Surface Modification of Polypropylene (PP) by Atmospheric Pressure Dielectric Barrier Discharge (APDBD) in Air/Argon

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This paper reports a dielectric barrier discharge (DBD) generated in atmospheric pressure. AC power supply with voltage of 13 kV (r.m.s), and frequency of 50 Hz was used for the generation of the discharge. The discharge was characterized by current-voltage analysis and optical emission spectroscopy to determine electron temperature (T_e) and electron density (n_e). Electron temperature and density in the discharge were found to be 1.01 eV and 1.59 × 10^8/cm^3 respectively. The DBD was employed to enhance the surface properties of polypropylene (PP) film. The change in hydrophilicity of treated surface of PP was measured in terms of water contact angle (WCA). In addition, changes in morphology of control and treated films were studied by scanning electron microscopy (SEM) and atomic force microscopy (AFM). SEM and AFM observations on the polymer samples showed an increase in roughness of the surface due to the treatment in DBD. After the plasma treatment, WCA was found to change from 93.7° to 61.9°, which indicated that the surface had changed to a hydrophilic state caused by an increase in the surface roughness and incorporation of polar functional groups into PP surface. The treatment in the discharge in air with argon was found to be more effective in improving the hydrophilicity compared to the discharge in air without argon.

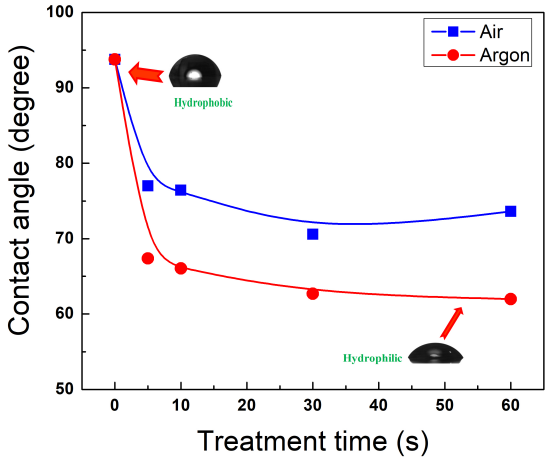

Fig. Water contact angle on the surface of PP as a function of treatment time in air and air-argon discharge.

References
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