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NOTES

Chemical Methods for the Deposition of Thin Films of Sb_2Se_3

Thin film deposition of bismuth chalcogenides (*1*, *2*), lead chalcogenides (*3*, *4*), lead oxide, and thallium oxide (*5–7*) etc. by chemical method has been reported. But a thorough literature search has found no reported chemical deposition method for the thin films of Sb_2Se_3. This short note describes the authors' successful attempt in deposition of Sb_2Se_3 thin films by chemical means.

A sodium selenosulfate solution is prepared by refluxing 5 g selenium powder with 12 g of sodium sulfite (anhydrous) in 200 ml of water for about 10 hr and subsequently cooling for 10–12 hr. On cooling, a little selenium separates out from the solution. It is then filtered to obtain a clear solution. Twenty-two grams of potassium antimonyltartrate is dissolved in 250 ml water to obtain a saturated solution of potassium antimonyltartrate.

Deposition of antimony selenide thin films. Twenty-five milliliters Sb^{3+} solution is taken in a glass beaker, 2.5 m triethanolamine and 30 ml 17(*N*) NH_4OH are added to it and stirred. To this solution 12.5 ml sodium–selenosulfate solution is added. Two cleaned glass slides (degreased and rinsed in running distilled water) are placed. When it is kept at room temperature (30°C) for about 10 hr, uniform thin films of Sb_2Se_3 are obtained on the glass substrates. They are then taken out, washed with water, and dried in open air. The Sb_2Se_3 films are found to be $9-12 \times 10^{-5}$ cm thick.

Film thickness was measured by the Fizeau method of interference fringes using a sodium vapor lamp and also from the difference in weight assuming that the density of the film is the same as that of the bulk.

X-ray diffraction data for Sb_2Se_3 show that films are amorphous in nature. The composition of the film is confirmed by the atomic absorption spectrophotometer method and gravimetric analysis. Scanning electron micrographs reveal random distribution of small crystallites for the films. Specific resistance of the films measured by the four-probe method and also by an electrometer amplifier (E A815) (Serial 088, Electronics Corporation of India Limited) are of the order of 10^7 ohm-cm. An optical band gap of Sb_2Se_3 is found to be 1.88 eV from electronic spectra at room temperature (30°C).

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P. PRAMANIK*
R. N. BHATTACHARYA

Department of Chemistry
Indian Institute of Technology, Kharagpur,
Kharagpur 721302, India

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* Author to whom correspondence should be addressed.

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