Poster

Fabrication of Opals and Inverse Opals with a Planar Defect

Likui Wang, (George) X. S. Zhao*

Department of Chemical and Biomolecular Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore 117576

Nanoscience and Nanotechnology Initiative, National University of Singapore, 10 Kent Ridge Crescent, Singapore 117576

Email: chezxs@nus.edu.sg

A facile method of fabricating opal and inverse opal structures with a planar defect was demonstrated. A single layer of silica beads was embedded into polystyrene opals by combining an inward-growing self-assembly method with spin-coating technique. After infiltration of silica, followed by removal of the polystyrene beads by calcination, an inverted structure was obtained. The silica beads were connected together by the infiltrated silica, thus a solid silica phase with the silica beads as a planar defect embedded in the inverse silica opal was obtained. The thickness of the defect layer can be adjusted by changing the size of silica beads. Scanning electron microscope images showed good quality of the crystal and uniformity of the defect layer. Optical transmission spectra indicated the existence of defect state induced by the defect layer in both the opal and inverse opal structures. High-cost techniques such as lithography and chemical vapor deposition are not involved in the fabrication of inverse opals with planar defects.

Figures:

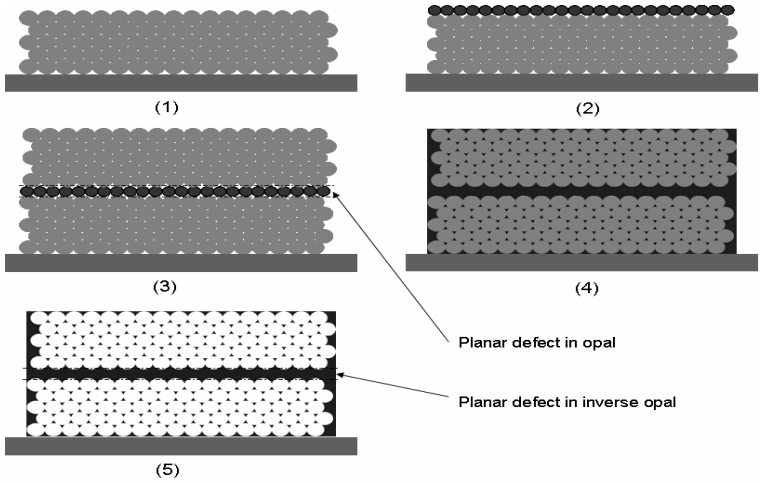

Figure 1. A scheme showing the steps of fabricating a planar defect embedded in an opal and inverse opal: (1) Growth of the first PS multilayer on a glass substrate by using an inward-growing self-assembly method; (2) Spin coating of a monolayer of silica beads on the surface of the PS colloidal crystal; (3) Growth of the second PS multilayer on the surface of the silica beads; (4) Infiltration with silica; (5) Removal of the PS particles by calcination.

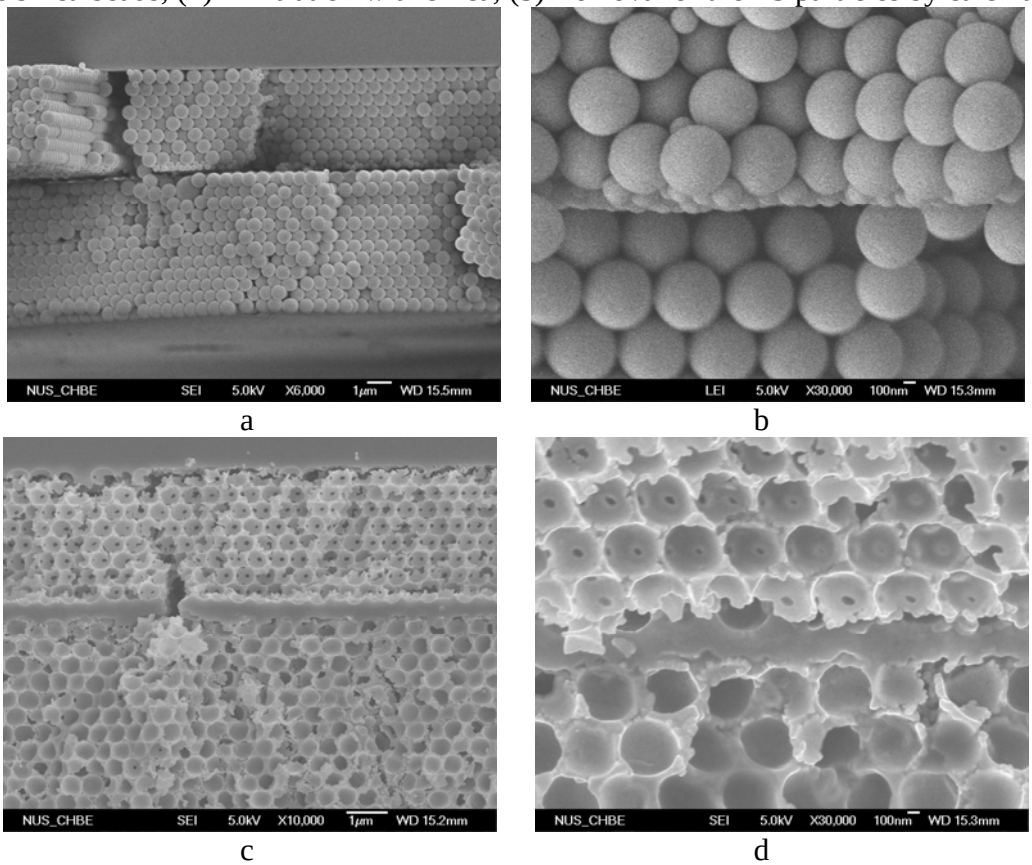

Figure 2. SEM images of an opal with planar defect and its inverted structure: (a, b) 20 layers of 560nm PS spheres embedded with a 225nm silica bead monolayer, low and high magnification; (c, d) the inverted opal sample, low and high magnification.