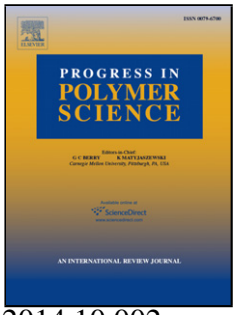

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Block Copolymer–Nanoparticle Hybrid Self-Assembly

*Tobias N. Hoheisel[1], Kahyun Hur[1,2], Ulrich B. Wiesner[1]**

[1]Department of Material Science and Engineering, Cornell University, Ithaca, New York 14853, United States

[2]Present Adress: Institute of Multidisciplinary Convergence of Materials, Korea Institute of Science and Technology, Seoul 136-791, Republic of Korea

Corresponding author. Email: ubw1@cornell.edu; Tel: +1-607-255-3487; Fax: +1-607-255-2365

Abstract

Polymer-inorganic hybrid materials provide exciting opportunities as they may display favorable properties from both constituents that are desired in applications including catalysis and energy conversion and storage. For the preparation of hybrid materials with well-defined morphologies, block copolymer-directed nanoparticle hybrids present a particularly promising approach. As will be described in this review, once the fundamental characteristics for successful nanostructure formation at or close to the thermodynamic equilibrium of these nanocomposites are identified, the approach can be generalized to various materials classes. In addition to the discussion of recent materials developments based on the use of AB diblock copolymers as well as ABC triblock terpolymers, this review will therefore emphasize progress in the fundamental understanding of the underlying formation mechanisms of such hybrid materials. To this end, critical experiments for, as well as theoretical progress in the description of these nanostructured block copolymer-based hybrid materials will be discussed. Rather than providing a comprehensive overview, the review will emphasize work by the Wiesner group at Cornell University, US, on block copolymer-directed nanoparticle assemblies as well as their use in first potential application areas. The results provide powerful design criteria for wet-chemical synthesis methodologies for the generation of functional nanomaterials for applications ranging from microelectronics to catalysis to energy conversion and storage.

Keywords

Aluminosilicate, Mesoporous, Mesostructure, Structure-direction, Self-consistent field theory, Co-assembly