

# **Fabrication and Characterization of Highly Conductive ITO electrode for Perovskite Solar Cells.**

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## Abstract

We have optimized the processing and annealing of sputtered indium-tin oxide (ITO) thin films for solar cell applications by DC magnetron sputtering. The effects of process parameters such as deposition power, reactive gas flow percentage, annealing temperature and time, as well as film thickness, on the sheet resistance and transmission of the ITO films was systematically studied, using a Design of Experiments. Additionally, structural characterization of the deposited films was performed using various techniques, including X-ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM), four-point probe, UV-VIS spectrometry, and atomic force microscopy (AFM). TEM analysis revealed grain boundaries, crystallinity, and d-spacing of ITO thin film. The grain size was calculated with the help of the Scherrer equation. The XRD spectra of the ITO films revealed a polycrystalline structure with preferred (222) orientation of the ITO film. The SEM image of the ITO target gives information about the morphology of the racetrack after sputtering. The topography and surface roughness were evaluated by atomic force microscopy (AFM). A sheet resistance of 10 ohms/sq. and transmission of over 90% over 400-700 nm wavelengths was achieved. Perovskite solar cells fabricated with these optimized ITO electrodes showed promising properties.