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Gas barrier coatings deposited on polymer films by means of atmospheric pressure dielectric barrier discharge

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Organic electronic components are sensitive to oxygen and water from the atmosphere. Actually, diffusion of these aggressive species from the atmosphere leads to degradation and severe loss of performances. In order to increase lifetime of electronic devices, it is thus necessary to efficiently protect the active part of the component from the outside environment, thanks to an appropriate embedding. Silicon oxide like (SiOx) layers deposited by low pressure plasma processes are widely used to provide efficient gas barrier properties when deposited on films. However, these are batch processes which are not suitable for the treatment of large areas of polymer films.
Atmospheric pressure plasma processing offers several advantages such as the ability to treat films on-line. Furthermore, such plasmas allow the deposition of a coating at low temperature (close to ambient), thus limiting thermal degradation of polymer films.
Efficient gas barrier property of a layer is obtained when its intrinsic gas permeability is low and when the quantity of critical defects is reduced. That is the reason why multilayers are generally used as barrier coatings, assuming that defects from one layer are stopped at the interface and do not propagate through the next layer.
In this work, monolayers based on different chemistries and deposited by means of atmospheric pressure dielectric barrier discharge (AP-DBD) are investigated as base material to develop subsequent multilayer coatings on poly(ethylene terephtalate) (PET). Organosilicon layers are deposited on PET films with simultaneous incorporation of nanoclays during plasma polymerization. Dispersion of nanoclays in the plasma polymer matrix is measured by means of scanning electron microscopy (SEM) and atomic force microscopy (AFM). Fluorocarbon coatings deposited by means of AP-DBD are investigated for their interesting hydrophobic property. They are characterized by sessile drop testing, SEM, AFM and X-ray photoelectron spectroscopy (XPS)
Chemical information about plasma polymer layers is provided by attenuated total reflectance - Fourrier transform infrared spectroscopy (ATR-FTIR). Improvement of both dispersion of nanoclays in the organosilicon matrix and hydrophobicity of fluorocarbon layers are targeted by tuning AP-DBD deposition parameters accordingly.

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