【Grant-in-Aid for Scientific Research(S)】
Science and Engineering (Chemistry)

Title of Project : Mesoscopically Sized and Restricted Polymer Thin Films for Creation of New Photoresponsive Functions

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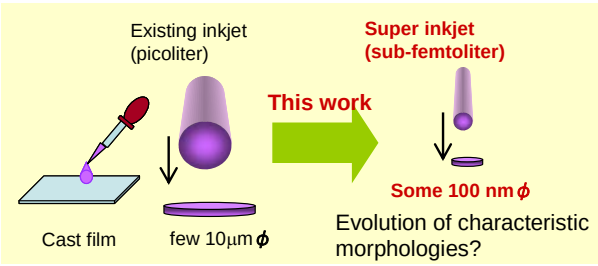
Research Area : Polymer Chemistry
Keyword : polymer thin films, mesoscopic restriction, wrinkle formation, photoresponse

【Purpose and Background of the Research】

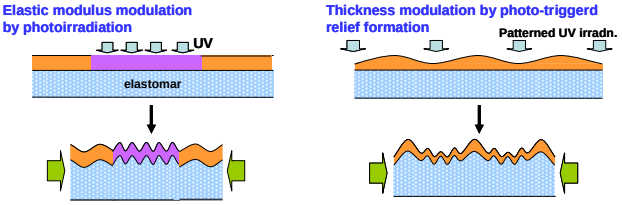
We have been accumulated a number of knowledge on smart photoresponsive films that exhibit molecular alignment and morphology evolutions in response to light. However, the investigations so far are limited to large area film systems. This project is planned to deal with mesoscopically (10 – 100 nm regime) restricted films prepared by a super-inkjet system (whole area divided) and surface wrinkling (patterned area divided). The materials will involve polymer blends, block copolymers, organic-inorganic hybrid materials. This project is intended to elucidate the characteristic morphology formation of phase separation structure whose feature size is less or comparable to the total film size. Based on the precise understandings of the film properties, the project also intends to create new photoresoponsive materials via introducing photoreactive unit such as azobenzene.

【Research Methods】

Mesoscale sized film will be prepared with a recently developed super-inkjet apparatus which is able to eject a droplet of sub-femtoliter levels. This allows formation of a film of less than one mirometer (mesoscopic film). Using this method, phase separation behaviors of the resulting films of polymer blends, block copolymers and organic-inorganic hybrids will be evaluated.



The surface wrinkling formed on an elastomer film is a subject of intensive study in recent years. In this project, we will use a various type of photoresponseive polymer thin films as the top coat layer. We expect that the patterned photomodulatins of the top layer can provide on-demand extended variations in the wrinkle formation phenomena.



【Expected Research Achievements and Scientific Significance】

New and versatile possibilities in pattern formation are proposed in this project, which is expected to contribute a great deal to polymer chemistry, physics and processing technologies. Based on the knowledge obtained, the fabrication of more precisely designed photoresponsive materials for photomechanical functions is anticipated.

【Publications Relevant to the Project】

1. J. Isayama, S. Nagano, T. Seki, Photo-triggered mass migrating motions in liquid crystalline azobenzene polymer films with systematically varied thermal properties, *Macromolecules*, **43(9)**, 4105–4112 (2010).
2. T. Seki, Light-directed smart responses in azobenzene-containing liquid crystalline polymer thin films, in *Functional Polymer Films* (R. Advincula & W. Knoll eds,), Vol. 2, Wiley-VCH , chapter 31, pp. 961-982 (2011).

【Term of Project】 FY2011-2015

【Budget Allocation】 144,000 Thousand Yen

【Homepage Address and Other Contact Information】

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