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## Purity and crystallinity of microwave synthesized antimony sulfide microrods

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### Abstract

Antimony sulfide ( $\text{Sb}_2\text{S}_3$ ) is a promising semiconductor material for solar cell applications. In this work, microrods of  $\text{Sb}_2\text{S}_3$  were synthesized by microwave heating with different sulfur sources, solvents, temperature, heating rate, power, and solution concentration. It was found that 90% of stoichiometric  $\text{Sb}_2\text{S}_3$  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  $\text{Sb}_2\text{S}_3$  were obtained by using TU. The morphology of the  $\text{Sb}_2\text{S}_3$  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  $\text{Sb}_2\text{S}_3$  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  $\text{Sb}_2\text{S}_3$  microrods can be increased by applying higher heating power although the crystal size did not change at all. In summary, pure and highly crystalline  $\text{Sb}_2\text{S}_3$  microrods of 6 to 10  $\mu\text{m}$  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.

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