Liquid Crystal Electrochemical Polymerization under Magnetic Field

Hiromasa Goto
(Division of Materials Science, Faculty of Pure and Applied Sciences, University of Tsukuba)

Liquid crystal electro-polymerization

Optically active conjugated polymers were prepared by electrochemical polymerization of achiral monomers in a cholesteric liquid crystal (CLC) electrolyte solution [1,2]. The polymer films thus synthesized exhibited circular dichroism (CD). This method can be referred to as "chiral electrochemical polymerization".

In the present report, the chiral electrochemical polymerization of thiophene derivatives by using CLC electrolyte containing cholesteric derivatives as chiral inducer was carried out. The surface morphology of the polymers was confirmed with polarizing optical microscopy observations. The polymers show not only electrochromism (Figure 1) but also “chiral electrochromism”. Change in the optical rotation of the polymer depends on the redox conditions. The ellipticity of this polymer is also found to exhibit hysteresis with redox cycle. The results indicate that the optical rotation of chiral polymer can be tuned through electric field by electrochemical method.

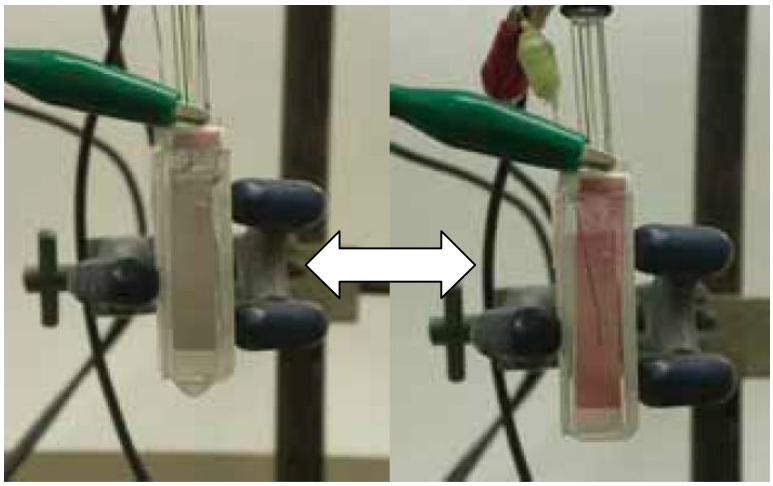

Figure 1. Electrochemical doping (oxidization) and dedoping (reduction) of the chiral polymer film in 0.1 M TBAP/acetonitrile solution. Left: +1.2 V, right: 0 V.

Electro-polymerization in liquid crystal under magnetic field

Liquid crystal can be oriented along the magnetic field. Oriented liquid crystal prepared by magnetic field provides oriented chemical reaction field. In this case, the liquid crystal electrolyte solution plays a role of uniaxial polymerization environment. Resultant polymers synthesized in the oriented liquid crystal show uniaxial oriented form confirmed with scanning electron microscopy (Figure 2). Polarized absorption spectra of the polymers thus prepared demonstrated anisotropy. Furthermore, "linear polarized electrochromism phenomenon" was found [2]. The polymer shows electrochromism by application of voltage, which change the color with linear dichroism.

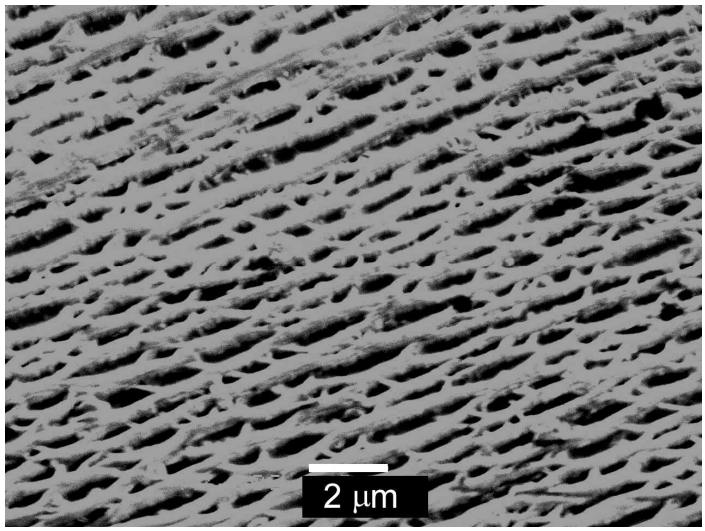

Figure 2. Scanning electron microscopy (SEM) image of the polymer prepared with liquid crystal electrochemical polymerization under magnetic field.

References

[1] Goto, H. *Phys. Rev. Lett.* **2007**, 98, 253901.
[2] Goto, H; Nimori, S. J. Mater. Chem., **2010**, 20, 1891–1898