PO3081

Comparative study of metal-oxide/diacrylate polymer multilayer stack barrier films for organic electronics encapsulation in a continuous roll-to-roll process

João Gomes[1], André Pinto[1], Maria Machado[1], José Silva[1], Joana Branquinho[1]

[1]CENTI, VN Famalicão, Portugal

jgomes@centi.pt

The lifetime stability of emerging organic optoelectronic devices is of major importance, due to the sensitivity of organic molecules and cathode metals to moisture and oxygen. For flexible OLED devices the target characteristics of barrier film coatings are flexibility, low weight, high transparency, low levels of water vapor transmission rate (WVTR) and oxygen transmission rate (OTR) and low cost production, with requirements for OLED lifetimes of 9000 hours demanding WVTR of <1E-6 $gm^{-2}day^{-1}$ and OTR of <1E-3 $cm^3m^{-2}day^{-1}$. Several barrier structures approaches have been proposed in order to reduce the permeation rate of vapour through the polymeric substrate, with the hybrid metal-oxide/polymer layer films being the more successful to date, stacking alternated polymer and inorganic layers in a multilayered structure of polymer/metal oxide,
In this work we present a comparative analysis of three different metal-oxide/diacrylate polymer multilayer barriers coated onto a transparent PEN substrate. Indium Tin Oxide, Titanium Dioxide and Aluminium Oxide thin films were deposited, interlayered with glycol-based diacrylate polymer thin and thick films. The resultant multilayers were studied, having the mechanical (flexibility) and adhesion properties between inorganic and organic layers, permeation rate to oxygen and water vapour, and optical transmission characterized comparatively, with the overall permeation and transmittance values compared with pre-defined target values. The di-acrylate polymer thin and thick films are coated using Polymer Multilayer deposition technologies setup in-line with pulsed DC reactive and AC dual magnetron sputtering for the metal-oxide sputter deposition. Both deposition processes are in-line, enabling a continuous roll-to-roll deposition process, and the comparative characterization addresses the thickness of each film, number of organic/inorganic layers, morphology, optical transmission and mechanical properties of the structure.

Keywords
Multilayer transparent barrier coatings
metal-oxide/diacrylate multilayer thin films
PML
AC and Pulsed DC reactive Sputtering