

Transparent Conductive Oxides for Large Area Applications by In-Line Magnetron Sputtering

Bernd Szyszka, F. Ruske, V. Sittinger, A. Pflug, W. Werner, C. Gerloff, S. Ulrich

Fraunhofer-Institute for Thin Films and Surface Engineering (IST),
Bienroder Weg 54e, 38108 Braunschweig, Germany
Email: bernd.szyszka@ist.fraunhofer.de

² Department of Electrical Engineering, University of St Mary, Athens 89657, Greece.
Email: anna@stmary.gr

Transparent and conductive oxide films are key components for large area optical devices such as energy efficient glazings, flat panel displays and thin film solar cells. Thin films with film thickness in the order of 10 nm are used as seed layer for Ag films and as blockers film for architectural glazing. Films with thickness of 100 to 200 nm are used as transparent electrodes in flat panel display applications. Thicker films with thickness from 500 to 1000 nm thickness are applied as window layer in thin photovoltaics.

Optimizing the film structure and morphology as well as defect chemistry is crucial for the performance of the different devices. This is especially true for ZnO:Al films which reveal complex dependencies of deposition parameters on film properties due to the hexagonal crystal structure and due to the complex defect structure for the Al doping of ZnO: The control of O or Zn-termination of the c-axis oriented hexagonal phase is crucial for wet chemical fine patterning, for application as seed layer and for the control of light scattering in Si-based thin film solar cells. Precise control of defect chemistry on the other hand is necessary to achieve high doping efficiencies. We present an overview on the current status of our TCO development for the different applications.