Self-Assembly of Porous and Composite Thin Film Nanostructures

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One goal of this task is the development of new synthesis and processing strategies that enable control of thin film pore size, pore size distribution, pore alignment and connectivity. A second goal is the development of efficient routes to thin film composite architectures. To achieve these goals, we exploit novel processing techniques like evaporation induced self-assembly, field directed self-assembly, and templated or confined nucleation and growth. By coupling these bottom-up strategies with top down approaches like lithography, stamping, and micro molding, we propose to synthesize new classes of hierarchical materials. Work continues on the development of self-assembled photosensitive nanostructures by incorporation of optically switchable moieties and various optically patternable reagents. The underlying processes for the demonstrated gray-scale patterning of pore size, refractive index, and hydrophobicity are being studied. Surfactant self-assembly is used to co-organize organic and inorganic precursors into 1-, 2-, and 3-dimensional conjugated polymer nanocomposite architectures and establish structure-property relationships (optical, electronic, and mechanical). Self-assembly and phase separation techniques create hierarchical porous and composite films with controlled structures and porosities.