Liquid Crystal Magneto-Electropolymerization

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1. Alignment of Liquid Crystal Conjugated Polymers

Magnetic field [1] or shear stress [2] affords to produce uniaxial alignment of liquid crystals. Orientation of liquid crystal conjugated polymer has been achieved under magnetic field. The aligned polymer thus obtained in the magnetic field shows main-chain orientation accompanied by orientation of liquid crystal substituents.

2. Liquid crystal electropolymerization

Electrochemical polymerization in liquid crystals has been carried out. The polymer obtained in liquid crystal matrix shows liquid crystal like morphology observable with optical microscopy [3] and scanning electron microscopy. Although the polymer shows liquid crystal like optical texture, the polymer shows no fluidity (polymer solid film). This is due to the fact that molecular collective form imprinting from liquid crystal matrix to resultant polymer in the polymerization process was occurred.

3. Liquid crystal chiral electropolymerization

Chiral conjugated polymers were prepared by electrochemical polymerization of achiral monomers in a chiral liquid crystal (CLC) electrolyte solution [1,2]. The polymer films prepared in chiral liquid crystal shows “Electro-driven change in optical rotation”. The optical rotation degree is comparable to that of Faraday rotators. The optical rotation degree can be precisely controlled be the external voltage less that 1 V. This can be a new physical effect in optical rotators. The ellipticity of this polymer is also found to exhibit hysteresis.

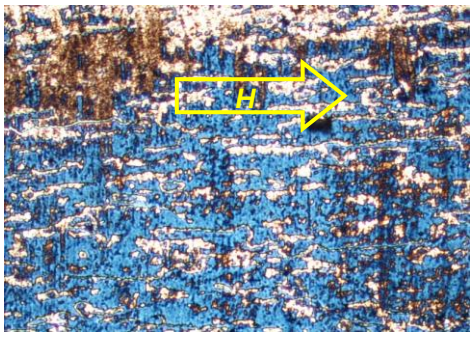

Figure 3. A polymer prepared in liquid crystal under magnetic field.

4. Liquid Crystal Magneto-Electrochemical Polymerization

We carried out electrochemical synthesis of conducting polymers in magnetic field of 12 T. The polymer thus obtained in the oriented liquid crystal show uniaxial form. Polarized absorption spectra of the polymers confirmed anisotropy and "**linear polarized electrochromism** [2]. The uniaxial optical function is controlled by application of external voltage.

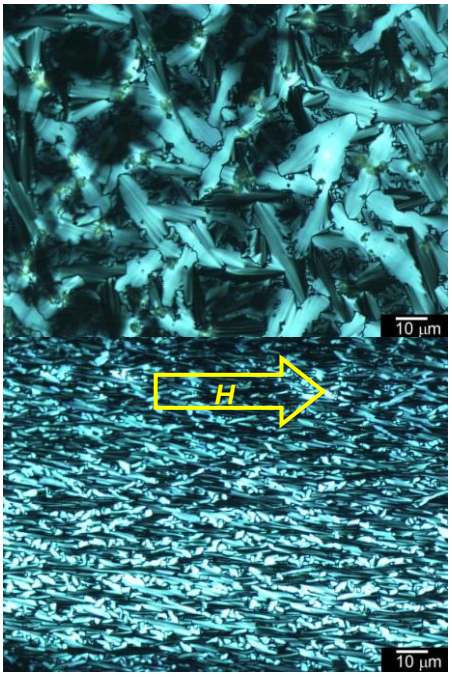

Figure 1. Polarizing optical microscopy images of unoriented polymer (top) and oriented polymer with magnetic field (bottom).

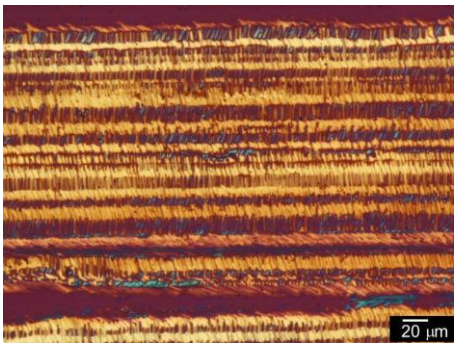

Figure 2. Alignment of a liquid crystal conjugated polymer with shear stress.

5. Liquid crystal magnetic orientation in solvent evaporation process

We developed a new method of magnetic orientation in solvent evaporation process via LC state to obtain aligned polymer. Uniaxial alignment of conjugated polymer in liquid crystal was achieved under magnetic field. A growth of the liquid crystal domains and magnetic orientation occur simultaneously in this process to form thin solid films with align liquid crystal order.

Reference

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