Affecting Parameters on Polymers Surface Treatment by Atmospheric PressurePlasma Jets

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ABSTRACT

Low-temperature atmospheric pressure plasma jet (APPJ) is a new technology that proves their effectiveness in the field of polymer surface treatment. It used to improve wettability and adhesion property of the surface. These modifications are affected by the treatment time, source- surface distance, the discharge gas and the type of polymer. The aim of this study is to reach a deeper understanding about the influence of these parameters on the surface modification of different polymer through review of research paper published during the past years.

Introduction

Due to their ease of installation and the absence of vacuum chamber the atmospheric pressure plasma jets (APPJs) at low-temperature take the attention of modern research, especially in the surface treatment and modification of polymer [1,2]. There are various methods to generate APPJ, such as radio frequency (RF) discharge,alternative courant discharge (AC) and direct current (DC) discharge. All of these methods are used to modify the property of polymer surface like the wettability or the adhesion strength paint and coatings to polymer surface. Given the variety of parameters that are involved in APPJ treatment, a comprehensive understanding of the effect of these factors will aid in better utilization of this methods. This study focuses on the effect of the importantparameters; treatment time, distance of the surface from the source and the gas used, already published by researchers.

Treatment time

During the exposition to the jet, the surface properties change with treatment time then remain unchanged when the time is greater than a critical value depending on the type of polymers [3,4], due to the saturation of activesites.

Surface-source distance

The concentration of the plasma spaces decreases along the jet, this axial gradient is due to the short lifetime of the reactive spaces and their reaction with atmospheric space or recombination processes in the plasma bulk. As aresult, the modification of surface is important when the surface is near from the source [5,3].

Discharge gas

The energetic space of the plasma such as ions, electron, excited atoms or molecules are depending on the discharge gas, consequently the change will be different. It was fond that in the case of air or a mixture of oxygen and argon O_2/Ar plasma, the modification of contactangle is more important than Argon plasma. This resultcould be attributed to the formation of high concentrationof polar groups produced by air and oxygen [5].

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Type of polymer

The chemical composition of the polymer affects significantly the degree of change that the plasma induces on its surface. Aromatic polymers are more resistant than other polymers to plasma modification, because of their aromatic groups, such as phenolic compounds [6].

Conclusion

The treatment time, the source-surface distance, the discharge gas and the type of polymer are among factors that affect modification of polymer surface properties with atmospheric pressure plasma jet. Such a review study will contribute to master all parameters behind the desired properties and then aids to set and develop this technology to specific application.

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