In situ prepared polypyrrole–Ag nanocomposites: optical properties and morphology

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Abstract

Polypyrrole–silver (PPy–Ag) nanocomposites with various silver contents have been synthesized via a kinetically favorable one-step chemical oxidative polymerization process. The oxidant, ammonium persulfate, was used to oxidize pyrrole monomer for growing chains of PPy. And AgNO3 was used as a precursor for metallic silver nanoparticles. The detailed characterization techniques, UV–Vis–NIR, fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy, X-ray diffraction spectroscopy, field-emission scanning electron microscopy, and transmission electron microscopy (TEM), have been used to reveal electronic environment, structure, and morphology of composites as well as as-synthesized PPy. The synthesis environment prior to polymerization has also been investigated by absorption spectroscopy. The TEM images of PPy–Ag nanocomposites reveal that silver nanoparticles are deeply embedded into the polymer matrix in addition to surface adsorption. It is observed that the size distribution of inorganic nanoparticles (ca. 4–10 nm, depending on the metal ion concentrations) as well as structural morphology is altered by the initial concentrations of silver ions.