

# The Effect of Gas Environment on the Electronic and Optical Properties of Amorphous Indium Zinc Tin Oxide Thin Films

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The electronic and optical properties of Indium Zinc Tin Oxide (IZTO) thin films using gas environment were investigated by X-ray photoelectron spectroscopy (XPS) and reflection electron energy loss spectroscopy (REELS). REELS spectra revealed that the band gaps of IZTO thin films are 3.26, 3.07, and 3.46 eV for water mixed with oxygen, argon mixed with oxygen, and air environments, respectively. The measured band gaps by REELS are consistent with the optical band gaps obtained by UV-Spectrometer. The optical properties represented by the dielectric function  $\epsilon$ , the refractive index  $n$ , the extinction coefficient  $k$ , and the transmission coefficient  $T$  of the IZTO thin films with different gas environments were determined from a quantitative analysis of REELS spectra. The calculated transmission from quantitative analysis of REELS spectra shows good agreement with transmission measured by UV-spectrometer. The transmission values of 89% and low electrical resistivity of  $3.55 \times 10^{-3} \Omega \cdot \text{cm}$  have been achieved for argon mixed with oxygen which indicates that the gas environment plays an important role in improving the electronic and optical properties of films.

**Keywords:** IZTO, REELS, XPS, electronic and optical properties