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PREPARATION AND PROPERTIES OF PSII-TREATED POLYSTYRENE PLATES

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The Plasma Source Ion Implantation (PSII) technique has been utilized to improve the hardness, friction, wear and corrosion properties of material surfaces, and to substitute the doping steps in semiconductor manufacturing. Recently, our group investigated the use of PSII in the modification of polymeric materials.

Polymer surfaces can be modified by a common method using corona discharge or radio-frequency glow discharge plasma. Plasma treatments have long been known to increase the wettability of hydorcarbon-based polymers, such as polypropylene, polyethylene, and polystyrene. It is also well known that surface modification efficiency introduced by the plasma treatment significantly decays with time.

In this study polystyrene was treated with different kinds of plasma ions to render the surface more hydrophilic or hydrophobic by PSII. Hydrophobic recovery of PSII-treated polystyrene was also observed as a function of ageing time, ageing temperature, and treatment parameters. Treatment parameters are kinds of gases, pressure, plasma power, pulse frequency, pulse voltage, etc. Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) has been used to interpret the PSII-treated polystyrene surface and its hydrophobic recovery, with assistance of X-ray Photoelectron Spectroscopy (XPS) and water contact angle measurements. Hydrophilic property improvement as measured by water contact angle goniometer can be linked to the chemical changes occuring at the surface of polystyrene as identified by TOF-SIMS. These findings are complemented by XPS data. TOF-SIMS spectra of $^{18}O_2$ PSII-treated samples showed the presence of ^{18}O-containing peaks in clusters from the modified surfaces. The comparison of ageing behavior data allows for examination of the differences in the stability of the functionality introduced by the plasma and PSII treatment techniques. These experiments are designed to give a deeper understanding of the properties and mechanism of PSII treatment on polymer surfaces.