8th INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND CONDENSED MATTER PHYSICS

dedicated to
the 70th anniversary of the foundation of first research institutions of the ASM,
the 55th anniversary of the inauguration of the Academy of Sciences of Moldova,
the 70th anniversary of Moldova State University
the 90th anniversary of academician Sergiu Radautsan

ABSTRACTS

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SSNN 25P LIGHT STIMULATED MASS TRANSPORT IN As-S CHALCOGENIDE NANOLAYERS STUDIED *IN-SITU* USING SYNCHROTRON PHOTOELECTRON SPECTROSCOPY

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In this report the results of investigation of influence of over bandgap laser irradiation on structural transformations [1], atomic rearrangements and mass transport in As_xS_{100-x} chalcogenide nanolayers are considered. Amorphous As-S nanolayers were prepared *in-situ* by thermal evaporation of source glasses in ultra high vacuum. Preliminary structural studies of source glasses and As-S nanolayers were performed using Raman/SERS spectroscopy and DFT calculations of As_4S_m cage-like molecules (m=3-5) together with orpiment and anorpiment like 2D network forming 12-membered rings. The differences between concentrations of As-rich As_4S_m cages (As_4S_3, *r*-As_4S_4, *p*-As_4S_4, *etc*) in the structure of these glasses were established.

In order to investigate the effect of over bandgap (λ=403 nm) laser irradiation the surface structure of as-deposited, annealed and irradiated stoichometric $As_{40}S_{60}$ nanolayers, with the relatively low concentration of *r*-As_4S_4 and two As-rich, $As_{45}S_{55}$ and $As_{50}S_{50}$ compositions with the higher concentration of *r*-As_4S_4 molecules were investigated and characterized in detail by means of photon-energy dependent (E_{ex} = 100, 120, 150, 220, 400, and 650 eV) synchrotron radiation photoelectron spectroscopy. Least-squares curve fitting of the experimental As 3d core level spectra show that the blue laser irradiation of As-S nanolayers lead to increase of concentration of As-rich As-As-2S and 2As-As-S structural units (s.u.) at the surface of As-S nanolayers (see for example Figure 1). Simultaneously, the increasing of As content at the surface of irradiated nanolayers by about ~2 at.% were also detected from compositional analysis of As 3d and S 2p core level peaks.

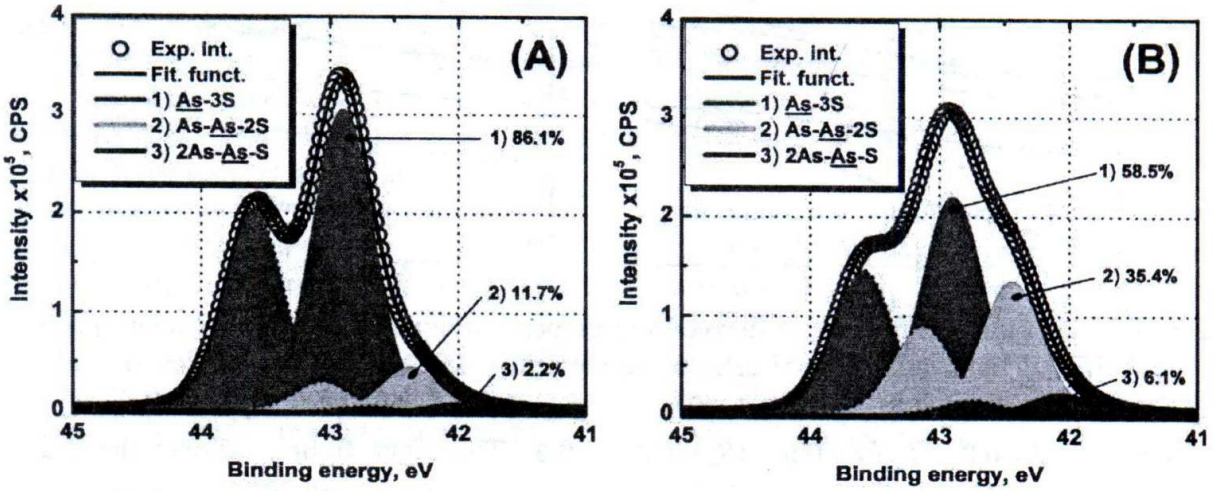

Figure 1. Curve fitted As 3d core level spectra of annealed (A) and laser irradiated (B) As_xS_{100-x} (x=45) nanolayers measured using excitation photon energy of 120 eV.

This phenomena is observed for all studied compositions and it is found to be fully reversible in "thermal annealing" - "laser irradiation" cycles. The mechanism of laser assisted mass transport in As-S nanolayers through light induced structural rearrangements is discussed and the possibilities of potential applications of this effect in modern photonics is proposed.

[1] R. Holomb, N. Mateleshko, V. Mitsa, P. Johansson, A. Matic, M. Veres. J. Non-Cryst. Sol. **352** (2006)1607-1611.