

Infrared absorption spectra of As-Se glasses

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Abstract. IR absorption spectra of As-Se glasses have been studied over a wide range of compositions. Various two-phonon, multiphonon (combination tones) and impurity absorptions have been identified. Compositional variation of relative band intensities has been explained in terms of the chemically ordered network model.

Keywords. Infrared spectra; As-Se glasses.

1. Introduction

Infrared spectroscopy of chalcogenide glasses has attracted wide attention because of their special IR transmitting properties. In particular, As_2Se_3 glass has been studied in detail by many workers (Edmond and Redfearn 1963; Hilton *et al* 1966; Taylor *et al* 1970; Lucovsky 1972; Moynihan *et al* 1975). Recently Moynihan *et al* (1975) have reported the IR spectra of glassy As_2Se_3 doped with As_2O_3 in the region 250 to 4000 cm^{-1} . Spectra of amorphous As (Lucovsky and Knight 1974; Greaves *et al* 1979), Se (Hilton *et al* 1966; Savage and Nielsen 1964; Lucovsky *et al* 1967; Siemsen and Riccius 1969) and As-Se (Hilton *et al* 1966; Moynihan *et al* 1975) have also been reported in the literature and absorption frequencies of amorphous As, Se, As-Se and As_2Se_3 below 500 cm^{-1} are summarised in table 1. Molecular vibration calculations have been performed by Lucovsky (1972) and Lucovsky and Martin (1972) who find that the spectrum of As_2Se_3 conforms to that of vibrating AsSe_3 units. In the 200 to 1200 cm^{-1} region As_2Se_3 exhibits several peaks due to multiphonon absorption (Moynihan *et al* 1975). Some of the rather intense absorption bands appear to be due to the presence of As_2O_3 and SeO_2 impurities. As_2O_3 having a very high extinction coefficient (Hilton *et al* 1966; Moynihan *et al* 1975; Jerger and Sherwood 1964) gives rise to bands even at low concentrations of ~ 100 ppm (below the saturation solubility of As_2O_3 in As_2Se_3).

Various properties of binary As-Se glasses have been investigated in this laboratory (Mohan *et al* 1980; Rao and Mohan 1980) and the properties support a

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