PO3075

Large area barrier coating of flexible substrates

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Plasma polymer SiO_x coatings are widely used in order to enhance oxygen and water vapour barrier properties of polymers used in various industrial applications. In order to achieve a high quality barrier coating on large area flexible substrates e.g. plastic foils, homogeneous pretreatment and coating of the film has to be ensured. The homogeneity of the barrier is not only influenced by the film thickness, but also by the adhesion properties of the deposited layer on the plastic substrate as well as the morphology and chemical composition of the coating. The correlation between film morphology, the strain behaviour of the permeation barriers and the underlying plasma properties during the deposition process is not yet described sufficiently for large area chemical vapour deposition processes. To correlate the properties of the deposited thin films with the process parameters a deeper understanding of the interaction between plasma and polymer is necessary. In the presented project a new coating plant for low pressure CVD processes has been designed. Using pulsed microwave excited plasma, it allows the coating of foils up to a size of 300 * 300 mm². The material used is a polyethylene terephthalate (PET) foil (23 µm thick) Hostaphan RD by Mitsubishi Polyester Film, Wiesbaden, Germany. The pulsed plasma is characterised spatially and time resolved using various techniques, e.g. Langmuir probe and plasma absorption probe. Especially the effects of different process parameters on the permeation properties and strain behaviour of the deposited coatings are investigated. Next to XPS and contact angle measurements, suitable physical analysis methods like AFM and tensile testing in a LSM are used to characterise the surface in correlation to the plasma properties. Support by the German Research Foundation in the frame of SFB-TR87 is gratefully acknowledged.

Keywords
large area
barrier coating
plasma absorption probe
langmuir probe
PET