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Fabrication of Actuating and Rewritable Film by Self-Assembled Hierarchical Superstructures

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Extended Abstract

The development of supramolecular chemistry provides a platform for the design and synthesis of multifunctional molecules which can evolve into the self-assembled superstructures with the targeted physical properties.[1, 2] To fabricate the remote-controllable actuating and rewritable films, we newly designed and synthesized a benzene-1,3,5-tricarboxaimde (BTA) derivative containing photo-responsive azobenzene (AZ) mesogens (abbreviated as B3AZ).[3] On the basis of the thermal, microscopic, and scattering results, B3AZ was first self-assembled to nanocolumns mainly driven by the intermolecular hydrogen-bond between BTA cores, and these self-assembled nanocolumns were further self-organized laterally to form the low-ordered hexagonal columnar liquid crystal (LC) phase (Φ_{LC}) below the isotropic temperature. Upon cooling, lamello-columnar crystal phase (K_{Cr}) emerged at room temperature via a highly ordered lamella-columnar LC phase (K_{LC}). Note that alkyl tails were disordered in the K_{LC} phase, while the ordered alkyl tails did participate for the construction of well-ordered K_{Cr} phase. Because the B3AZ molecules exhibiting the LC behaviors can form the hierarchical three-dimensional (3D) superstructures, thin films and free-standing films were fabricated by the programmed self-assembly.[4,5] Additionally, hydrogen bondable amide unit in the BTA core play a key role to form the macroscopic films. The 3D organogel networks consisted of fibrous and lamellar superstructures were fabricated in the B3AZ cyclohexane-methanol solutions. By tuning the wavelength of light,[5] the shape and color of the 3D networked thin films were remote-controlled 3D actuating and rewritable films with the self-assembled hierarchical B3AZ thin films. It can be stepping stones for the advanced flexible optoelectronic devices. This work was supported by the BK21 plus, BRL2015042417, Mid-Career Researcher Program (2016R1A2B2011041), and Global Ph. D. Fellowship Program (NRF-2016H1A2A1907561) of Republic of Korea.

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