Change of Microhardness of Amorphous Thin-Films of the System Ge-As-Se Under the Influence of Laser Irradiation

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This paper presents the results of studies of photoinduced changes in microhardness of amorphous films $Ge_xAs_ySe_{100-x-y}$ under influence of laser irradiated (laser power of 50 mW, wavelength of 655 nm). For realization of researchers chalcogenides glasses for such syllables were prepared: $Ge_4As_4Se_{92}$, $Ge_9As_9Se_{82}$, $Ge_8As_{32}Se_{60}$, $Ge_{16}As_{24}Se_{60}$, $Ge_{24}As_{16}Se_{60}$, $Ge_{32}As_8Se_{60}$ and $Ge_{40}Se_{60}$. The thin films were got thermal evaporation method of glasses by analogical syllables in a vacuum (10^{-3} Pa) on surface from quartz glass. Measuring of microhardness of H was conducted by means of PMT-3 instrument with the used of indenter of Vickers on-loading 0.05 Pa. At including of laser microhardness exponentially diminishes during the first 25-30 min in dependence on chemical composition lowering of microhardness of films makes a 10 - 27 %. Increase of time of irradiation over 30 min results in stabilizing of microhardness.

It is educed that at increase of mane coordinating number of Z in an interval a 2.12 - 2.48 size ΔH changes poorly enough. At Z=2.67 ($Ge_{24}As_{16}Se_{60}$) there are the minimum relative photoinduced changes of microhardness. At the increase of Z from 2.67 to 2.80 sizes ΔH swiftly grows approximately in 7 times ($Ge_{40}Se_{60}$). The indicated intervals of the photoinduced changes of microhardness of films of $Ge_xAs_ySe_{100-x-y}$ correlate with position of areas of glasses with different structural flexibility on the diagram of glass formation in the system Ge - As - Se. As a point at Z=2.67 is a 2d-3d topological structural transit point is possible to assert that the maximal photoinduced changes of mechanical parameters of chalcogenide glasses of the system Ge - As-Se, take place in glasses with a three-dimensional structure. This feature can be explained within the structure of intermolecular structural model of the photoinduced plasticity of chalcogenides glasses. The structure of films of the system Ge - As - Se at $Z > 2.67$ under the action of laser irradiation passes the broken of the homopolar bonds in (As - As, Ge - Ge) and transformation of formed by them has volume (3-measurable) structural units of the plenary trivial oriented complexes. As a result of such processes structure of dimension and it structural has inflexibility fall down.

Reduction of the relative photoinduced changes of hardness is at $Z < 2.67$ it can be contingently the subzero dimension of structure in the initial films of system $Ge_xAs_ySe_{100-x-y}$ by irradiation.