# LASER DIRECT WRITING INTO GE-AS-S GLASSY SYSTEM

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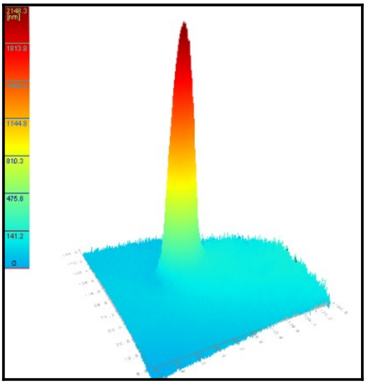
Microlenses on the surface of chalcogenide glasses have an application as passive optical elements. Single microlenses are used to transmit light to optical fibers while microlens arrays are often used for integrated circuits.
The present work is focused on the microlens formation on the surface of stoichiometric $(GeS_2)x$ $(As_2S_3)(1-x)$ bulk glasses (x = 27, 35, 59, 73, 82 ,95). These glasses were chosen because of their unique properties (wide IR transparency, low phonon energy, good photosensitivity and optical nonlinearity) [1].
The glasses were prepared by a direct synthesis from elements (5N). The optical surface quality was (RMS < 5nm). The role of several parameters (chemical composition, mechanical and optical properties, exposition conditions) was investigated. Properties of microlenses and non-illuminated areas were compared. For illumination was used CW laser (λ= 532 nm, spot the diameter ≈ 40 µm, the maximum laser power density up to 2000 W/cm$^2$). The illumination led to the glass expansion and microlenses formation. The highest microlenses (h ≈ 2,2 µm) were obtained on the surface of glass with 59 mol % of $GeS_2$. From the dependence of the microlenses height on the radiation intensity the threshold value of microlens formation was determined. This value indicates the minimal energy for surface changes/microlenses formation.




When comparing the microlenses and non-illuminated areas no structural and chemical composition changes were observed (Raman Spectroscopy and EDX analysis). On the other hand, changes of mechanical properties (Force Spectroscopy) were found.

References:
[1] Yang, Y.; et. al. J. Non-Cryst. Solids, 2016, *440*, 38-42.