Microfluidic Synthesis of Multicolor Photonic Crystals With Tunable Photonic Bandgaps

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Colloidal photonic crystals (PhCs), the periodic structures of monodisperse colloids, have been increasingly interested due to their selective light reflection properties and potential applications. Recently, Janus colloidal PhCs with two different colors were fabricated via using various sizes or concentrations of colloidal particles. Colloidal PhCs in previous research, however, could have only single or double photonic bandgaps. In this work, colloidal PhCs including multiple photonic bandgaps were synthesized by using cylinder shaped microfluidic device. Cylindrical microfluidic chip with four inlets were prepared by bonding two hemicylindrical channels with two inlets, respectively. When introducing photocurable solution with different sizes of silica particles through each inlet, four parallel flows could be formed and cylindrical microparticles could be fabricated by photopolymerization. Each quarter of photonic crystals display diverse structural colors, which could be controlled by adding magnetic nanoparticles to the photocurable silica suspension and exposing UV light under the magnetic field. Multiple photonic bandgaps of colloidal PhCs could be manipulated by application of external magnetic field.