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BRIEF COMMUNICATIONS

Semiconduction in Silver Orthoarsenate

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Silver orthoarsenate is found to be an n-type semiconductor of electron activation energy 0.61 eV.

Silver orthoarsenate (Ag_3AsO_4) is prepared as a brick red powder consisting of cubic crystals (*1*), by mixing aqueous solutions of sodium orthoarsenate and silver nitrate in the presence of acetic acid. The precipitate is washed with deionized water and dried at 110°C. In the absence of air silver orthoarsenate remains stable up to a temperature of 250°C.

To measure the resistivity the powder was compacted into a glass tube (diameter 0.8 cm) and pressed between carbon electrodes to a pressure $\sim 10^5$ Pa, so that a pellet of length ~0.5 cm is formed. At this pressure the effect of grain boundaries becomes negligible and the conductivity characteristics are found to be independent of the polarity. The ends of the tube are sealed with epoxy resin, the sample is immersed in a thermostatic oil bath, and the resistance at various temperatures is measured using a resistance meter. The plot of log ρ vs T^{-1} yields a straight line showing that the relation (*2*)

$$\rho = \rho_0 e^{E/KT} \qquad (1)$$

is satisfied with $\rho = 2.24 \times 10^{-8}$ Ωm and $E = 0.61$ eV (Fig. 1). The current voltage characteristics are found to be linear throughout the temperature range of the measurements.

Thermoelectric tests (*2*) show that the major charge carriers are electrons. There is no evidence for ionic conductivity (*3*, *4*).

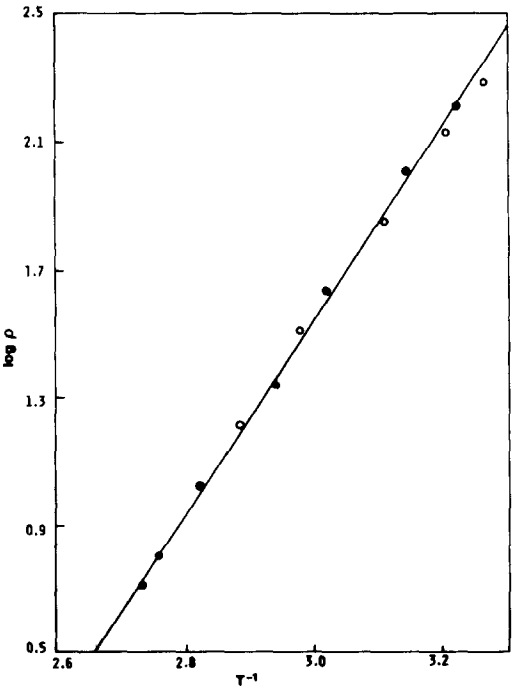

FIGURE 1

0022-4596/83 $3.00

We conclude that silver orthoarsenate is a semiconducting material with an electron activation energy of 0.61 eV.

There is no evidence that the electrical transport in silver orthoarsenate or related covalent oxy-anion silver salts had been studied earlier. We have found that the isomorphous compound Ag_3PO_4 is also a semiconductor. However, the room temperature conductivity of this material is smaller th an that of Ag_3AsO_4 by factor of $\sim 10^2$.

References

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