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Compositional dependencies of Raman spectra of Ge-As-Se chalcogenide glasess

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Chalcogenide glasses are known as perspective materials of optoelectronics with a high optical transparency in the infrared region of telecommunication windows 3-5 and 8-12 μm. In this work, influence of composition on structural transitions and optical properties of chalcogenide glasses was studied by Raman technique. Obtained Raman spectra chalcogenide system $Ge_{4.5}.As_{14.5}Se_{81}$, Ge13.5As23.5Se63 and Ge18As28Se54, Ge27As37Se36, Ge30As40Se30 were analyzed using CoRa software. The Ge–Se vibrations in [GeSe4] tetrahedrons occurred at 193 cm−1. The As-Se vibration band generally occurs at around 230 cm−1. In the higher frequency region, there occurred a weak band at 250 cm−1 with a broad shoulder at 300 cm−1, assigned to Se–Se vibrations in Se-chains and asymmetric stretches in [GeSe4], respectively. The existence of Ge–Ge bonds is indicated by the shoulder occurring in the region 170–180 cm−1 at the lower frequency side of the Ge–Se band, assigned to Ge–Ge vibrations in [Se3Ge–GeSe3] structural units. The band at 100 cm−1 is assigned to As–As vibrations, and its shoulder at 130 cm−1 to Ge–As vibrations. As the content of germanium increases, the chance for tetrahedrons [GeSe4/2] meeting each other increases, which is indicated by the occurrence of edge-shared [GeSe4/2] band at 214 cm-1. Thus, the structure of the glasses is described as a mixture of the AsX3/2 and GeX 4/2 , connected either directly or through chalcogen chains and with presence of non-stoichiometric structural units.

Topics

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