Nanocomposites and nanomaterials

Micellar and micelle-like structures of block and graft copolymers and polymer/inorganic hybrids as effective nanoreactors for synthesis of silver nanoparticles

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The noble metal nanoparticles dispersed in polymeric matrices are significant interest due to special optical, electrical, binding and disinfecting properties that allow considering them as the advanced materials of modern nanotechnologies. The formation of nanoparticles with necessary size and shape and also the nanoparticle stabilization against aggregation in polymer/metal compositions or solutions are the main important problems for their successful application.

In the present work, we have studied and compared the processes of silver nanoparticle (AgNP) synthesis by borohydride reduction of Ag+-ions in aqueous solutions of some micelle-forming block and graft copolymers and polymer/inorganic hybrids (MOPEO-*b*-PAAm, PAAm-*b*-PEO-*b*-PAAm, PVA-*g*-PAAm and SiO_2-*g*-PAAm) contained poly(ethylene oxide) (M_v=6 kDa), its monomethyl ether (M_v=5 kDa), poly(vinyl alcohol) (M_v=90 kDa) or silica nanoparticles (R_g=7.7 nm) and chemically complementary polyacrylamide.

The effects of chemical nature, molecular architecture and concentration of polymeric matrices and also the content of silver nitrate on the reaction parameters, size, morphology and stability of Ag-nanoparticles in aqueous solutions were established using ^{1}H NMR and UV-Vis spectroscopy, WAXS, SAXS and TEM methods. The block and graft copolymers and the polymer-inorganic substances were shown to be effective nanoreactors, which were capable of ensuring the high rate and efficacy of chemical reduction of Ag+-ions up to nanoparticles with the 2-5 nm size and narrow size distribution. The compositions of MOPEO-*b*-PAAm, PAAm-*b*-PEO-*b*-PAAm, PVA-*g*-PAAm and SiO_2-*g*-PAAm with AgNP demonstrated the two-level fractal organization of their structure.