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Influence of Plasma Bullets in Helium Atmospheric Pressure Plasma Jet on the Surface Modification of LDPE

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Pursuing a very effective approach which is used to improve the surface properties of polymers without altering their intrinsic bulk properties is always popular. The technology has shown attractive perspectives in the field of surface modification of polymers as atmospheric pressure cold plasma is particularly rich in active components. In the past decade, many researchers devoted their interests to the plasma treatment effects and mechanism. These works have constructed a foundation for conducting the further investigations. In the present work, the surface modification of low density polyethylene (LDPE) by using a glow-like helium atmospheric pressure plasma jet (APPJ) was investigated. The influence of plasma bullets on the LDPE surface properties was examined in detail. The APPJ was electrically and visually characterized by employing the probes and digital camera. The APPJ's length and deposited power with the gas flow rates and the applied voltage were researched statically. A stable and uniform APPJ with suitable power was selected to treat LDPE thin film (about 50um). The photo treated after APPJ showed a concentric annular structure but not a uniform area on surface of LDPE. Then the dynamic evolution of the plasma bullets with nanosecond scale worked on the surface of LDPE were captured with an intensified charged couple device (ICCD) camera. The hydrophilicity measurement results indicated a spokewise distribution of water contact angle (WCA). This result maybe not our respect. On the basis of our previous researches about the plasma bullets, we considered the penning effects and added a little nitrogen into the pure helium. Using the optimized APPJ to treat the surface of LDPE, the surface modification effects was examined by employing different analyzing techniques including water contact angle (WCA) measurements for the wettability and surface energy, X-ray photoelectron spectroscopy (XPS) for the chemical composition.

Keywords
APPJ
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LDPE
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