Light-Transmittance Controllable Films from a Polymer Dispersed & Stabilized Liquid Crystal System

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Polymer-dispersed liquid crystal (PDLC) and polymer-stabilized liquid crystal (PSLC) systems are the two primary distinct systems in the field of liquid crystal (LC) technology, and they are differentiated by their unique microstructures. In PDLC films, the high polymer contents (usually higher than 50 wt%) is crucial for their high mechanical strength, excellent stability and facial large-area processability. However, PDLC films are opaque in their normal conditions and the transparent state requires a continuous electric field to sustain, which is not enough energy-efficient. Also, their high driving voltages (usually 55 V~85 V for a large area product) might create safety problems in practical applications. In PSLC films, the oriented liquid crystalline polymer networks between two substrates can stabilize the initial directions of the LC molecules. Thus, PSLC films can be transparent normally. However, the polymer content within a PSLC system is usually constrained below 10 wt%, making it difficult to realize the large-area processing of the composite using flexible substrates due to the poor adhesive strength. To maintain the advantages of the PDLC and PSLC systems and overcome their disadvantages, we present a novel coexistent system of polymer-dispersed and polymer-stabilized liquid crystals (PD&SLCs), which forms an oriented polymer networks within the LC droplets after a micro-phase separation between the LC and polymer matrix. Moreover, by preparing the PD&SLC films within different kinds of LCs, the large-area preparation of different functional and flexible light-transmittance-controllable (LTC) films can be facially realized, which shows great potential applications in the fields of energy-saving smart windows, LCs display, sensors and so on.

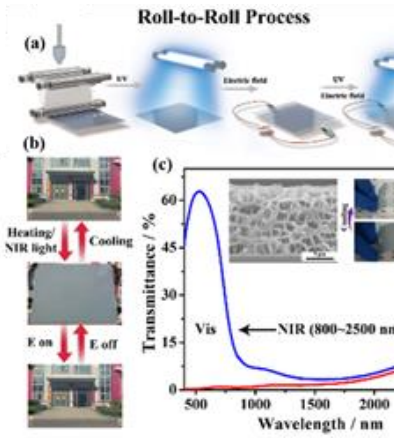

Figure. (a) The roll-to-roll process for preparing PD&SLC films; (b) Photographs demonstrating the large-area processability of the thermally LTC films and (c) Optical spectra of the thermally LTC films under different temperatures. Insert: Inner polymer structure of the films and the photographs showing the flexibility of the films.

Speaker Biography

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Tenured professor in Department of Materials Science and Engineering, College of Engineering, Peking University.

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Education Background

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Professional Experience

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Research Areas and Interests

(1) Blue phase liquid crystalline materials

(2) Liquid crystalline materials for TFT-LCD;

(3) Chiral molecular motors;

(4) Carbon Matrials from LC composite materials

(5) Polymer dispersed liquid crystal (PDLC) films;

(6) Polymer stabilized liquid crystal (PSLC) films;

(7) Films of co-existence system of PDLC and PSLC.