Microfluidic Encapsulation of Cholesteric Liquid Crystals

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Cholesteric liquid crystals (CLCs) have long been studied and used for various photonic applications due to their unique optical properties of photonic bandgap. Encapsulation technology that creates CLC "ink" capsules can provide additional opportunities and therefore remain an important yet unmet need. In this work, we report a microfluidic approach to encapsulate highly viscous CLCs and control their optical properties. Capillary microfluidic devices enable the production of double-emulsion drops composed of a core of CLCs and a shell of photocurable hydrogel prepolymers through single-step emulsification. In-situ photo-polymerization of the prepolymers in the shell leads to formation of hydrogel membranes enclosing the CLCs. The diameters of the core and shell can be precisely adjusted by flow rates of fluids. With paired capillary channels for CLC injection, bandgap wavelength can also be finely tuned by relative flow rates of two distinct CLC streams.