Shear Stress Effects on Photochromic Nitrospiropyrans

Makoto Inokuchi [1], Ryosuke Sakai [1], Shuhei Ohshima[1], Yukiko Shimizu[1]
Kazuhiro Yabuuchi[1, 2], Kyuya Yakushi [3], and Ichimin Shirotani[4]
[1] *Department of Applied Chemistry, Tokyo University of Science, Yamaguchi, Japan*
[2] *Department of Applied Chemistry, Chubu University, Japan*
[3] *Institute for Molecular Science, Japan*
[4] *Muroran Institute of Technology, Japan.*
Email: inokuchi @ ed.yama.tus.ac.jp

The shear stress effect is a new approach in solid state science. We have studied the effects on thin films of photochromic spiropyrans using the sapphire anvil cell and performed the *in situ* observations under a microscope with spectroscopic measurements. Spiropyran in solution exhibits chromic behavior with transforming to merocyanine as shown in Fig.1. We present the shear stress effects and the chromic behavior of 6-nitrospiropyrans with different alkyl chains and its cyclodextrin inclusion compounds.

6-nitrospiropyrans (SPs) with methyl, propyl and pentyl groups on nitrogen atom of the indole ring have been prepared; they are abbreviated as N-methylSP, N-propylSP and N-pentylSP. When shear stress was applied to the thin film of N-methylSP, the color changed from light-yellow to green. Subsequently, the green part changed to purple with releasing the stress.[1] Infrared and Raman spectra for the green and purple states showed that some spiropyran molecules were transformed to merocyanine by shear stress. N-propylSP and N-pentylSP exhibited the similar chromism to green under shear stress and then to blue purple and blue respectively with releasing the stress. Further, their photoresponsive properties with UV/Vis light irradiation were more sensitive than N-methylSP.

The inclusion compound of N-methylSP in γ-cyclodextrin has exhibited the chromic behavior from pink to dark red by shear stress and then to red-purple as releasing stress. Raman spectra showed that the transformation to merocyanine was induced under shear stress and that merocyanine molecule was stabilized in γ-cyclodextrin. In addition, the inclusion compound showed the faster photochromic behavior than independent spiropyran.

The results suggest that the space around spiropyran molecule is related to the transformation to merocyanine and chro The inclusion compound mic behavior. We shall discuss the development of "shearchromism" and the new method for controlling chemical bonds.

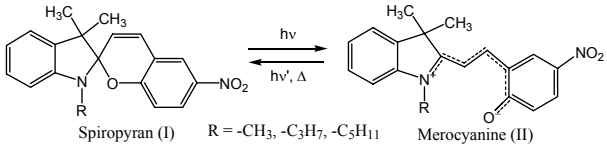

Fig.1 Photochromism of Spiropyran

[1] M. Inokuchi, et al., *J. Low Temp. Phys.*,**142**(2006) 211