MICROSTRUCTURE AND PROPERTIES OF ALLOYED SILVER-GOLD NANOPARTICLES

O.Prymak[1], S.Ristig[1], W.Meyer-Zaika[1], D.Raabe[2], M.Epple[1]

[1]Institute of Inorganic Chemistry and Center for Nanointegration Duisburg-Essen (CeNIDE), University of Duisburg-Essen, Essen, Germany
[2]Microstructure Physics and Alloy Design, Max-Planck-Institut für Eisenforschung, Max-Planck-Str. 1, 40237 Düsseldorf, Germany

Abstract

Alloyed silver-gold nanoparticles recently raised an interest in biomedicine as potential antibacterial and surface-functionalized agents for imaging, drug-delivery, and tumor thermo-therapy [1,2]. The here synthesized alloyed AgAu nanoparticles with different compositions of silver and gold, as determined by atomic absorption spectroscopy (AAS), were prepared by reduction with citrate and tannic acid in aqueous media and subsequently functionalized by the addition of polyvinylpyrrolidone (PVP) [3]. UV spectroscopy confirmed that the particles consisted of alloyed Ag:Au and are not of a separate core-shell structure. The resulting nanoparticles were monodisperse and had a uniform size of ~6 nm, except pure Ag and Ag:Au-90:10, as shown by differential centrifugal sedimentation (DCS) and transmission electron microscopy (TEM). By means of X-ray powder diffraction (XRD) and use of Rietveld refinement [4], the precise lattice parameters, crystallite size and microstrain were determined. Based on the results by XRD, DCS and TEM it was shown, that the nanoparticles were not twinned, except pure Ag and Ag:Au-90:10. Additionally, a distinct deviation from Vegard's linear rule of alloy mixtures for the lattice parameter was found for the nanoparticles. This effect was also found for AgAu bulk materials, but was much more pronounced in the nanostate. Further investigations of the crystal structure of the alloyed nanoparticles by means of synchrotron radiation might be helpful to gain more information about the interactions of silver and gold atoms.

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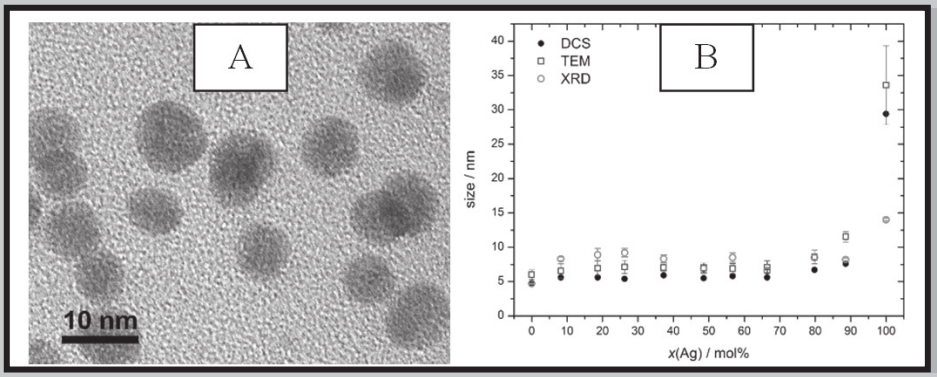

FIG. 1. (A) Representative TEM image of Ag:Au-40:60 nanoparticles, stabilized with PVP and (B) average particle size from DCS (hydrodynamic diameter), TEM (metallic core), and XRD (crystallite size).

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CALCIUM PHOSPHATE NANO-PARTICLES FOR DELIVERING SYNTHETIC DRUG MOLECULES ACROSS THE CELL MEMBRANE

O.Rotan[1], V.Sokolova[1], T.Schrader[2], M.Epple[1]

[1]Institute for Inorganic Chemistry and Center for Nanointegration, University of Duisburg-Essen, Universitätsstr.7, 45117 Essen, Germany
[2]Institute of Organic Chemistry, University of Duisburg -Essen, Universitätsstr.7, 45117 Essen, Germany

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Introduction

Many synthetic drug molecules have their targets sites inside the cells. Typically, large molecules are not able to cross the cell membrane on their own and in order to bring them across it, an efficient carrier is needed [1]. We have loaded calcium phosphate nanoparticles with different synthetic drug molecules, i.e. a polyfunctional anionic polymer, a cationic calixarene dimer and a molecular tweezers. A polyfunctional anionic polymer was developed for selective inhibition of lysozyme as a model of enzyme inhibition [2]. A calixarene dimer due to its chemical and topological characteristics has the ability to specifically bind to the major groove of the DNA molecule that result in cell death [3]. Molecular tweezers inhibit the specific protein-protein interactions that lead to the formation of amyloidogenic aggregates inside the cells[4]. These aggregates are the cause of multiple incurable diseases, for example, Alzheimer's disease, Parkinson's disease and type-2 diabetes [5].