Nanostructured surfaces

Thermocrystallization of $(As_2S_3)_{45}(SbSI)_{55}$ amorphous films

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In present report we have adduced the results of studying the process of crystallization of the $(As_2S_3)_{45}(SbSI)_{55}$ amorphous films.

Thin films (thickness – 1.5 μm) were prepared from the above glass by vacuum evaporation from quasi-closed effusive cell on rotating cold silica substrates. Surface relief of annealed films was studied using the atomic force microscope Nanoscope IIIa Dimension3000.

Temperature dependence of film transmission is not a simple. Film crystallization is accompanied by a sharp decrease of transmission. The temperature range for the film $(As_2S_3)_{45}(SbSI)_{55}$ in which it crystallizes is 20-30 K. Film bleaching is observed in the precrystallization area in a fairly wide range of temperatures, which we attribute to the formation of structural chain clusterings $SbS_{2/2}I$ from trigonal pyramids $AsS_{3/2}$ in the structural network characteristic of the crystalline antimony sulphoiodide. This process is accompanied by the diffusion of Sb and I atoms and a decrease in their number in the amorphous matrix. The results of Raman spectra investigations confirm this conclusion.

We present the results of previous studies of surface morphology of amorphous $(As_2S_3)_{45}(SbSI)_{55}$ films depending on heat-time modes of treatment by means of atomic force microscopy (AFM). The time of isothermal annealing (τ_a) of structures ranged from 30 minutes to 1 hour at temperatures (T_a) of 398 K and 405 K, respectively. Analysis of the film surface relief after annealing at appropriate T_a and τ_a testifies to the appearance of point crystallization, which tends to develop over time. With T_a and τ_a increasing, the average crystallite size increases from 150-300 nm to 750-1000 nm. Alongside with that their height grows too (from 20 to 100 nm). The obtained data indicate the possibility of controlling the size of crystalline inclusions of SbSI on the surface of $(As_2S_3)_{45}(SbSI)_{55}$ films by changing the heat-time mode of their treatment.