Abstract

During the last years there is has been an enormous research effort on the materials and processes for the production of transparent electronic devices (e.g. Organic Light Emitting Diodes-OLEDs, Organic Photovoltaics-OPVs, Electrochromic Devices-ECDs etc) grown on flexible polymeric substrates as well as on rigid substrates, such as Si and glass. The deposition of Transparent Conductive Oxides (TCOs) characterized by superior optical and electrical properties, in combination with desirable growth characteristics, compatible to polymeric substrates, is of considerable importance. Among all TCO materials, Zinc Oxide (ZnO) has emerged as one of the most promising materials due to its optical and electrical properties, its high chemical and mechanical stability and due to its low cost and abundance compared with the most currently used TCO materials.

In the framework of this Master Thesis, ZnO thin films were deposited on rigid silicon and flexible polymeric Poly-Ethylene Terephthalate (PET) and Poly-Ethylene Naphthalate (PEN) substrates by Pulsed DC Magnetron Sputtering technique from a ceramic ZnO target. The process held at room temperature and at argon atmosphere, applying various power on the target in order to investigate the effect of the deposition parameters on the structural, optical and topographical properties of the films. In-situ and real-time Vis-fUV Spectroscopic Ellipsometry (SE) has been employed to monitor the ZnO deposition. The analysis of the SE spectra revealed information about the growth mechanism, showing that the island growth is dominant. Furthermore, SE provided information about the time-dependence of the optical parameters (energy gap, absorption peaks, conductivity) of the films. The X-ray diffraction technique revealed that the films were preferentially grown parallel to the (002) axis and showed how the crystallinity of the films changes according to the power applied. Atomic Force Microscopy measurements revealed that the roughness of the films depends more on the power applied and less on the type of the substrate used.