

## Electrical properties of a-antimony selenide

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**Abstract.** This paper reports conduction mechanism in a-Sb<sub>2</sub>Se<sub>3</sub> over a wide range of temperature (238 to 338 K) and frequency (5 Hz to 100 kHz). The d.c. conductivity measured as a function of temperature shows semiconducting behaviour with activation energy  $\Delta E = 0.42$  eV. Thermally induced changes in the electrical and dielectric properties of a-Sb<sub>2</sub>Se<sub>3</sub> have been examined. The a.c. conductivity in the material has been explained using modified CBH model. The band conduction and single polaron hopping is dominant above room temperature. However, in the lower temperature range the bipolaron hopping dominates.

**Keywords.** Chalcogenide glasses; amorphous semiconductors; a.c. conductivity; electrical properties.

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### 1. Introduction

During the last few years amorphous semiconductors have been used in the manufacture of solar cells, batteries and phototransistors as well as in some steps of technological processing of very large scale integration (VLSI) microelectronics circuits [1]. Thermally induced structural and electrical effects are known to be important in inducing the memory phenomenon in semiconducting chalcogenide glasses [2–6]. Alzewel *et al* [7, 8] have studied the electrical conductivity of powdered antimony chalcogenides. Antimony alloys have received great attention in the past due to semiconductivity of Sb concentration. It was reported by Mott and Devis [9] that the effect of Sb in Se is even greater than in Te in promoting crystallization. Recently, study has been made on thin and thick films of the system Bi<sub>10</sub>Sb<sub>x</sub>Se<sub>90-x</sub> ( $x = 35, 40$  and  $45$ ) [10]. Crystalline Sb<sub>2</sub>Se<sub>3</sub> has been prepared and studied by several workers [11, 12]. Antimony triselenide (band gap  $\sim 1.2$  eV), [13] a p-type semiconductor having an orthorhombic  $D_2^5$  structure with unit cell dimensions  $a = 11.77 \pm 1$ ,  $b = 3.962 \pm 7$  and  $c = 11.62 \pm 1$  Å [14] is used in the preparation of recording optical laser disc and as an insulating material in MIS solar cells. The preparation and study of amorphous-Sb<sub>2</sub>Se<sub>3</sub> can throw light on the possible applications of this material in that form. Measurements of electrical properties of a-Sb<sub>2</sub>Se<sub>3</sub> are reported in this paper over a wide temperature and frequency range. Results indicate that electrical properties can be explained on the basis of widely accepted modified-correlated barrier hopping (m-CBH) model for chalcogenide glasses.