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Coating defects in barrier films deposited on polymers

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Polymers, like polyethylene terephtalate (PET), are used in fields like packaging or microelectronics but they have limited barrier properties against gas permeation. For many applications, like encapsulation of microelectronics, improved barrier properties are essential. Increased barrier performance can be achieved by thin inorganic films that are deposited by PE-CVD or PE-ALD and that serve as barrier film. However, a residual gas permeation is still present. This is lead back to the microscopic defects existing in plasma deposited coatings that may arise from particles, surface roughness or inhomogeneities on the surface of the polymer.
Deposited films (e.g. PE-CVD: SiO_x, PE-ALD: TiO_2) are analyzed by means of oxygen permeation measurements and detection of microscopic defects. The visualization of defects is based on the increase of defect diameter by reactive oxygen etching of the polymer and imaging with SEM. The etching process is performed in a capacitively coupled oxygen plasma.. The defects are quantified by an image processing software. Defects of various diameters and distributions are observed leading to the classification of defects.
The defect density is correlated with film thickness, OTR and various coatings (SiO_x, TiO_2,
a-Si:H). The effect of an additional substrate bias and of plasma pre-treatment on the defect density is presented.

Keywords
coating defects
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