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Impact of rapid thermal annealing on the properties of different Ag layer thicknesses Ag/ITO bilayer films

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This study involved rapid thermal annealing of Ag/ITO bilayer films of different Ag layer thicknesses in nitrogen gas at a typical kesterite precursor crystallization temperature. AFM analysis showed a thermally stable surface with fewer high peaks/valleys for the annealed thinner Ag layer bilayer films with relatively normally distributed homogeneous grains. Annealing also increased shrinkage of lattice parameters, changes of the underlying ITO crystal preferential orientation and diminished delafossite (AgInO2) peaks with increasing Ag layer thickness bilayer films. Annealing achieved compressed crystallite size for thinner and tensile crystallite size for thicker Ag layer bilayer films. Un-annealed bilayer films showed enhanced electrical conductivity with increasing Ag layer thickness, however, increasingly deteriorated with annealing. Increasing the un-annealed bilayer films' Ag layer thickness increasingly reduced solar transmittance with maintained a similar shape as the un-annealed ITO films. We observed nearly similar spectral and average transmittance for annealed as the un-annealed ITO films; however, these differed for the annealed bilayer films of different Ag layer thickness. Annealing reduced the band gaps of ITO films and these bilayer films, however, within the bandgap ranges reported for ITO films. Thinner Ag layer bilayer films provided relatively suitable properties for application in bifacial CZTS solar cells back contact. This study extends the use of Ag/ITO bilayer films in optoelectronic applications that require present processing conditions.

Apply to be considered for a student ; award (Yes / No)?

No

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PhD

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