Smectic-Smectic LC Phase Separation in Mixtures of Rod-like Polymers

棒状高分子の混合系におけるスメクチック-スメクチック相分離

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長さの異なる剛体粒子の二成分混合系において、スメクチック-スメクチック相分離が起こることが、理論的に予測されている。我々は、分子量分布を狭く調製した非常に剛直な高分子の二成分混合系において、理論的予測が再現することを実験的に実証した。

The theoretical and computational studies on liquid crystalline phases formed in the systems of rod-like particles have been reported since 1950s. The smectic phase, which has been subject to considerable research for a long time, was reproduced in the mono-disperse rod-like particles even with repulsive forces, i.e., excluded volume interactions. In the binary systems of mono-disperse hard-rod-shaped particles with different lengths, the formation of various smectic phases have been predicted by the numerical experiments and computer simulations, depending on the length ratio and mixing ratio of the components [1-3]. When the length ratio is 5 or more, the binary system was predicted to segregate into the smectic phases of each component [4].

Although this segregation, which is mainly based on the steric repulsion between particles, might be of considerable interest to academics and professionals in the field of LC devise applications, no experimental verification has been provided except that only the smectic-smectic phase separation exhibited by the binary systems of conventional LC molecules with aromatic mesogens and aliphatic tails has been reported.

In this study, we present an experimental finding of the predicted segregation by synchrotron radiation small/wide-angle X-ray diffraction (SR-WAXD/SAXS) and atomic force microscopy (AFM) in the thermotropic LC systems of the binary mixtures of the polysilanes (poly[*n*-tridecyl-(*S*)-2-methylbutylsilane]s) with narrow molecular weight distributions and different molecular weights, which can be regarded as rods with different lengths [5-6].

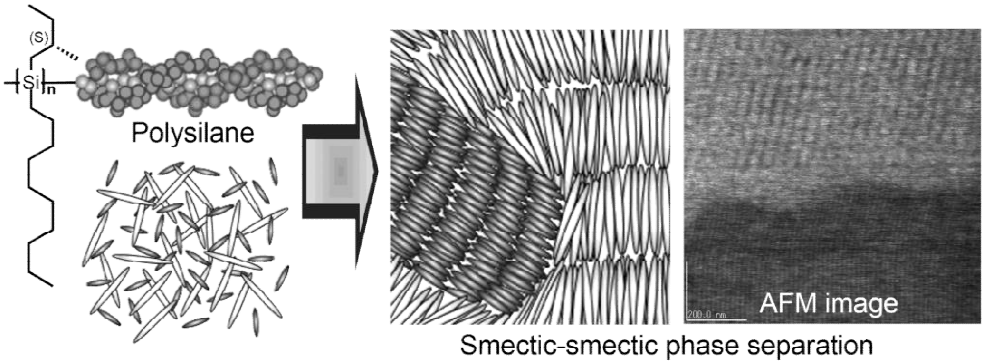

Fig. 1: Schematic illustration and AFM image of segregation observed in the binary mixtures of rod-like polymers with different lengths

References

[1] S. Varga, E.Velasco, L. Mederos, F. J. Vesely *Mol. Phys.* **107**, 2481-2492 (2009). [2] G. Cinacchi, L. Mederos, E. Velasco *J. Chem. Phys.* **121**, 3854-3863 (2004). [3] R. Van Roij, B. Mulder *Phys. Rev. E.* **54**, 6430-6440 (1996). [4] T. Koda, H. Kimura *J. Phys. Soc. Jpn.*, **63**, 984-994 (1994). [5] K. Okoshi, J. Watanabe, *Macromolecules* **43**, 5177-5179 (2010). [6] K. Okoshi, A. Suzuki, M. Tokita, M. Fujiki, J. Watanabe, *Macromolecules* **42**, 3443-3447 (2010).