

Photoresponse of Microphase Separation Structure for Liquid Crystalline Block Copolymers with Azobenzene Mesogens

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1 Introduction

Liquid crystalline polymers having an azobenzene moiety in the side chain show a liquid crystalline/isotropic (LC/Iso) phase transition caused by *trans-cis* photoisomerization triggered by UV irradiation. Therefore LC block copolymers with azobenzene mesogens can change reversibly the spacing or morphology of the microphase separation (MS) by the UV-induced LC/Iso transition. In this paper, we will present responsiveness of the MS structure to the LC/Iso transition induced by photoisomerization for the block copolymer composed of azobenzene-type liquid crystalline (PAzo) and rubbery poly(*n*-butyl acrylate) (PBA) blocks.

2 Experiment

Block copolymers shown in Fig. 1 were synthesized by atomic transfer radical polymerization. The molecular weights of PBA(xx)-P06Azo(yy) are xx and yy thousands, respectively. SAXS experiments were carried out at BL-6A and BL40B2 (Priority Program for Disaster-Affected Quantum Beam Facilities) at Spring8. DSC and polarized optical microscopy (POM) were also used.

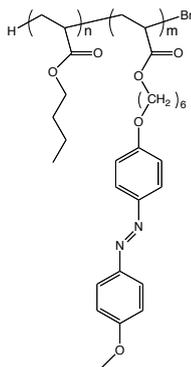


Fig. 1 Chemical Structure of the Block copolymer.

3 Results and Discussion

As shown in Fig. 2, the SAXS peak due to the smectic (Sm) LC structure appears and disappears at UV-off and -on, respectively, for the PAzo homopolymer. This LC transition is reversible in the repeat of UV-on/off. An LC texture observed by POM also disappears at UV-on.

Fig. 3 shows SAXS profiles for block copolymers at 80°C. The MS structures can be assigned from the ratio of the position of the peaks to be

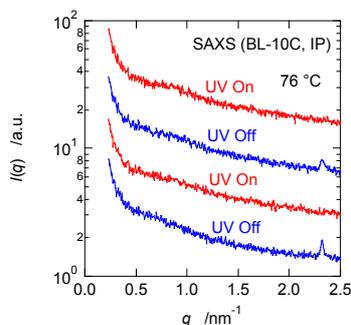


Fig. 2 SAXS profiles at UV-on/off for LC homopolymer.

lamellar for Azo07, PAzo-cylindrical for Azo05 and PBA-cylindrical for Azo17. As shown in Fig. 4, the peak position q_m responds reversibly to UV-on/off. Fig. 4 also shows the required time for the change is 20-30 sec. The spacing of the MS structure is larger at UV-off, i.e., in the liquid crystalline state, as we reported previously in the thermotropic liquid crystallization [1-2]. This may be caused by the expansion of the main chain toward the microdomain interface.

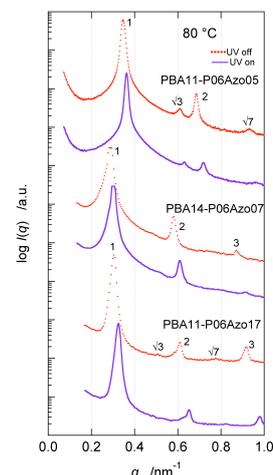


Fig. 3 SAXS profiles at UV-on/off for block copolymers.

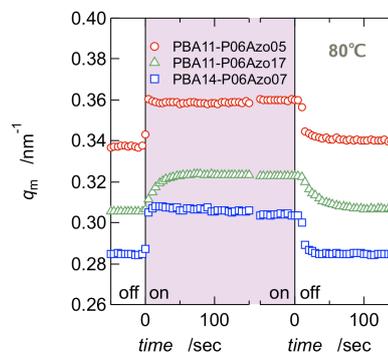


Fig. 4 The change of the MS peak position in UV-on/off for block copolymers.

Acknowledgment

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References

- [1] H. Takeshita et al., *Polymer* **50** (2009) 271.
- [2] S. Taniguchi et al., *Polymer* **49** (2008) 4889.

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