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Optical and electrical properties of gallium doped indium tin oxide optimized for low deposition temperature applications

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Abstract:

In optoelectronic and photovoltaic devices, transparent conductive oxides are important in establishing a good electrical contact while minimizing optical losses over a broad range of wavelengths (400–1200 nm). To date, research has focused on In_2O_3 - SnO_2 (ITO) films. In this paper, we report on a study of Ga-doped ITO (GITO) films, which in contrast to standard ITO 90/10 (*i.e.* In:Sn = 90:10) films contain less In. Initially, we describe the development of a multicomponent Ga-In-Sn oxide target with a Ga:In:Sn ratio of 4:64:32, which was used in a radio-frequency sputtering system to deposit GITO thin films on glass substrates. Furthermore, we describe the microstructural/structural (scanning electron microscopy and X-ray diffraction spectroscopy), optical (wavelength dependent complex refractive indices) and electrical (resistivity, mobility, free carrier density) measurements used to optimize sputtering conditions and post-annealing processing. As well as achieving an optimized/improved GITO thin film deposited at high substrate and annealing temperatures, we obtained promising thin