Two-step synthesis of polymer nanocomposites with controllable size of nanoparticles

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Polymer composites containing metal nanoparticles are promising materials with unique optical, electrical and catalytic properties. Simple method of metal-polymer nanocomposite fabrication is proposed. The polyelectrolyte chains grafted to the polymer backbone are used as the nanoparticles precursors. Metal ions inside the spatially confined volume of the graft chains can be easily reduced by both chemical and radiochemical methods with the formation of metal nanoparticles in situ. Variation of grafting degree, length and density of graft chains allows to stabilize metal nanoparticles against their aggregation and oxidation, to control their size and morphology.

As a result of radiation-induced graft polymerization of acrylic acid monomers onto poly (tetrafluoroethylene-co-hexafluoropropylene (FEP) film and subsequent ion-exchange and reduction stages the FEP-Ag and FEP-Co nanocomposites were obtained. The formation of polymer nanocomposites was confirmed by SEM, XRD method, and UV spectroscopy. It was found that the size and morphology of metal nanoparticles, as well as color and spectroscopic characteristics of nanocomposite films strongly depend on experimental condition during the ion-exchange stage.