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Mechanism of polymeric surface modification using by an atmospheric-pressure plasma jet

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Non-thermal atmospheric-pressure plasma jet is one of effective plasma processes for the polymeric surface modification. The plasma jet is technologically simple, environmentally friendly and is very economical as they often do not require expensive vacuum equipment. Using this plasma source, we have successfully achieved localized modification, with a circular boundary, that was confirmed by both 2-d scanning of the water contact angle and observing the lens epithelial cells in culture on the modified polymeric surface. However, modified area is typically more than ten times larger than the radial scale of the gas nozzle. Understanding of the mechanism for how the small plasma jet can modify the large area of polymeric surface helps us to control the size of the effective modified area. Plasma jet emerging into the moist ambient air is typically complex. The interaction creates number of radicals, charged species and photons. Our preliminary work of a (time-resolved) mass spectrometry revealed there are numbers positive and negative ions, probably similar number of radicals, ultraviolet photons in wide range of energy. In recent, we suggested a blocker between the jet and polymer substrate to block the ionic species and the photons approaching the polymeric surface. In particular, the shape of the blocker is a round to allow gas passing behind it but terminate ionic species and high energy photons. Also, it is stained to block the visible photons. Further investigation of mass spectrometry and Schlieren photograph will discuss at the meeting.

Keywords

Atmospheric-pressure
plasma jet
polymer modification
mass spectrometry