Effect of growth conditions on the optical properties of In_2S_3 thin films in the broad FIR–DUV spectral range

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Indium sulfide In_2S_3 semiconductor compound is being considered as a replacement for the CdS buffer layer in the next generation $Cu(In,Ga)Se_2$ (CIGS) thin film solar cells. In addition to its non-toxicity, one of its main advantages is its ability to deposit good quality thin films by a relatively simple and therefore inexpensive method of Vacuum Thermal Evaporation, which predestines it for industrial applications. Determining the influence of different deposition techniques and conditions on the optical properties of In_2S_3 films is a key factor for their optoelectronic applications.

Here we focus on the studying of the effect of deposition conditions on the structural and hence optical properties of In_2S_3 thin films grown by the above motioned method. The complex dielectric function ε(E) of the films deposited on glass substrates has been determined in the broad spectral range from the far-infrared FIR to the deep-ultraviolet DUV based on infrared spectroscopy using the synchrotron radiation (IR) and spectroscopic ellipsometry (VIS–DUV). The strong impact of the substrate and post-annealing temperatures on the optical properties is discussed in relation to the structural changes.

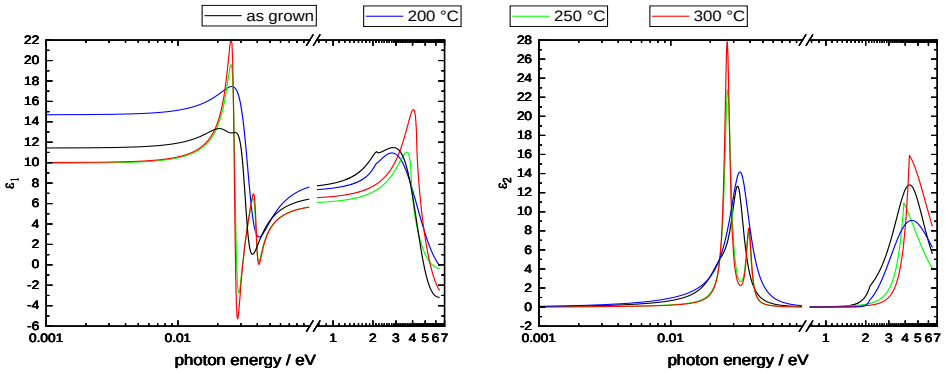

Fig. 1. Real ε_1 and imaginary ε_2 parts of the complex dielectric function for In_2S_3 thin films annealed at different temperatures (substrate temperature 250 °C)

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