

Accepted Manuscript

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PII: S0167-577X(18)30433-6

DOI: <https://doi.org/10.1016/j.matlet.2018.03.069>

Reference: MLBLUE 24030

To appear in: *Materials Letters*

Received Date: 15 December 2017

Revised Date: 26 February 2018

Accepted Date: 12 March 2018



Please cite this article as: J.E. Samaniego-Benitez, A. Garcia-Garcia, R. Ramirez-Bon, Synthesis of Coppers Sulfite hexapods by simple hydrothermal route, *Materials Letters* (2018), doi: <https://doi.org/10.1016/j.matlet.2018.03.069>

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Synthesis of Coppers Sulfite hexapods by simple hydrothermal route

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Abstract

In this work, the obtaining of $\text{Cu}_{7.2}\text{S}_4$ hexapods by a hydrothermal process of two stages is reported. First, hexapods of Cu_2O were obtained using copper chloride, and then in the second stage, sodium sulfite was used at different weight ratios in relation with Cu_2O for the transformation into $\text{Cu}_{7.2}\text{S}_4$. The XRD, SEM, Raman, and XPS studies show that at 1:1 weight-ratio the conversion is not completely achieved and the presence of the two phases in the hexapod is detected. By increasing the weight-ratio to 1:2, $\text{Cu}_{7.2}\text{S}_4$ hexapods with smooth surface were totally transformed into $\text{Cu}_{7.2}\text{S}_4$ ones with modified surface completely covered by nanosheets.

Keywords: Copper sulfite, Hexapods, Hydrothermal, Microstructures.

1.-Introduction

Copper sulfide micro-/nanostructures are actually among the most studied materials due to their versatility, availability and low-toxicity nature[1,2]. These structures have a wide field of applications such as photocatalysis, energy conversion, and biomedicine[3–9]. To date, it has been reported different routes for the synthesis of such materials as hydrothermal, electrodeposition, microwave irradiation, thermolysis, or template-assisted approaches[1]. By controlling the synthesis parameters is possible to obtain micro/nanostructured Cu_{2-x}S with different morphologies as zero-dimensional (0D), one-dimensional (1D), two-dimensional (2D) and three-dimensional (3D) (supplementary information). In this work, we report the production of $\text{Cu}_{7.2}\text{S}_4$ hexapods through a two-stage hydrothermal route; and their structural characterization during the transformation from oxide to sulfide compound. The objective of this study is to synthesize Cu_2S microstructures through the transformation of Cu_2O ones to expand the number of different morphologies which can be obtained from these materials and consequently, also their applications.

2.-Experimental.

The synthesis of the Cu_2S hexapods was carried out in a two steps process. The first stage consists of the synthesis of Cu_2O hexapods by the hydrothermal route[10,11] dissolving 7.5g of KHCO_3 , 1.35g of $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$, 1.05g of $\text{C}_6\text{H}_{12}\text{O}_6$ and 1.125g of CuCl_2 in 75ml of deionized water. The solution was transferred into a Teflon-lined autoclave and heated at 120°C for 16 hours. The resulting red precipitate was collected, washed and dried at 125°C for 4 hours; this sample was labeled as M1. For the Cu_2O to Cu_2S transformation, Na_2SO_3

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