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Structure and Bonding in As–Sb–S Chalcogenide Glasses by Infrared Reflectance Spectroscopy

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Abstract

The structure of chalcogenide glasses xSb2S3•(1 – x)As2S3 with 0 ≤ x ≤ 0.75 was studied by infrared reflectance spectroscopy. The absorption coefficient spectra, calculated from reflectance by Kramers–Kronig analysis, were deconvoluted in the high-frequency region from 250 to 450 cm-1, and the frequency and relative intensity of the component bands were studied as a function of Sb2S3 content. Band assignments were based on the molecular model, and experimental relative intensities were compared with those calculated in terms of the random substitution and heterogeneous structure models proposed in the literature for such glasses. The results were found to be consistent with a glass structure formed by a random distribution of trigonal AsS3/2 and SbS3/2 pyramidal units bridged by sulfur atoms. A band resolved at ca. 360 cm-1 was associated with mixed As–S–Sb bridges, in accordance with the composition dependence of its relative intensity which was found to be maximum at x = 0.5.