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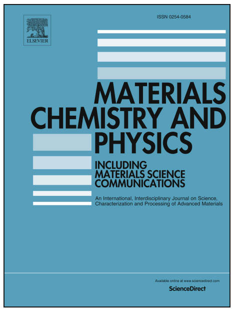

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Purity and crystallinity of microwave synthesized antimony sulfide microrods

Claudia Martínez-Alonso[1,]*, Eliot U. Olivos-Peralta[2], Mérida Sotelo-Lerma[3], Roberto Y. Sato-Berrú[4], S. A.Mayén-Hernández[1], HailinHu[2,#]

[1]Facultad de Química, Universidad Autónoma de Querétaro,Querétaro, Querétaro, 76010, México.

[2]Instituto de Energías Renovables, Universidad NacionalAutónoma de México, Temixco, Morelos, 62580, México.

[3]Universidad de Sonora, Hermosillo, Sonora, 83000, México.

[4]Centro de Ciencias Aplicadas y Desarrollo Tecnológico, Universidad Nacional Autónoma de México, MéxicoD.F., 04510, México.

E-mails: *claudiamartinezalonso30@gmail.com; #hzh@ier.unam.mx

Abstract

Antimony sulfide (Sb_2S_3) is a promising semiconductor material for solar cell applications. In this work, microrods of Sb_2S_3 were synthesized by microwave heating with different sulfur sources, solvents, temperature, heating rate, power, and solution concentration. It was found that 90% of stoichiometric Sb_2S_3 can be obtained with thiourea (TU) or thioacetamide (TA) as sulfur sources and that their optical band gap values were within the range of 1.59 to 1.60 eV. The most crystalline Sb_2S_3 were obtained by using TU. The morphology of the Sb_2S_3 with TU the individual rods were exhibited, whereas rods bundles appeared in TA-based products. The solvents were ethylene glycol (EG) and dimethylformamide (DMF). EG generates more heat than DMF during the microwave synthesis. As a result, the Sb_2S_3 obtained with EG contained a larger percentage of oxygen and smaller crystal sizes compared to those from DMF. On the other hand, the length and diameter of Sb_2S_3 microrods can be increased by applying higher heating power although the crystal size did not change at all. In summary, pure and highly crystalline Sb_2S_3 microrods of 6 to10 μm long and 330 to 850 nm in diameter can be obtained by the microwave method with a careful selection of chemical and thermodynamic parameters of the synthesis.

Keywords: antimony sulfide, microrods, optical band gap, microwave heating.