Solution study of novel diblock copolymers: Morphology and structural transition

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Abstract

The solution behavior and morphology of the nanostructures formed by novel block copolymers based on 1-cetyl[2-(acryloyloxy)ethyl]dimethylammonium bromide (ADHA) and 2-hydroxyethylacrylate (HEA) or N-isopropylacrylamide (NIPAM) have been studied using small angle X-ray scattering (SAXS), dynamic light scattering (DLS), and transmission electron microscopy (TEM). In these block copolymers the pADHA block consists of long hydrophobic C-16 tails connected to a positively charged quaternary ammonium group, making it amphiphilic, while the second block is either fully hydrophilic (pHEA) or thermoresponsive (pNIPAM). Using SAXS, we demonstrate that the morphology of block copolymer nanostructures is dependent on the solute concentration and on the length and composition of the blocks. In the case of thermoresponsive pADHA-b-pNIPAM, two types of ordered structures are formed and their characteristics are also defined by the temperature. Complementary information is obtained from DLS, showing large particles with the size up to 280 nm, which is beyond the resolution of the SAXS data. Loss of ordering around the lower critical solution temperature followed by ordering restoration at the higher temperature was observed for the pADHA-b-pNIPAM block copolymers. The differences in the structural order in the block copolymer solutions are directly related to their ability to coat hydrophobic metal nanoparticles. (C) 2013 Elsevier Ltd. All rights reserved.

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