

Synthesis and characterization of polyaniline derivative and silver nanoparticle composites

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Abstract

There has been a recent surge of interest in the synthesis and applications of electroactive polymers with incorporated metal nanoparticles. These hybrid systems are expected to display synergistic properties between the conjugated polymers and the metal nanoparticles, making them potential candidates for applications in sensors and electronic devices. Composites of polyaniline derivatives – polyaniline, poly(2,5-dimethoxyaniline) and poly(aniline-2,5-dimethoxyaniline) – and silver nanoparticles were prepared through simultaneous polymerization of aniline derivative and reduction of AgNO₃ in the presence of poly(styrene sulfonic acid) (PSS). We used AgNO₃ as one of the initial components (1) to form the silver nanoparticles and (2) as an oxidizing agent for initiation of the polymerization reaction. UV-visible spectra of the synthesized nanocomposites reveal the synchronized formation of silver nanoparticles and polymer matrix. The morphology of the silver nanoparticles and degree of their dispersion in the nanocomposites were characterized by transmission electron microscopy. Thermogravimetric analysis and differential scanning calorimetry results indicate an enhancement of the thermal stability of the nanocomposites compared to the pure polymers. The electrical conductivity of the nanocomposites is in the range 10^{-4} to 10^{-2} Scm⁻¹.