Fabrication of Porous Polymeric Inverse Opal with Silica@PMMA Core-Shell Particles

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Photonic crystals are composed of regularly repeating nanostructures of different dielectric constant. Due to inherent property, photonic band gap, researchers have been developed the applications such as sensing, waveguides, coding, display and so on. To enhance the optical property, inverse opal has been considered due to high contrast of dielectric constants of component. However, multi-steps are needed for preparation of inverse opal by conventional methods. In this study, we proposed a simple route for the fabrication of porous polymeric inverse photonic crystals composed of silica@ poly (methyl methacrylate) (PMMA) core-shell particles. First, mono-disperse silica@PMMA core-shell particles were obtained by Stöber method and emulsion polymerization. Next, we fabricated photonic films with core-shell particles on a silicon wafer pre-washed with Piranha solution and de-ionized water. These films were heated at around glass transition temperature of PMMA and the interstitial space between adjacent particles was filled with rubbery PMMA. Finally the silica-PMMA composite photonic crystals were fabricated and the porous polymeric inverse opal was obtained by treating it with hydrofluoric acid solution to remove the silica particles.