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Micro-Raman Analysis of Some As-S-S-Te Nanostructured Semiconductors

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Abstract

In the present work some nanostructured chalcogenides of the As-S-Sb-Te system have been investigated by non-contact Micro-Raman spectroscopy which is a powerful technique for obtaining information on the local structure of the crystalline as well as disordered materials, especially when the composition and structure is varied. In this paper we report micro-Raman spectra of $As_{1.17}S2.7Sb_{0.83}Te_{0.40}$, $As_{1.04}S_{2.4}Sb_{0.96}Te_{0.60}$, $As_{0.63}S_{2.7}Sb_{1.37}Te_{0.30}$, and $As_{0.56}S_{2.4}Sb_{1.44}Te_{0.60}$, of bulk semiconductor compounds and thin films. These semiconductor alloys are interesting and important from the point of view of assessing their physical properties, primarily the structure, as well as for determining the scope of technical application. It was established that the Raman spectra of light scattering of bulk samples differs from the spectra of thin films with a higher As content and a low Sb content, but samples prepared as bulk and powder exhibit the same behavior. All spectra have characteristic intense bands which are assigned to the Te-Te ($\nu = 119$ cm^{-1}), As-As ($\nu = 234$ cm^{-1}), AsS3/2 ($\nu = 345$ cm^{-1}), As4S4 ($\nu = 495, 236, 223, 189, 168$ cm^{-1}), As4S3 (270–273 cm^{-1}), S8 rings ($\nu = 146, 220$ cm^{-1}) and SbO ($\nu = 255$ cm^{-1}) structural units. It was also found that the sample $As_{0.63}S_{2.7}Sb_{1.37}Te_{0.30}$ have a more amorphous phase, while $As_{0.56}S_{2.4}Sb_{1.44}Te_{0.60}$, $As_{1.17}S_{2.7}Sb_{0.83}Te_{0.40}$ and $As_{1.04}S_{2.4}Sb_{0.96}Te_{0.60}$ samples are more polycrystalline.

Keywords: nanostructured quaternary amorphous semiconductors, Micro-Raman spectra, vibration modes

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