Structural and optical properties of amorphous GeTe films

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Chalcogenide amorphous materials are known to have different structural and optical properties depending on the deposition method. Here, we investigate thin amorphous GeTe films [1] obtained through co-sputtering from two distinct Ge and Te targets and by pulsed laser deposition (PLD) from a polycrystalline GeTe target.
The formation of a single and homogeneous amorphous GeTe phase by co-deposition is uncertain since we can have mixtures of monoelemental nanoclusters. In order to refine the homogeneity of the amorphous phase during co-sputtering, the temperature of the substrate was increased from room temperature up to 180 °C.

The obtained films have been investigated by X-ray diffraction, X-ray reflectometry, X-ray photoelectron spectroscopy and spectroscopic ellipsometry. We have found important differences in the structural and optical properties of amorphous GeTe films deposited by PLD and magnetron co-sputtering. The mass density and optical bandgap of the co-sputtered films increased with substrate temperature. We have also observed that the refractive index and absolute reflectivity become progressively larger by heating the substrate.

The X-ray photoelectron spectroscopy investigation suggests the formation of Ge-Te bonds and thus of the GeTe alloy at a substrate temperature of 180 °C. This research points out the importance of optimizing the deposition process in order to obtain a homogeneous amorphous phase.

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References:

[1] A. C. Galca,F. Sava,I. D. Simandan, C. Bucur, V. Dumitru, C. Porosnicu, C. Mihai, A. Velea, J. Non-Cryst. Solids 499, 1-7 (2018)., DOI: 0.1016/j.jnoncrysol.2018.07.00