

# Nanostructured surfaces

## Angular ellipsometry of indium tin oxide films

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Indium tin oxide (ITO, or tin-doped indium oxide) is a solid solution of indium(III) oxide( $\text{In}_2\text{O}_3$ ) and tin(IV) oxide( $\text{SnO}_2$ ). ITO is the urgent problem of modern physics. It is applied for the production of transparent electrodes of liquid crystal screens[1] and solar cells[2].

We investigated the optical properties of thin films of indium oxide, produced by reactive magnetron sputtering in DC mode with different deposition times. The total pressure of reactive mixture (1/3 of oxygen and 2/3 of argon) was  $7 \cdot 10^{-3}$  Torr. The camera was exhausted to the vacuum  $2 \cdot 3 \cdot 10^{-5}$  Torr. The samples were heated up to the temperature of about 130-150°C during 20-30 min. The unoxidized silicon was used as a substrate. Time of the films deposition was equal to 10, 20, 40 and 60 seconds.

Ellipsometric parameters ( $\Delta$  phase shift between p- and s- polarization components and azimuth  $\psi$  of the restored linear polarization) samples were determined in a wide range of incidence angles  $\phi$  by standard laser ellipsometer "ЛІФ-3М-1" with helium-neon laser (wavelength  $\lambda = 632.8$  nm). The model of non-absorbing homogeneous layer on the absorption substrate (Si) was proposed to calculate the refractive index  $n$  and ITO films thickness  $d$ [3].

The defined thickness of the films are of 9,0-30,8 nm and the refractive index of 2.05-2.13 depending on the time of deposition according to the proposed model.

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2. J. Hotovy, J. Hupkes, W. Bottler, E. Marins, L. Spiess, T. Kups, V. Smirnov. *Sputtered ITO for application in thin-film silicon solar cells: Relationship between structural and electrical properties // Applied Surface Science.* – Vol. 269. – 2013.- pp.81-87..

3. Поперенко Л.В., Кудрявцев Ю.В., Стащук В.С., Янг Пак Лі. *Оптика металевих структур.- К. : Видавничо-поліграфічний центр «Київський університет», 2013.- 531 с.*