Temperature and illumination dependent mass transport during the surface relief formation in As-S(Se) amorphous chalcogenides

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Abstract

Investigations of amplitude-phase optical and geometrical relief formations at room temperatures, rather well known for a-Se and selected compositions from As-Se system [1,2], were extended towards wide temperature range from 77 K up to softening temperatures of given materials. Besides the holographic recording of periodical 1D or 2D surface relief structures experimental techniques were developed and used for in-situ or afterwards measurements of complementary changes in optical transmission and surface relieves. It was shown that changes of optical density and surface relieves can be detected at temperatures down to liquid nitrogen and up to softening temperatures of the given glass compositions. The rate of the processes increases with temperature following Arrhenius law with rather small activation energies, but at temperatures close to the softening temperature thermal erasing prevails. The possible role of diffusion, related to different components of glass and viscosity in these light and temperature stimulated mass transport processes was analyzed. This way the interrelations between composition, recording conditions and efficiency, erasing processes and stability were established for samples from the given system of materials.

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