Self-Organization and Crystallization of Colloidal Particles in Photocurable Droplets

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Self-assembly, which is a governing principle how materials form in nature, has attracted great attention in materials chemistry and soft condensed-matter physics. However, most of self-assembled structures have always contained undesired defects and the overall orientation of their arrangement or packing structure is hard to control.
Recently, we developed the novel route to creating spherical shaped colloidal crystals using emulsion droplet as a geometrical confinement for the self-assembly of colloidal particles. In this study, we report fabrication method of spherical colloidal crystals (or photonic balls) and their photonic characteristics. In order to make photonic balls, we made photocurable emulsion droplets with high concentration of colloidal particles. Particles in droplets were arranged to reduce the total energy of system and formed the onion ring-like structure from surface to core of droplets. Subsequent UV exposure induced solidification of droplets within a few seconds and solidified structure showed unique properties as spherical photonic crystals, unlike usual film structure.