Surface Modification of Polypropylene by Atmospheric Pressure Plasma Jet in Argon/Oxygen

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Abstract

Atmospheric pressure argon/oxygen plasma jet was generated by using high voltage power supply with voltage in the range of (0-20) kV and frequency in the range (0-30) kHz. The plasma obtained was characterized by electrical and optical methods. The effects of plasma treatment on the surface properties of polypropylene films were investigated in terms of Fourier-transform infrared (FTIR) spectroscopy, scanning electron microscope (SEM), atomic force microscopy (AFM), and contact angle measurement. Contact angles with water and glycerol were used to determine the surface free energy of the sample. The surface free energy value of untreated sample was 27.8mJ/m^2 and increased to 52.5 mJ/m^2 after 1 minute of plasma treatment. The results showed a considerable improvement in surface wettability. The change in hydrophilicity was found to be dependent on treatment time up to 10s leading to a saturation beyond that. SEM and AFM images indicated that the surface roughness significantly increases after the treatment. This experiment further shows that C=O bond is the key factor to the improvement of the hydrophilicity of polypropylene surface.

References

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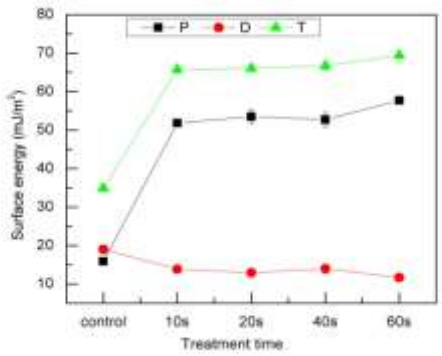

Figure. Total surface energy (T), polar component (P) and dispersion component (D) of PET as a function of treatment time in plasma.