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SYNTHESIS OF SnSe FILMS OBTAINED BY MAGNETRON SPUTTERING

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This work presents a study of SnSe thin films obtained by RF magnetron sputtering, which is a technology relatively cheap and easy for devices based on thin film, unlike most SnSe fabrication techniques for thermoelectric applications already present in the literature. In this study we characterize the optical, electrical and compositional properties of the materials. SnSe films deposited by magnetron sputtering, demonstrate low thermal conductivity substantially below that of the single crystal A-axis. A low thermal conductivity is useful for the development of thermoelectric generators, but it is also of interest for the development of other devices based on SnSe films such as solar cells, etc. To confirm the SnSe film and the SnSe single crystal, the materials were investigated using X-ray diffraction (EDX). The peak in these patterns can be attributed to the low temperature phase of film deposition (200 °C) which belongs to the prime space group (database file number 1537675), at the same time analogous results were also obtained by Matthew R. Burton in the paper [1]. Scanning electron microscopy (SEM) of SnSe films demonstrates homogeneous morphologies, while the SnSe crystal exhibits a uniformly flat surface morphology typical of a layered crystal. These nano-layers are formed throughout the film, further indicating that the non-porous structure may form due to an initial energy preference interaction with the glass substrate, which is maintained throughout the film growth. Electrical measurements performed for SnSe films indicated for a current I = 30 μA and applied voltage V = 342 mV, a resistance of approximately R_{4w} = 11.4 kΩ and R_{2w} = 15.6 kΩ. Measurements made on a Jasco V-670 spectrophotometer at room temperature of the transmission and reflection spectra revealed that in both spectra the interference pattern is observed, particularly well evidenced in the reflection spectrum. According to the position of the interference lines, the thicknesses of the films were estimated to be approximately 440 nm. From the reflection and transmission spectra the absorption spectra of the SnSe films were determined. Since SnSe is an indirect energy bandgap semiconductor, the $(h\upsilon\alpha)^{1/2}$ dependence was constructed to determine the bandgap of the film. Crossing the linear part with the ordinate axis indicated a bandgap of Eg = 1.1 eV which is a little too large, while for this material the bandgap is known to be 0.94 eV [2].

References:

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