Characterization of In_2O_3:Sn/i-ZnO nanocrystalline thin films on polyimide substrates

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It is well known that the highly resistive zinc oxide layers with intrinsic conductivity (i-ZnO) are commonly introduced between the buffer CdS nanolayers (~ 30 – 50 nm) and the transparent conductive oxide layers (tin-doped indium oxide, In_2O_3:Sn ~ 200 – 300 nm) in Cu(In,Ga)Se_2 – based solar cells which usually fabricated on soda-lime glass or polyimide substrates [1,2].

In this paper we present analysis of the structural and optical properties of nanocrystalline In_2O_3:Sn/i-ZnO thin films fabricated on polyimide substrates by radio frequency (RF) magnetron sputtering technique. The polyimide substrates – polyethylene terephthalate (PET) and polyethylene naphthalate (PEN) films with a thickness of about 25 μm were also investigated by luminescence, transmittance and X-ray diffraction (XRD) methods at room temperature. The X-ray patterns of In_2O_3:Sn/i-ZnO/PET and In_2O_3:Sn/i-ZnO/PEN heterostructures shows a prefered orientation of the In_2O_3:Sn grains along the [400] direction, which is generally observed for near-stoichiometric polycrystalline films. Both heteroctructures show high transmittance exceading 50 % in the visible region of about ~ 400 – 1000 nm. The decreasing transmittance in the near-infrared region 0.5 – 1 eV is related with higher carrier concentration in In_2O_3:Sn thin layers. The influence of oxygen on physical properties of In_2O_3:Sn/i-ZnO/PEN and In_2O_3:Sn/i-ZnO/PET heterostructures has been also discussed.

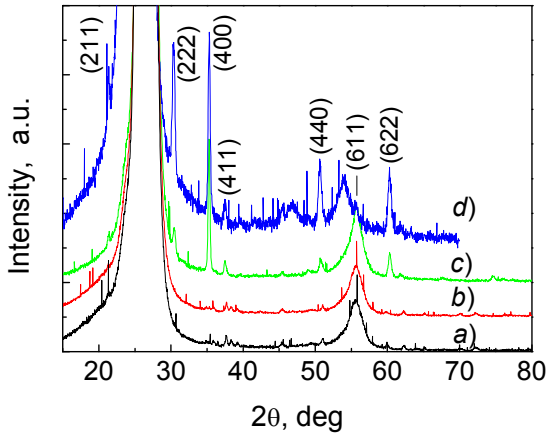

Fig.1 – XRD-pattern of polyimide and heterostructure a – PEN, b – PET, c – ITO/i-ZnO/PEN, d – ITO/i-ZnO/PET on polyimide substrate.

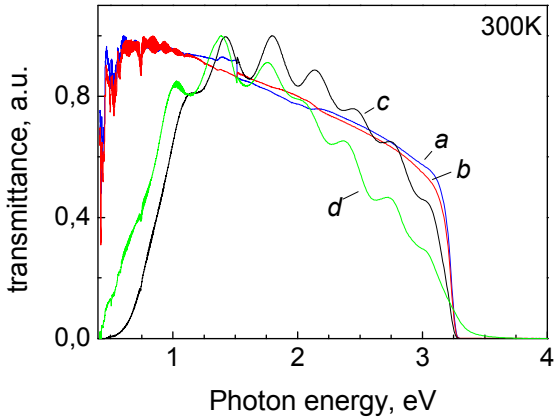

Fig.2 – Optical transmittance spectra of polyimide and heterostructure on polyimide substrate: a – PEN, b – PET, c – ITO/i-ZnO/PEN, d – ITO/i-ZnO/ PET.

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