

Transmittance and work function enhancement of RF magnetron sputtered ITO:Zr films for amorphous/crystalline silicon heterojunction solar cell

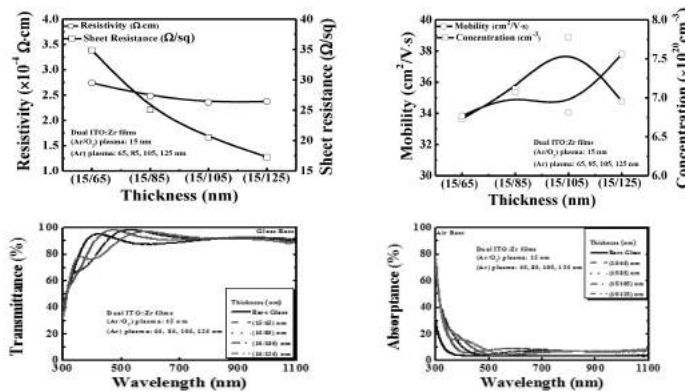
Yongjun Kim¹, Shahzada Qamar Hussain¹, Sunbo Kim², Junsin Yi^{1,2*}

¹School of Information and Communication Engineering, SungKyunKwan University, 300 Chunchun-dong, Jangan-gu, Suwon, Gyeonggi-do 400-746, Republic of Korea

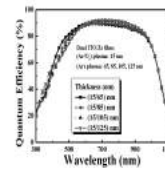
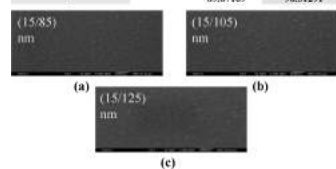
²Department of Energy Science, SungKyunKwan University, 300 Chunchun-dong, Jangan-gu, Suwon, Gyeonggi-do 400-746, Republic of Korea

Recently, TCO films with low carrier concentration, high mobility and high work function are proposed beneficial as front electrode in HIT solar cell due to free-carrier absorption in NIR wavelength region and low Schottky barrier height in the front TCO/a-Si:H(p) interface. We report high transmittance and work function zirconium-doped indium tin oxide (ITO:Zr) films with various plasma (Ar/O₂ and Ar) conditions. The role of (Ar/O₂) plasma was to enhance the work function of the ITO:Zr films whereas the pure Ar plasma based ITO:Zr showed good electrical properties. The RF magnetron sputtered ITO:Zr films with low resistivity and high transmittance were employed as front electrode in HIT solar cells, yield the best performance of 18.15% with an open-circuit voltage of 710 eV and current density of 34.63 mA/cm². The high work function ITO:Zr films can be used to modify the front barrier height of HIT solar cell.

Keywords: ITO:Zr, work function, HIT solar cell, transmittance



Transmittance (%)	Bare Glass	(15/65) nm	(15/85) nm	(15/105) nm	(15/125) nm
Air Base (300-1100) nm	92.00232	82.87482	83.00758	81.81252	82.57656
Glass Base (300-1100) nm	100	89.87169	90.51291	90.26094	89.70203



Thickness (nm)	J _{sc} (cm ² /mA)	V _{oc} (mV)	FF (%)	η (%)
(15/65)	710	32.72	72.05	16.74
(15/85)	710	33.27	73.87	17.45
(15/105)	710	34.63	73.84	18.15
(15/125)	710	33.88	72.92	17.54