



First Sharp Diffraction Peak features of the intermediate phase glasses and amorphous thin films in the non-stoichiometric $(\text{GeS}_4)_x(\text{AsS}_3)_{1-x}$ system

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Abstract

Grazing incidence X-ray scattering (GIXRS) patterns of thin solid films based on non-stoichiometric chalcogenide glasses (ChG) from the pseudo - binary system $(\text{GeS}_4)_x(\text{AsS}_3)_{1-x}$ were studied with a focus on the First Sharp Diffraction Peak (FSDP), assigned to the middle range order (MRO) of the glassy material. The films were grown using explosive thermal evaporation in vacuum (10^{-4} Pa) of pulverized ChG, prepared from previously synthesized bulk glasses, onto mono-crystalline silicon substrates. Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray (EDX) spectroscopy were used to examine the morphology and elemental composition of the films, which were found to have similar composition to the bulk glasses. However, it was revealed that the molecular structure of the grown amorphous films differs from that of the initial ChG bulk material, as indicated by changes in the composition-dependent position and width of the FSDP. Additionally, the intensities of the FSDP in the films were higher compared to those of the bulk samples, suggesting that the molecular-like structure of ChGs is more pronounced in the form of thin films grown from the vapor phase.

Keywords: chalcogenides glasses, thin solid films

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