bond systems for the study of the mechanisms which might be different from those of polymer matrix systems. To elucidate the energy dynamics of the photochromic reactions of the samples, the steady-state UV-Vis absorption, fluorescence, and low temperature (77K) time-resolved fluorescence spectroscopy were employed. As the results, the electronic energy state and their dynamics involved in the ring-cyclization were determined and the photochromic quantum yields of each sample were calculated. With these results, the ab initio calculation was performed to confirm the detailed mechanisms by providing not only the structure of the diarylethene derivatives on the ground state but also the information about the electron densities of the intramolecular atoms.

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