Colloids and Surfaces A: Physicochem. Eng. Aspects 415 (2012) 281–287

Contents lists available at SciVerse ScienceDirect

Colloids and Surfaces A: Physicochemical and Engineering Aspects

journal homepage: www.elsevier.com/locate/colsurfa

Synthesis and characterization of Ag/Au alloy and core(Ag)–shell(Au) nanoparticles

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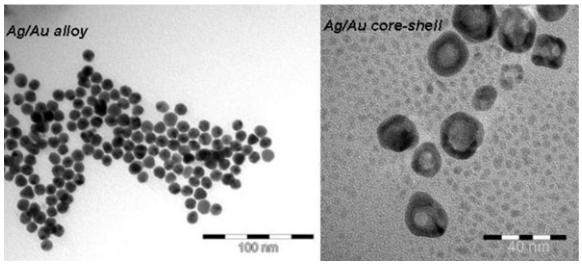
HIGHLIGHTS

- Ag/Au alloys and core–shell type NPs with various compositions were synthesized
- The HRTEM images clearly confirm the core–shell structure of NPs.
- Small AuNPs are also formed along the synthesized core–shell nanoparticles.
- Size of Ag/Au NPs can be controlled with the molar ratio of silver and gold atoms.
- The plasmon band of alloys can be tuned by varying the ratio of metals.

GRAPHICAL ABSTRACT

Representative TEM images of silver–gold alloys and core(Ag)–shell(Au) type nanoparticles.



ARTICLE INFO

Article history:
Received 17 July 2012
Received in revised form 6 September 2012
Accepted 7 September 2012
Available online 2 October 2012

Keywords:
Silver–gold nanoparticles
Alloy
Core–shell
Structural analysis

ABSTRACT

Bimetallic silver–gold nanoparticles (NPs) with different structures were prepared. Namely, silver–gold alloy and core(Ag)–shell(Au) type nanoparticles were synthesized at various Ag/Au ratios using only sodium citrate as reductant without any stabilizers. The synthesized NPs were characterized by different structure analysis methods. The unique optical properties of these NPs were studied by UV–vis spectroscopy. For Ag/Au alloy NPs the λ_{max} values are linearly tunable from ~408 nm to 525 nm depending on the composition. The plasmon band of core–shell NPs can be shifted to higher wavelengths by depositing a gold shell with increasing thickness. The HRTEM images clearly confirm the two different structures of the NPs. We found that the size of alloy nanoparticles decrease from d ~15 nm to d ~8 nm with the increase in gold content. In contrast, core(Ag)–shell(Au) type NPs with progressively increasing size (d = 13–16 nm) along with separately formed smaller gold NPs were formed.

1. Introduction

Because of the unique optical, electric, magnetic and catalytic properties of noble metal nanoparticles (NPs) – especially gold and silver – they have been intensively studied for the last 10–15 years as potent biosensors or novel optical and electronic devices. Moreover, gold nanoparticles (AuNPs) also play an important role in numerous fields of biomedical applications (e.g. diagnostics, sensing, in vitro and in vivo imaging and therapeutics techniques)

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http://dx.doi.org/10.1016/j.colsurfa.2012.09.005