Polymer Surface Modification With Plasma Reaction For Materials Integration

by

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ABSTRACT

Surface modification of polystyrene thin films was achieved using a plasma process with reactive gases to form functional groups. Advancing contact angles were measured after modification. Polystyrene surfaces were observed to reach a minimum average wetting contact angle of 7^{o}. The time required to achieve this contact angle decreased significantly by increasing the power of the discharge or by lowering the discharge source closer to the polymer substrate. Characterization studies of power, height, and corona exposure time versus contact angle led to the formation of surface energy gradients across the substrate.

Photoluminescent tagging agents were used to quantify the degree of carboxyl modification achieved with water plasma and amine modification achieved with ammonia plasma. AMCA (7-amine-4-methyl coumarin hydrazide) was used to show that surface modification reaches a maximum functionalization before degradation of the polymer substrate occurs with water vapor. A parallel study with OPA (O-phthaldialdehyde) yielded similar results when ammonia was ionized over the surface.

Additionally, stable surfaces were created by chemical reaction of zinc acetate with the freshly modified polymer. Zinc sulfide particles were formed within the polymer surface by reaction with hydrogen sulfide gas. Flourescence spectroscopy was used to verify the formation of zinc sulfide.

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