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BOOK of ABSTRACTS

Contents

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Laser induced mass transport in As-S chalcogenide nanolayers as basis for novel active functional optics and ultrafast photonics

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Nowadays photonics and light technology are already used in information processing systems. Novel photonic and nano-technologies are extremely developing fields indicating that we will depend as much on photonics rather than on electronics in the nearest future. New types of materials are needed to control the light and to access all optical functionality, generally called nanostructured materials with dimensions of their structural elements in the order of tens nanometers.

During the last decades amorphous and glassy chalcogenides containing one or more chalcogen elements (S, Se or Te) have attracted much scientific interest. In addition to their intrinsic infrared properties, the useful combination of optical activity, structural photosensitivity and high third-order optical non-linearity of chalcogenides offer wide possibilities of their applications in domains like information technologies (data storage and ultrafast optical information processing), renewable energy technologies (high efficiency solar cells, solid electrolytes), modern medicine, thermal imaging, sensing and biosensing, etc. The structure and its coupling to the fundamental physico-chemical and optical properties of amorphous chalcogenides has been the subject of intensive studies for decades. In particular, special interest is dedicated to light-matter interactions in various chalcogenide systems.

This report is on the influence of over-bandgap laser irradiation on structural transformations, atomic rearrangements and mass transport in As_2S_3 chalcogenide nanolayers. Amorphous As-S nanolayers were prepared *in-situ* by thermal evaporation of source glasses in ultra high vacuum. 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 realgar-like *r*-As_4S_4 inclusions were studied and characterized by means of photon-energy dependent (E_{ex} = 100, 120, 150, 220, 400, and 650 eV) synchrotron radiation photoelectron spectroscopy. The experimental As 3d core level spectra show that the irradiation of As-S nanolayers with blue laser cause the increase of the concentration of As-rich As-As-2S and 2As-As-S structural units (s.u.) at the surface of As-S nanolayers (Fig. 1). Simultaneously, the rise of the As content at the surface of irradiated nanolayers by about ~2 at.% was also detected from compositional analysis of As 3d and S 2p core level peaks. Photon-energy depended luminescence was also studied and the structure of As_2S_3 nanolayers before and after laser irradiation was characterized by surface-enhanced Raman spectroscopy. The mechanism of laser assisted mass transport in As-S nanolayers through light induced structural rearrangements will be discussed and the possibilities of potential applications of this effect in modern functional optics and nanophotonics will be proposed.

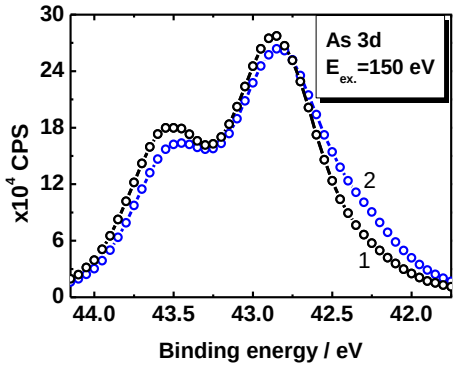

Fig. 1. As 3d core level spectra of as-deposited (1) and laser irradiated (2) As_2S_3 nanolayers.

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