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## Highly conductive and transparent ITO:Zr films for amorphous/crystalline silicon heterojunction solar cell

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ITO films doped with a small amount of high-permittivity materials not only retain the basic properties of ITO films but also improve some of their properties. We report the highly conductive and transparent (ITO:Zr) films with various substrate (RT to 300oC) temperatures on glass substrate for the HIT solar cell applications. We observed a decrease in sheet resistance from 36 to 11.8 Ω / □ with the increasing substrate temperature from RT to 300oC, respectively. The ITO:Zr films showed also lowest resistivity of 1.38x10<sup>-4</sup> Ω .cm and high mobility of 42.37cm<sup>2</sup>/V.s, respectively. The surface and grain boundaries are improved with the increase of substrate temperature as shown by SEM and AFM surface morphologies. The highly conductive and transparent ITO:Zr films were employed as front electrode in HIT solar cell and the best performance of device was found to be Voc = 710 mV, Jsc = 33.70 mA/cm<sup>2</sup>, FF = 0.742, η = 17.76% at the substrate temperature of 200°C.

**Keywords:** ITO:Zr, temperature, HIT solar cell, transparent

