Thermal and Photoinduced Phase Transitions of Liquid Crystals of Azobenzene-tripheylene Derivatives with Ether Linkages

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It was found that a triphenylene mesogen having six azobenzene moieties with tetradecyloxy derivative 1 exhibits both calamitic (rod-like) and discotic (disk-like) mesophases. 1 exhibits both smectic A (SmA) of calamitic mesophase and rectangular columnar (Colr) of discotic mesophase as an enantiotropic way. This is the first example of single mesogen exhibiting both calamitic Sm and discotic col mesophase in thermotropic way. Furthermore, it is so interesting that one can observe photoinduced isotermal phase transitions among SmA, Colr and isotropic (Iso) phases. This implies that the alternative change of molecular shape between rod and disc, which is accompanied with the isothermal phase transitions, could be controlled by photo as well as thermal way. Also this indicates this bimesomorphic transition property profoundly concerns to the photoinduced trans-cis isomerization of azobenzene moieties.

The dodecyloxy homologue 2 exhibits SmA, smectic C (SmC) and Colr in an enantiotropic way. In this study, the derivative having ether linkages instead of ester 3 was synthesized, and studied on the mesomorphism. 3 shows SmA and a highly ordered Sm phases. The phase transitions temperature of 3 were determined to give 68.7 °C and 58.4 °C for phase transitions between Iso and SmA and between SmA and a highly ordered Sm phases. These temperatures are decreased by ca. 150 °C relative to these of 2 (Fig.1). The range of SmA temperature of 3 is larger than one of 2. This finding indicates the linkage is definitive factor for the mesomorphism with shape change of molecule. Moreover, SmA of 3 is transitioned into Iso by UV irradiation at 365 nm.


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