Surface Functionalization of Organic Materials by Weakly Ionized Highly Dissociated Plasma

Miran Mozetič[1]
[1]*Jozef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia*

Miran.mozetic@guest.arnes.si

A review on surface modification of different polymers by treatment in oxygen plasma is presented. Plasma is created in a high frequency inductively coupled gaseous discharge at the power of several 100W. In such discharge created in pure oxygen or a mixture of oxygen with argon, plasma with the following parameters is obtained: the electron temperature of several 10.000 K, the charged particle density around $1x10^{16}$ m^{-3}, and the neutral oxygen atom density of the order of 10^{21} m^{-3}. A huge flux of neutral oxygen atoms on the surface of samples exposed to plasma assures for rapid interaction with polymer materials. The modification of surface properties of the following polymers was studied: polyethyleneterephthalate (PET), polyethersulphone (PES), polyphenylenesulfide (PPS), Nylon 6 polyamide (PA6), polytetrafluoroethylene (PTFE), polystyrene (PS), polypropylene (PP) and cellulose (ink-jet paper and textile). The polymer samples were treated for 3 s in oxygen plasma (glow region as well as early afterglow) at a pressure of 75 Pa. The appearance of the functional groups on the surface of the samples was monitored by high resolution X-ray photoelectron spectroscopy (XPS). The results show that oxygen plasma treatment is an effective tool for surface modification. On all polymer surfaces increased concentration of oxygen is detected. The high resolution C1s peaks indicate formation of several new oxygen-containing functional groups. On all polymers groups like C-O, C=O and O=C-O are observed. The concentration of these groups depends on the type of polymer. The highest uptake of oxygen by the polymer was found for cellulose and the lowest for polypropylene. The only exception was polymer PTFE where practically no chemical changes were observed after plasma treatment.