

Surface Modification of Silica Nanoparticles with Hydrophilic Polymers

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Silica (SiO₂) nanoparticles grafted with a water-soluble polymer, i.e. nonionic poly(oxyethylene methacrylate) (POEM) and ionic poly(styrene sulfonic acid) (PSSA) were prepared via a three-step synthetic approach; 1) the activation of silanol group (-OH) in the surface of SiO₂ nanoparticles, 2) surface modification to chlorine (-Cl) group and 3) graft polymerization from nanoparticles via atom transfer radical polymerization (ATRP). The successful synthesis and chemical compositions in the modified SiO₂ nanoparticles were confirmed using FT-IR, UV-visible spectroscopy and X-ray photoelectron spectroscopy (XPS). Thermogravimetric analysis (TGA) results indicated that the grafting amounts of polymer in the nanoparticles were 5 and 8 wt% for POEM and PSSA, respectively. X-ray diffraction (XRD) showed that the grafting of polymers did not significantly alter the microstructure of SiO₂ nanoparticles. Grafting of water-soluble polymer improved the dispersion properties of nanoparticles in alcohol, as verified by scanning electron microscopy (SEM).