PO1065

The effects produced by two types of atmospheric pressure plasma sources on polymeric surfaces

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The objective of this study is to determine the optimal treatment conditions, to compare the modifications and also to analyze the local effects produced on polymeric foils by two types of atmospheric pressure cold plasma sources, namely by a dielectric barrier discharge (DBD) and a discharge with bare electrodes (DBE). Argon is used as feeding gas while the discharges are generated with radiofrequency (13.56 MHz) power. Both sources produce planar jets and have similar operating operational (RF power, gas flow rates) and dimensional (discharge volume, size and shape of nozzle) parameters. The treatments were performed in open atmosphere using a scanning procedure which allowed a uniform surface modification. Studied polymers were polyethylene terephthalate (PET) and polymethylmethacrylate (PMMA). Treatment conditions were varied to observe their effects in terms of changes in surface proprieties of polymeric materials. The effects were evaluated by atomic force microscopy and static contact angle measurements. The results show a significant increase of surface wettability after very short (50 ms) cold plasma exposure, for all materials. Polymeric surfaces studied were converted from a hydrophobic character into a hydrophilic behavior with a water contact angle less than 45 degrees. After treatment, the studied samples were deposited in air at room temperature. The hydrophobic recovery (ageing effect) of the modified surfaces was monitored as a function of time. These results indicate that both types of plasma sources improve the wettability of the studied materials; still in similar working conditions the DBE plasma is more efficient for modification of surface properties. In addition, the planar jets were characterized by Optical Emission Spectroscopy to reveal the difference between the two source types and to infer the role of active plasma species in surface modification.
Acknowledgments: This work was financially supported under projects PN III/Nucleu/NILPRP/Romania

Keywords
surface modification
atmospheric pressure treatments
wettability