Last question is interesting from another point of view. The transition from microelectronics to nanoelectronics at the beginning of our century led to a decrease in the size of active areas of devices to units of nanometers, that is, to sizes comparable to the size of ordered areas in materials in which there is no translational symmetry. This is why the problem of determining dependence of electronic and other properties of semiconductor materials on the degree of their atomic structure ordering becomes urgent. However, to solve this problem, it is necessary to classify semiconductor materials according to the degree of structure ordering first. An attempt to carry out such a classification is made in this report.

Separation of objects according to degree of atomic structure disorder is based on the size of the ordering areas. In this case, existing semiconductor materials can be divided into macro-ordered and nano-ordered. Nano-ordered systems include nanocrystalline materials, non-crystalline (glassy and amorphous) materials, and nanocomposite materials. The dimensions of the ordered regions in these cases lie in the range from single to tens of nanometers [2]. The dimensions of the ordered regions determine the degree of localization of charge carriers. The localization of charge carriers, in turn, determines the mobility and electrical conductivity mechanism in the material. The analysis of the classification presented in the report shows that the adopted method of dividing semiconductor materials into ordered (crystalline) and disordered (non-crystalline) materials does not fully reflect the real situation and needs to be improved. Special attention is paid in the report to consideration of the glassy state of matter and its definition [3].

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Laser-induced periodic surface structures (LIPSS) of amorphous GST225 thin films upon femtosecond laser irradiation

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Ultrashort laser irradiation is proven as an alternative to lithography for nanostructuring surfaces of various materials via formation of laser-induced periodic surface structures (LIPSS) or ripples [1]. In this work, our efforts were focused on the study of LIPSS formation with the periodicity of the order of laser wavelength on surfaces of $Ge_2Sb_2Te_5$ (GST225) amorphous thin films. GST225 composition is one of the extensively investigated phase change memory (PCM) materials, which is currently used for rewritable data storage applications based on structural phase transitions. In addition, we studied the processes of laser crystallization and laser amorphization of GST225 thin films under ultrashort pulsed irradiation.

The GST225 amorphous thin films have been prepared by *dc* magnetron sputtering. We used a Yb:KGW femtosecond laser with wavelengths λ=515 and 1030 nm, pulse duration of 600 fs, and repetition rate of 200 kHz to study surface modification.

It is shown that, with specially selected parameters of the laser irradiation (laser pulse fluence, number of pulses, and light polarization), it is possible to realize LIPSS formation with the periodicity of the order of laser wavelength in the pre-ablation regime. The characteristic feature of the surface nano-structures is the presence after the laser action of the periodic modulation of the refractive index of the ridges and valleys of the gratings due to different phase states whose dielectric constants differ greatly from one another. The formation of LIPSS originates from the interference of the incident light with surface electromagnetic wave excited by irradiation. We used the model of heterogeneous crystallization for objects with different surface curvatures to explain the observed effect of the phase transformation in laser-induced periodic surface structures.

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Chalcogenide based nano-layered solid electrolytes

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It is well-known that extensive interphase surface promotes ion conductivity. Nano-layered thin films are suitable for investigation that phenomenon.

Films composed of alternating AgI (or Ag_2Se) and glass nanolayers were prepared via laser ablation. For this aim the following glass compositions were used: [0,4AgI·0,3$GeSe_2$·0,3Sb_2Se_3], [0.75(0.5$GeSe_2$·0.25Sb_2Se_3·0.25As_2Se_3)·0.25Ag_2Se], [V_2O_5·GeO_2].