Nanocomposites and nanomaterials

Characterization and aging effect of silver and gold sols synthesized in aqueous solution of branched and linear polyacrylamides

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Recently years silver and gold nanoparticles (AgNPs and AuNPs) attract significant attention due to their unique optical, thermal, electrical properties and prospects of biomedical application. Ag and Au NPs raise difficulties in developing stable colloidal dispersion, since nanoparticles undergo agglomeration.

The present study focuses on the formation and properties of silver and gold sols synthesized by wet reduction method in noncharged and anionic linear and branched polyacrylamide polymer matrices. The UV-Vis spectroscopy revealed the formation of nanoparticles by exhibiting the typical surface Plasmon absorption maxima for both metallic nanoparticles. Transmission electron microscopy and Zeta-sizer were used for analysis of nanoparticle size distribution in silver and gold sols. It was established that branched polymer matrices were more efficient for in situ AgNPs and AuNPs synthesis as well as for stabilization of these sols in comparison with linear ones. Special emphasis was placed on the aging effect of these systems, namely, size changes of Ag and AuNPs during 3 months. It was observed that the most significant changes of Ag and AuNPs size distribution take a place during the first month of observation. Average nanoparticles size changes from 4-8 to 10-12 nm and the aging process depends on polymer matrix type. Moreover, it was proved that size distribution and the aging process is strongly depending on the nature of polymeric stabilizer. Branched polyelectrolyte matrices allow to synthesize AuNPs with higher content of small particles (4-5 nm) while it was impossible to synthesize stable sol in the case of linear anionic PAA.