energy of LF modes correlate with position of the "plateau" region, where $k(T) \approx$ const: 7.7 cm^{-1} (1 fixation point); 4.8 cm^{-1} (2); 2.0 cm^{-1} (3); 3.7 cm^{-1} (4). Soft vibrations can serve as an additional source of resonant scattering of phonons and could be responsible a known universal weak dependence of k (T), maximum of specific heat and contribute to the formation of QES in LF Raman spectra. The frequency position of rigid vibration of As_nS_m clusters (rings and chains fully terminated by extra heavy dummy hydrogen) is located near 26 cm^{-1} in the central part of the LF Raman "BP" [2].

References

[1] V. Mitsa, A. Feher, S. Petretskyi , R. Holomb, V. Tkac, P. Ihnatolia ,A. Laver Nanoscale Research Letters .- 2017.- Vol. 12. – Pp. 345 -361.
[2] R. Holomb, P. Ihnatolia, O. Mitsa, V. Mitsa, L. Himics, M. Veres. Appl. Nanosci. (2019). Pp. 1-12. https://doi.org/10.1007/s13204-018-00948-5.

The direct laser writing micro relief structures on chalcogenide glass by laser beam recorder of master discs

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The area of the direct laser writing application is much wider than only recording of optical discs The direct laser writing in photoresist enables to be fabricate a wide range of continuous micro relief phase elements .Recording systems with precise rotating devices, positioning of optical heads, and stabilizing of the power of recording lasers allow the creation of various devices for writing micro-optical elements[1,2].The method of direct laser writing of the diffractive optical elements has significant advantages over other technologies for the formation of phase optical elements like accurate control of the process parameters, flexibility in fabricating continuous-relief micro-optical elements via a single exposure scan and development , allows to exercise fabrication of diffractive optical elements with arbitrary surface-relief profile [2].The requirements for the accuracy of the manufacture of the micro-optics elements have increased considerably in recent years and suggest the transition to a submicron and nano -size range of the dimensions of the optical structures elements. Inorganic photoresists based on chalcogenide semiconductors are widely used in direct laser writing [3-5]. On chalcogenide semiconductors micro relief images by direct laser writing can be obtained by various methods: local evaporation of the absorbing material , due to a change in the volume of the material in the irradiation zone, photo-structural transformations with subsequent selective chemical etching. Micro relief images on chalcogenide semiconductor films can be formed under the action of laser pulses of various durations. Photo-structural transformations in chalcogenide semiconductors allow you to create multi-level micro-relief images . An analysis was made of the possibilities of using standard laser beam recorder of master discs for direct laser writing of diffractive optical elements over a large area and micro-optic elements. The recording of micro relief images was carried out on films of chalcogenide semiconductors in the mode of photo-structural transformations.

References

[1] Gale, M. T. (1994). Fabrication of continuous-relief micro-optical elements by direct laser writing in photoresists. Optical Engineering, 33(11), 3556. oi:10.1117/12.179892

[2] Wang, C. (2002). Fabrication of diffractive optical elements with arbitrary surface - relief profile by direct laser writing. Optical Engineering, 41(6), 1240. doi: 10.1117/1.1476689

[3] Schroeter, S., Vlček, M., Poehlmann, R., & Fišerová, A. (2007). Efficient diffractive optical elements in chalcogenide glass layers fabricated by direct DUV laser writing. Journal of Physics and Chemistry of Solids, 68(5-6), 916–919. doi:10.1016/j.jpcs.2007.01.014

[4] Petrov VV, Kryuchin AA, Kostyukevich SA, Rubish VM - Inorganic Photolithography Institute for Physics of Metals, NAS of Ukraine, Kyiv, 2007

[5] Almeida, J. M. P., Paula, K. T., Arnold, C. B., & Mendonça, C. R. (2018). Sub-wavelength self-organization of chalcogenide glass by direct laser writing. Optical Materials, 84, 259–262. doi:10.1016/j.optmat.2018.06.068

Grouping of semiconductor materials by degree of atomic structure disorder

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The first practical application of a semiconductor device occurred at the beginning of last century, when a metal-semiconductor contact point was used to demodulate radio signal. However, development of the band structure theory (A. Wilson, 1931) led to explosive development of solid-state electronics, creation of integrated circuits, increasing the degree of integration in accordance with Moore's Law along with a corresponding decrease in the sizes of elements. General direction in the development of solid-state electronics focused on manufacture of devices based on single crystals and on the enhancement of the crystal's structure, since the band structure theory was based on presence of translational symmetry of crystal lattice. The success of the band theory led to the opinion in the last century that presence of translational symmetry is a prerequisite for the existence of semiconductor properties in a material.

However, the discovery of chalcogenide glassy semiconductors by B. T. Kolomiyts and N. A. Goryunova in 1955 [1] showed that the presence of translational symmetry is not a necessary condition for the existence of semiconductor properties of a material, since local order in the atomic arrangement is sufficient for this. At the same time, introduction of the concept of local ordering leads to a number of questions: how these areas are formed, what their sizes should be to preserve semiconductor properties, and how these sizes affect the electronic properties of a material.