Preparation of Shape-anisotropic Building Blocks for Photonic Crystals

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Self-assembly method for the preparation of photonic bandgap materials has attracted great attention after pioneering work by Yablonovich in 1987. A number of colloidal crystallization methods of monodisperse microspheres have been developed in association with the self-assembly approaches for nanotechnology. Despite unique optical properties of colloidal crystals or their inverted structures, realization of a complete photonic bandgap is still difficult due to the symmetry of photonic crystal lattices. To address this problem, theoretical calculations for the introduction of asymmetry in the lattice of a photonic crystal have been conducted and ellipsoidal polystyrene lattice was prepared by Xia et al. to reduce the symmetry of opaline lattice. However, only lattice spacing between (111) planes of colloidal crystal could be changed. In this study, compressive stress was applied to prepare disk-shaped polystyrene colloidal crystals infiltrated with poly(dimethylsiloxane) aligned along (111) direction of opaline lattice. Scanning electron microscopy was used to observe the deformed shape of composite colloidal crystal. The reflectance spectra of were obtained to observe the change of pseudo-gap with the spectra of the original composite film.