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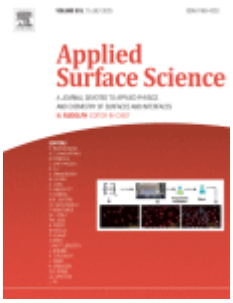

Full Length Article

Reversible laser-assisted structural modification of the surface of As-rich nanolayers for active photonics media

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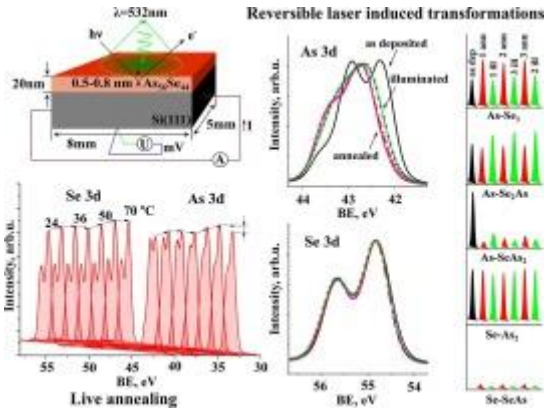
Highlights

- Synthesis and *in-situ* controlled annealing of As-rich As-Se nanolayers.
- Reversible structural rearrangements in the structure of $As_{56}Se_{44}$ nanolayers.
- Light induced transformation of the valence band spectra of $As_{56}Se_{44}$ nanolayers.
- Laser assisted reversible modification of the structure and electronic properties.

Abstract

Reversible structural changes of As-rich As–Se nanolayers occurring during *in situ* thermal annealing and above-bandgap laser illumination were studied by synchrotron radiation photoelectron spectroscopy. It was found that the first thermal annealing of $As_{56}Se_{44}$ nanolayers led to a decrease of the concentration of As that can be connected with evaporation of more volatile As-rich fractions from the surface. This process is accompanied by structural rearrangements in the nanolayers. *In situ* green laser illumination of annealed samples causes an increase in the concentration of homopolar As–As bonds associated with As-Se_2As *s.u.*, while the opposite effect was detected during further thermal treatment. These processes appeared to be reversible for three sequences of annealing and illumination. The observed effect of the reversible photoinduced structural modification is discussed in detail, and possible applications as an active optical medium for photonics are proposed.

Graphical abstract



Abbreviations

SRPES
synchrotron radiation photoelectron spectroscopy
ChG
chalcogenide glass
BE
binding energy
FWHM
full width at half maximum
VB
valence bands

Keywords

As–Se nanolayers
Synchrotron radiation photoelectron spectroscopy
Photoinduced changes
Reversibility
Valence band