Simultaneous Dynamic Measurement of Transcription and formation processes of Ultra-anisotropic Cylinder Nanostructures

Tomokazu Iyoda

(Tokyo Institute of Technology, Chemical Resources Laboratory)

【Outline of survey】

Microphase-separated nanostructures in block copolymers have fascinated one to understand the correlation between their ordered structures and the polymer structures so far, and now a new wave is surging on them as the self-assembled nanostructures leading to industrial use as the coming engineered plastics. Emphasis should be placed on both high reproducibility and mass production of these ordered nanostructures through self-assembling nanofabrication processes, expected as one of the powerful counterparts of the top-down-type nanofabrication such as lithography and beam processing. Recently, we have developed a series of PEO – liquid crystalline block copolymers which consist of poly(ethylene oxide) (PEO) and polymethacrylate bearing azobenzene mesogen in the side chain and have fabricated hexagonally arranged and normally aligned PEO nanocylinder domain structures in their thin films on a roll-type PET film substrate which were prepared by continuous coating with a microgravure. This success satisfies the above requirements applicable to industrial use and also guarantees their high regularity as reliable nanotemplates for structural transcription to and hybridization with various materials such as metal, semiconductors, and so on. In this research, we will plan the first development of an advanced grazing incidence small angle X-ray scattering for laboratory use equipped with optical-fiber based Raman and UV-visible spectroscopes and the first measurement of real-time nanostructure and spectroscopic monitoring on the phase-segregated nanostructure formation of our block copolymer thin films.

【Expected results】

1. To understand the formation mechanism of the highly ordered microphase-separated nanostructures in functional block copolymer thin films with spectroscopic changes by Raman and UV-visible spectroscopes.
2. To control the highly ordered microphase-separated nanostructures by external fields such as UV light, electric field, and magnetic fields.

【References by the principal researcher】

• Y. Tian, K. Watanabe., X. Kong, J. Abe, and T. Iyoda, "Synthesis, nanostructures and functionality of amphiphilic liquid crystalline block copolymers with azobenzene moieties", *Macromolecules*, 35, 3739-3747 (2002).

• T. Iyoda, "Reliable Template Thin Films of Phase-segregated Polymeric Nanostructures, *Electrochemistry*、74、491-496 (2006).

• H. Yu, J. Li, T. Ikeda, and T. Iyoda, "Macroscopic Parallel Array of Nanocylinders by Rubbing Technique"、*Advanced Materials*、18、2213-2215 (2006).

【Term of project】 FY2006－2010	【Budget allocation】36,600,000 yen

【Homepage address】 http://www.res.titech.ac.jp/~hikari/english/index.html