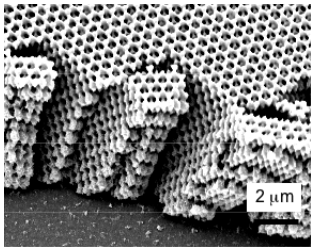
NANOHOUR

Wednesday, October 24, 2007
3:00 PM, Beckman Institute - Room 3269

Fabrication of 3D Silicon-Air Photonic Crystals with Embedded Defects using Multi-beam Interference Lithography

Vinayak Ramanan - Graduate Student in Materials Science and Engineering

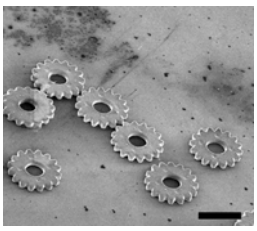


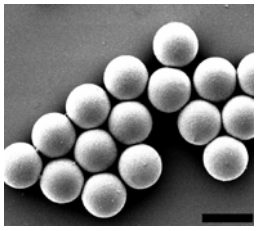
Holographic lithography is an attractive technique for the creation of large area, defect-free, three-dimensional photonic crystals. Structures with potential in photonic applications are fabricated in the photoresist SU-8, through concurrent exposure with 4 non-coplanar coherent beams of laser radiation. The dimensions of the fabricated structures closely match those predicted by full intensity calculations. The polymer–air holographic structure is then used as a template to create higher refractive index contrast photonic crystals by infilling using Atomic Layer Deposition and Low Temperature Static Chemical Vapor Deposition. These photonic crystals exhibit excellent optical properties with strong reflectance peaks at the calculated band gap frequencies. Aperiodic features are also written within the crystals using two-photon polymerization, demonstrating the ability to create designed defect structures such as waveguides in a silicon-air photonic structure fabricated by multi-beam holography.

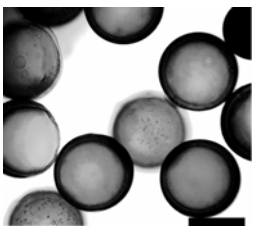
AND

Colloidal Assembly via Microfluidics: Routes to Microgears, Janus Granules, and Granular Shells

Robert Shepherd - Graduate Student in Materials Science and Engineering







The microfluidic assembly of colloid-filled hydrogel components of varying shape and composition is investigated. 1-Fluid, 2-Fluid, and 3-Fluid microfluidic routes are used to form 2D extruded, spheroidal/Janus spheroidal, and hollow sphere geometries respectively. 2D extruded geometries, such as microgears, are formed via Stop Flow Lithography, where a photoactive colloidal suspension is exposed to UV through a photomask within an inverted microscope, polymerizing a background solution of acrylamide and “freezing” the colloids into the extruded negative of the photomask image at rates of 103 min^{-1}. Using similar suspension chemistries, spheroidal colloidal assemblies are formed by shearing the concentrated colloidal suspension in a continuous oil phase to form drops of the colloidal suspension using a (2-Fluid) sheath-flow or a (3-Fluid) double emulsion capillary device. Homogenous and Janus (hemispherically distinct) sphere and disk granules are produced by confining the drops in sheath-flow microchannels of desired geometry while granular shells are produced in a double emulsion micro-capillary device. To preserve their drop structure, photopolymerization of the acrylamide-based hydrogel solution is carried out immediately after drop-breakup. Representative drops and dried granules are imaged using fluorescence and scanning electron microscopy to probe their structural evolution during assembly.

Coffee and cookies will be served.
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