

The Preparation of Silver Nanoparticles on Functionalized Mesoporous Silica by In situ Formation of Adsorbed Silver Ions

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Mesoporous silica (MS) with large pores (about 6 nm) and thiol functionalized mesoporous silica (TFMS) obtained by functionalization of 3-mercaptopropyltrimetoxysilane (MPTMS) were synthesized. ²⁹Si MAS NMR, TG and FT-IR confirmed the functionalization of MPTMS on the surface of mesoporous silica, and the amount of silver loading on the TFMS in various concentrations of AgNO₃ in aqueous solution was investigated. Silver nanoparticles were prepared by two methods: (1) direct reduction of Ag⁺ ions with NaBH₄ in aqueous AgNO₃ solution containing MS, (2) in situ reduction of Ag⁺ ions adsorbed on TFMS with NaBH₄. The characteristics of products from both methods were compared using SAXRD, TEM, N₂ adsorption-desorption and UV-vis absorption spectroscopy. Ag nanoclusters were mostly confined and dispersed in the channels of the TFMS and their sizes were under 6 nm. However, Ag nanoparticles on the MS formed outside the mesoporous channels rather than within them.