OR1907

Characterization of reactively sputtered permeation barrier materials on polymer substrates

John Fahlteich[1], Waldemar Schönberger[1], Matthias Fahland[1], Nicolas Schiller[1]

[1]Fraunhofer FEP, Dresden, Germany

john.fahlteich@fep.fraunhofer.de

Permeation barrier layers are not only used for food packaging but also needed to encapsulate flexible electronic devices. Commonly two approaches are followed to achieve very low water and oxygen permeation through a coated flexible polymer film: single layer optimization and the deposition of multilayer stacks. To optimize the properties of single layers special coating processes are used (e. g. ion beam assisted deposition or atomic layer deposition). In multilayer stacks barrier layers and polymer-interlayers are deposited alternately.
However, in both types of systems inorganic oxide or nitride layers form the barrier layer. Thereby sputtered layers are observed to be more impermeable compared to evaporated layers and the most PECVD layers. This paper reviews and compares different metal oxide layers, which are deposited onto a polyethylene-terephtalate (PET) film using a reactive dual magnetron sputtering process. The oxides of aluminum, silicon, titanium, zinc and a zinc-tin alloy are compared regarding their permeation barrier, structural and surface properties.
Cross-section images taken with scanning electron microscopy show a very compact structure for both aluminum oxide and zinc-tin oxide layers. These materials also have the lowest water vapor permeation compared to all other materials. The permeation mechanisms in both the amorphous materials and the polycrystalline zinc-oxide are evaluated by temperature dependent water vapor and oxygen permeation measurements.

Keywords
permeation barrier
reactive sputtering
zinc-tin oxide
encapsulation
polymer substrate