**Physical - chemical properties of sulfur enriched As-S-Ge glasses related to middle-range order structure**

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Ternary nonstoichiometric chalcogenide glasses in the As-S-Ge system along the tie-line (GeS4)x (AsS3)1-x have been synthesized and characterized by applying XRD analysis, material density and ultrasound propagation measurements. On the basis of the results obtained from density measurements, for each glass composition has been evaluated the molecular weight, average molar and atomic volumes as well as the compactness of the glassy structure. Alongside, the material densities together with experimentally measured velocity of ultrasound propagation in it were used for determination of longitudinal elastic modulus and its compositional dependence. Providing XRD halos analyses the special attention was paid to “first sharp diffraction peak (FSDP)” ascribed to middle range order (MRO) structure of the glassy material. It was revealed that the position of the FSDP nonlinearly shifts with composition change and a maximum of the diffraction angle is clearly derived for glasses comprising about 8 at.% Ge that is composition (GeS4)0,33 (AsS3)0,67. Applying the Bragg equation to the FSDP peak position of each composition the structural period between MRO domains and its compositional dependence were calculated. From these data followed that the mentioned glassy (GeS4)0,33 (AsS3)0,67 exhibits the minimal inner distance between domains. As these result correlate with compositional dependence of average molar volume, it was concluded that the glasses from the pseudo-binary system AsS3 – GeS4 containing around 8 at.% Ge have the most “packed” MRO structure. The further increasing of Ge concentration leads to rather sharply boosting of both the average molar volume and inner distance between MRO domains, although finally this increasing tends to saturation. Wherein, it was established that the velocity of the ultrasound propagation reveals the similar compositional dependence, which provides evidence of a direct influence of structural period of the MRO domains on acoustic properties of glassy materials. At that, the compositional dependence of longitudinal elastic modulus better correlates with compositional dependence of compactness of the glassy structure, which is associated with the free volume and flexibility of the glassy network. It was found that among glasses under investigation here the highest compactness and elasticity exhibits the composition (GeS4)0,17 (AsS3)0,67 that comprises 4 at% Ge. The results are explained in terms of deep structural transformation in the middle range order caused by molecular reorganization. The substitution of trifold coordinated As atoms by fourfold coordinated Ge ones leads to a non-monotonic modification of medium range ordering structure, which controls the physical properties, including the elastic ones of the glass.

**Keywords:** Glasses, Chalcogenides, *XRD, FSDP*