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Preparation of Cu_2O and Cu_2O@Cu Core-Shell Nanostructures by a Simple Chemical Technique

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Extended Abstract

Cuprous oxide (Cu_2O) and core-shell Cu_2O@Cu nanostructures have been synthesized by a facile wet-chemical approach using aqueous solution of copper (II) sulfate ($CuSO_4$), L-ascorbic acid ($C_6H_8O_6$) and potassium hydroxide (KOH). The short synthesis time of one minute and the effects of solvent temperature on the crystal structure, morphology and optical properties of the synthesized nanostructures have been studied. The structural and optical studies showed the nanoparticles prepared at room temperature is phase pure crystalline Cu_2O material with band gap energy of 2.08 eV. The morphological studies of the samples prepared at solvent temperatures of 40 ^oC, 60 ^oC, and 80 ^oC showed the core-shell nature of the synthesized Cu_2O@Cu nanostructure. The X-ray diffraction and X-ray photoelectron spectroscopy (XPS) studies confirm the increase of Cu content with the increase of solvent temperatures from 40 ^oC to 80 ^oC.

Core-shell nanostructures have much potential in many applications because of their novel chemical, physical, electrical and optical properties[1]. Various core-shell nanostructures have been obtained previously by Kirkendall effect and Ostwald ripening process [2,3]. The elemental Cu as a shell has been reported to play a crucial role in many reactions due to its high activity.

In this work, a simple, facile approach was used to prepare core-shell Cu_2O@Cu nanostructures in one minute. To the best of our knowledge, such method has not yet been reported and could be used to synthesize other core-shell materials.

The morphological analysis showed the solvent temperature-dependent core-shell features of the synthesized Cu_2O@Cu core-shell nanoparticles with elliptical and oval shapes, and different sizes. The structural and composition analyses revealed the presence of pure phase Cu_2O (at RT), and Cu_2O@Cu with increased amount of Cu content with increase of the solvent temperature.

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