Supramolecular Assemblies and Nanostructured Liquid Crystals for Future Materials

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Liquid crystals have been widely used as informational flat-panel display in our daily life due to their anisotropic structures and stimuli-responsive properties. For polymeric liquid-crystalline (LC) materials, they have been successful in fabrication of high strength fibers and plastics, and optical films. Recently new generation of supramolecular assemblies and nanotructured liquid crystals with unconventional design of molecular and assembled structures has attracted attention because they can be applied as future materials.[1-7] Here we present our approaches to new direction of supramolecular materials and liquid crystals for new generation of functional materials. We have prepared a variety of nanostructured LC materials exhibiting ionic[1-3], electronic[1,2], photonic[4], separation[5,6], and stimuli responsive properties[1-4]. These materials can be used in the field of energy, environment, healthcare, and new devices. For example, we have developed LC nanostructured materials forming smectic, columnar, bicontinuous cubic structures. They act as water treatment membranes they remove ions and harmful agents[5,6]. They are also applied as electrolytes for lithium batteries and solar cells, Mechanochromic sensors can be built by LC luminescent materials that chagnge the colors by mechano-stimuli responsive phase transitions. As new LC materials, hydroxyapatite or calcium carbonate/polymer nanorods have been obtained.[7] They show LC colloidal solution responsive to magnetic fields. These hybrids are expected to be environmentally friendly biodegradable functional materials. These molecular-based anisotropic soft materials have great potential as highly functional materials to be useful as new future materials.

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