

Rubber Photonic Capsules of Crystalline Colloidal Arrays for Reflective Color Displays

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Display devices operated at reflection mode have been developed and widely used for E-books and signboards due to their high readability, low energy consumption, and clear display even under the sunlight. However, most devices only provide grey scale panel, thereby limiting their applications. To address this problem, we have developed a microfluidic method to create photonic ink capsules. With a glass capillary device, we encapsulate crystalline colloidal arrays (CCAs) into the core of double-emulsion drops in a highly controlled fashion. The photocurable resins are used as middle phase to form solid membrane on the surface of the core. The capsules whose membrane is designed to be elastic and thin are reconfigurable in shape; this enables the dense packing of the capsules with low void fraction. The CCAs in the capsules possess crystalline order in half the wavelength and therefore diffract a light at specific wavelength. Such diffraction colors can be tuned by external electric field, thereby providing great potentials for reflection-mode color displays.