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Plasma pre-treatment of PET for barrier coatings

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In the recent years, polymers could further reduce glass and metals in high-tech applications as well as in consumer products due to their favourable properties. Plasma processes are widely used to modify the polymer surface as well as to deposit functional layers on them. Different barrier coatings are currently used in industrial applications and science. The most important barrier coating consists of silicon oxides (SiO_x). SiO_x coated polymers show a remarkably reduced oxygen and water vapour transmission rate. As polymers however usually possess a low surface energy an appropriate pre-treatment of the surface may be necessary in order to provide a strong adhesion of the coating to the substrate. The general approach of a plasma surface pre-treatment is to remove loosely bonded contamination from the surface and then to optimize the polymer surface in order to provide a stronger adhesion of the applied barrier coating. The polymer used in this study is RD23 (Mitsubishi Polyester Film Group, Wiesbaden), which is a 23µm thick, three layer coextruded PET foil with anti-block particles on one side and a very flat surface without particles on the other side. It is treated using argon and oxygen in pulsed microwave as well as a CCP and an ICP with comparable electron densities between 2-5×10¹⁶m⁻³ and different, adjustable ion energies. For different treatment times, the polymer surface morphology is investigated using a SEM, a LSM and an AFM. XPS, contact angle measurements as well as FTIR are used to investigate changes in chemistry and bond structure. SiO_x coatings are then deposited to investigate the influence of the different pre-treatments on the adhesion as well as on the oxygen barrier performance. Supported by the German Research Foundation within the SFB-TR87.

Keywords

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