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Experimental Study of Atmospheric pressure Argon /Oxygen Plasma Jet and Treatment of Polycarbonate and Polyamide-Nylon Surface

Rajendra Shrestha, Deepak Subedi

Kathmandu University, Dhulikhel, Nepal

rajendra.ts2002@gmail.com

In this work, we report a plasma jet with a capillary electrode working at atmospheric pressure is developed to create non thermal plasma. It was operated with Ar/O_2 gas using 3.5 kV, 27 kHz, sine wave as an excitation source. The discharge has been characterized by electrical and optical methods. The electrical properties of discharge have been studied by means of voltage and current measurement to determine electron density. Electron temperature has been estimated by optical emission spectroscopy. This plasma jet has been used for surface modification of polycarbonate (PC) and polyamide-nylon (PA6,6). The aim of this study is to determine the optimal treatment conditions and also to compare the polymer surface modification induced by argon plasma jet with the one obtained by Argon/Oxygen plasma jet. Different discharge power density, distance from the nozzle and treatment time are selected to study the effects of discharge operation parameters on the surface treatment. The surface properties of the untreated and plasma-treated samples are characterized through contact angle and surface energy measurement. Changes in surface composition and chemical bonding were analyzed by Fourier transformed infrared spectroscopy (FTIR) that detected incorporation of oxygen-related functional groups. Results showed that after the atmospheric pressure Ar/O_2 plasma jet treatment, the water contact angle decreases with the increase of treatment time leading to an increase in surface energy.

Keywords
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contact angle
surface energy
FTIR