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Ordered Inorganic/Organic Composites via Novel Templates and Techniques

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The fabrication of well ordered nanocomposite materials offers new opportunities for device applications. Recently we reported that nanostructured templates with sub-10 nm domains can be easily obtained through the blending of disordered polymer surfactants containing poly(ethylene oxide) as the hydrophilic block with homopolymers including poly (acrylic acid), poly (4-vinyl phenol) and poly (styrene sulfonate) that selectively associate with the PEO block through hydrogen bonding. These inexpensive blends are strongly segregated, yielding well ordered domains. Moreover, the functionalities imparted by the homopolymers provide convenient handles for binding active materials such as nanoparticles and for promoting in situ, phase selective reactions to produce hierarchical metal oxide polymer composites. The behavior of the template systems and their use for the fabrication of well ordered polymer/nanoparticle, metal/oxide polymer, and metal oxide/polymer/nanoparticle composites using aqueous routes or via the 3-D replication of the template structure in supercritical fluids will be discussed.