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PII: S0167-577X(14)01284-1
DOI: http://dx.doi.org/10.1016/j.matlet.2014.07.034
Reference: MLBLUE17366

To appear in: *Materials Letters*

Received date: 10 April 2014
Accepted date: 5 July 2014

Cite this article as: Chidambaram Siva, Chandrasekaran Nivedhini Iswarya, Pari Baraneedharan, Muthusamy Sivakumar, L-cysteine assisted formation of mesh like Ag_2S and Ag_3AuS_2 nanocrystals through hydrogen bonds, *Materials Letters,* http://dx.doi.org/10.1016/j.matlet.2014.07.034

L-Cysteine assisted formation of mesh like Ag_2S and Ag_3AuS_2 nanocrystals through hydrogen bonds

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Abstract

Biomolecules assisted formation of inorganic nanostructures facilitates the electrostatic stabilization and thus impact in the material properties. We have studied the Ag^0 nuclei mediated synthesis of Ag_2S nanocrystals, where L-Cysteine is utilized as sulfur source. Also, we have obtained the novel Ag_3AuS_2 nanocrystals by adopting the gold ions in the L-Cysteine assisted Ag_2S formation. From the XRD patterns, the crystal sizes of Ag_2S and Ag_3AuS_2 nanocrystals are calculated as 6.5 nm and 13 nm respectively. FT-IR results revealed that, Ag_2S and Ag_3AuS_2 nanocrystals were interconnected themselves with L-Cysteine molecules through hydrogen bonding. Interestingly, the mesh like interconnected morphology has been observed in HR-TEM images in both Ag_2S and Ag_3AuS_2 nanocrystals. The HRTEM images shows the average particle size of 5.2 nm for Ag_2S and 9.1 nm for Ag_3AuS_2 nanocrystals.

Keywords: Biomaterials, L-Cysteine, Ag_2S, Ag_3AuS_2, Hydrogen bonds, Nanocrystalline materials

1. INTRODUCTION

The ability of the organosulphur compounds (including those with sulfhydryl and disulfide moieties) to attach strongly to certain metallic surfaces, creates the modified interfaces with unique properties. These biomolecule conjugated metallic surfaces may find significant applications in several areas such as chemical sensing, catalysis and electrochemical reactions [1-4]. One of the water soluble amino acid available in natural sources, L-Cysteine is highly reactive, due to the presence of sulfur in the form of sulfhydryl. The hydrogen in a sulfhydryl group of L-Cysteine can be easily replaced by cations or metal surfaces to form a covalent bond. The functional groups of L-Cysteine are useful in resulting enzymatic reactions, metal conjugation, capping the particle to prevent the agglomeration, which influences in the applications such as