Silica-based organic-inorganic hybrid material macroprecursors: Synthesis, Self-assembly and Hydrolysis-Condensation

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Among the several ways to obtain organic–inorganic hybrid materials, the sol-gel process, which relies on base- or acid-catalyzed hydrolysis and condensation reactions of metal alkoxides, is frequently used. This technique can be easily combined with organic polymerization to produce a variety of organic/inorganic nanostructured materials. Along this line, block copolymers with reactive alkoxysilyl groups has recently attracted much interest within the polymer community [1-3].

Herein, a series of poly(acryloxy propyl triethoxysilane)/poly(styrene)-based diblock and triblock copolymers of various compositions and molecular weights were synthesized by nitroxide mediated polymerization (NMP) and characterized by the usual techniques. These gelable block copolymers were then self-assembled in a dioxane-methanol mixture to obtain spherical micelles [4]. TEM, SLS and DLS were used to study the morphology and determine the sizes of the particles before and after crosslinking while the kinetics of hydrolysis/condensation reaction of the reactive block was followed by liquid state 1H and 29Si NMR.

Moreover, the bulk microphase separation was studied for the above-mentioned triblock copolymers and ordered structures as lamellae and cylinder were realized according to TEM and SAXS analysis. The obtained morphologies were frozen by acid-catalyzed hydrolysis-condensation of poly(acryloxy propyl triethoxysilane) domains and characterized by DSC, TGA, FT-IR and solid state 29Si NMR.

References