

Ternary semiconductor thin films for solar cells application

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The Cd_{1-x}Mn_xTe semiconductor compound is a promising material for hetero-junction thin films solar cells application [1]. But physical properties (optical, structural and electrophysical) of polycrystalline Cd_{1-x}Mn_xTe thin films are not studied well. However these properties have strong effect on thin films performance. Therefore the main task of this research is to study the main physical properties of Cd_{1-x}Mn_xTe thin films obtained at different growth condition.

The polycrystalline Cd_{1-x}Mn_xTe ($x = 0-10\%$) thin films were obtained by the close-spaced vacuum sublimation technique [2] on cleaned glass substrate at different growth conditions. The surface morphology and structural properties of films were investigated by the scanning electron microscopy (SEM) and X-ray diffraction methods (XRD). It is allowed as to determined influence of growth conditions on main structural parameters of the thin films, namely: texture, lattice parameter, grain size and concentration of microdeformation. Joint analyze of the chemical composition used energy dispersive X-ray analysis (EDX) and X-ray induced luminescence with structural study by the X-ray diffraction method provide investigation of the effect of chemical composition change on structural properties of the thin films.

The investigation of the optical characteristics of the layers was performed by the spectrophotometric analysis method near the 'red boundary' of the semiconductor photoactivity. As a result, the reflection, transmission, absorption and refraction coefficients of the thin films deposited at different temperatures as well as the band-gap energy of the compound were determined. The values of the band-gap energy were used for determination of manganese concentrations in the films depending on the growth condition. In order to investigate band-gap deep levels and estimate concentration of point and extended defects in thin films the low-temperature photoluminescence was also used

References

- [1] Rohatgi A., Ringel S.A.: *Investigation of polycrystalline CdZnTe, CdMnTe and CdTe films for photovoltaic applications*, Solar Cells 27, 1989, p. 219-230.
- [2] Kosyak V.V., Opanasyuk A.S., Gnatenko Yu.P.: *Study of the structural and photoluminescence properties of CdTe polycrystalline films deposited by close-spaced vacuum sublimation*, Crystal Growth 312, 2010, p. 1726-1730.