BILKENT UNIVERSITY

unam - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

FACULTY OF SCIENCE

MATERIALS SCIENCE and NANOTECHNOLOGY GRADUATE PROGRAM SEMINAR

"Flexible optoelectronic fiber and films: Liquid crystal/polymer composites for wearable display applications"

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Stimuli-responsive textiles are of growing interest because they make it plausible to enhance the overall functionality of systems by integrating displays, sensors, and other complex devices into clothing. A few successful examples of fibers incorporating optoelectronic materials have been reported using electrospinning, infiltration, coating, or melt spinning. However, the optical responses of fibers to external fields has yet to be explored. In addition, liquid crystal displays (LCDs) have been fabricated onto a surface planarized fabric by sequential coating of functional layers or laminated between two plastic substrates for flexible display applications. Here we report on the development of the first electrically switchable and light modulating LC/polymer composite microfibers via two approaches: *i) electrospun LC/polymer fibers and ii) polymer dispersed LC (PDLC) fibers*. In the former method, the composite LC fibers consist of 4-pentyl-4' -cyanobiphenyl (5CB) and polylactic acid (PLA). In the process, the LC material is phase-separated and self-assembled to form the nematic domains in the core-shell microfiber structure while the degree of crystallinity of PLA is increased significantly. In the latter method, PDLC microfibers are drawn from a photopolymerized PDLC film prepared on the water surface. As a result, nearly spherical microcavities formed in the PDLC film are replaced with the fibrous polymer network. This highly stretched network structure reorients the nematic LC domains in the direction of the applied strain due to the physical principle of the orientational order coupling with mechanical stress.

Highly elongated and optically anisotropic LC/polymer fibers present fast electro-optical switching upon application of an electric field. We also demonstrate that highly ordered and birefringent LC fibers combined with electrically tunable optical features can be utilized to construct fiber based photonic devices, such as polarizers and light filters. The formation, morphology, alignment, and structural and optical properties are characterized by scanning electron microscopy, wide angle X-ray diffraction, optical microscopy, and differential scanning calorimetry. Most importantly, we produced polarization sensitive composite LC fibers that are endowed with electrically tunable birefringence. Our study represents a new approach to developing conformable textile devices and sensors woven from optoelectronic fibers.

Date : April 7, 2010 (Wednesday)
Time : 15:40
Place : Faculty of Science Building, A Block, Seminar Room (SA 240)

Tea and cookies will be served after the seminar