

# Properties of Indium Tin Oxide Multilayer Fabricated by Glancing Angle Deposition Method

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Commercial applications of indium tin oxide (ITO) can be separated into two useful areas. As it is perceived to bear electrical properties and optical transparency at once, its chance to apply to promising fields, usually for an optical device, gets greater in the passing time. ITO is one of the transparent conducting oxides (TCO), and required to carry the relative resistance less than  $10^{-3} \Omega/\text{cm}$  and transmittances over 80 % in the visible wavelength of light. Because ITO has considerable refractive index, there exist applications for anti-reflection coatings. Anti-reflection properties require gradual change in refractive index from films to air. Such changes are obtained from film density or nano-clustered fractional void. Glancing angle deposition (GLAD) method is a well known process for adjusting nanostructure of the films. From its shadowing effects, GLAD helps to deposit well-controlled porous films effectively. In this study, we are comparing the reference sample to samples coated with controlled ITO multilayer accumulated by an e-beam evaporation system. At first, the single ITO layer samples are prepared to decide refractive index with ellipsometry. Afterwards, ITO multilayer samples are fabricated and fitted by multilayer ellipsometric model based on single layer data. The structural properties were measured by using atomic force microscopy (AFM), and by scanning X-ray diffraction (XRD) measurements. The ellipsometry was used to determine refractive indices and extinction coefficient. The optical transmittance of the film was investigated by using an ultraviolet-visible (UV-Vis) spectrophotometer.

**Keywords:** Indium tin oxide, ITO, GLAD, Glancing angle deposition, Antireflection