

Fabrication of Polymer Nano-devices using Bottom-up Nanotechnology

Tokuji Miyashita

(Institute of Multidisciplinary Research for Advanced Materials, Tohoku University)

【Outline of survey】

Recently, bottom-up approaches for constructing ordered nanoscale structures in organic molecular assemblies have been of interest and various techniques for preparation of organic ultrathin films have been studied. Organic thin films are attractive materials for their processability, ease of functionalization, their light weight, flexibility, and so on. We have tried to prepare various polymer thin films applicable to electronic, photonic devices with Langmuir-Blodgett technique. It is found that *N*-alkylacrylamide polymer forms a two-dimensional net-work on the water surface and gives a condensed polymer monolayer. We are able to build-up the monolayer on a solid support and then obtain a polymer nano-sheet with nm-scale thickness and highly molecular orientation. Moreover, various functional groups have been incorporated into the polymer sheets and soft nano-devices based on their integrated assemblies have also been developed. In this work, we would like to prepare and develop the polymer nano-devices using these polymer nano-sheet assemblies and hybrid nano materials assemblies.

【Expected results】

Bottom-up nanotechnology with soft-materials is now immature, compared with top-down nanotechnology based on semiconductors. Tailor-made organization and integration of polymeric and organic materials are expected as a future technology. We have employed Langmuir-Blodgett method as an organization technology. Through our work on various functional polymer nano-sheet assemblies, a new type of fundamental technology based on polymer thin films and on the fabrication of soft nano-devices are expected.

【References by the principal researcher】

- J. Matsui, M. Mitsuishi, A. Aoki, and T. Miyashita, Molecular Optical Gating Devices Based on Polymer Nanosheets Assemblies, *J. Am. Chem. Soc.*, 126, 3708-3709 (2004)
- M. Aminuzzaman, Y. Kado, M. Mitsuishi, and T. Miyashita, Immobilization of a Fluorinated Polymer Langmuir-Blodgett Monolayer on a Solid Substrate for Surface Nanocoating, *J. Mater. Chem.*, 14, 3014-3018 (2004).

【Term of project】 FY 2005 - 2009

【Budget allocation】 79,000,000 yen

【Homepage address】 <http://res.tagen.tohoku.ac.jp/~profmiya/>