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Surface modification of PET film via a large area atmospheric pressure plasma: An optical analysis of the plasma and surface characterization of the polymer film

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This research presents a comprehensive study of surface modification of polyethylene terephthalate film substrates to improve its adhesion properties using a large area atmospheric plasma. Different aspects of this study includes: analysis of the physical and chemical characteristics of the plasma as well as the substrates and evaluation of adhesion of an acrylate based hard coating onto PET substrates. PET is chemically inert to most coatings, but atmospheric plasmas can modify the surface in a manner that is compatible with high throughput manufacturing. First, optical emission spectroscopy was employed to analyze the plasma in terms of its chemical composition as well as physical characteristics such as electron temperature and density. This section estimates electron temperature of 0.2-0.4 eV and density in the order of 10^{14}-10^{15} cm^{-3} for the studied plasmas. Second, various plasma gas mixtures with helium as the seed gas mixed with fraction of oxygen and/or nitrogen (0.5-1.1 v%) were used to carry out the surface treatment of the substrates at different exposure doses between 15 to 75 J cm^{-2}. Post-treatment characterization by XPS, AFM and a goniometer show that the surface becomes enriched with oxygen, rougher and more wetting depends on the power and composition of the plasma. Lastly, standard adhesion 180° T-peel tests indicated improved adhesion after treatment.

Biography

Farzad Rezaei has graduated with a PhD in Fiber and Polymer Science from the College of Textiles at North Carolina State University. Currently, he works at the College of Textiles as a Post-doctoral Research Scholar. The focus of his research is on polymeric coatings, surface modification and plasma science.

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