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Surface properties of polystyrene ionomers treated by plasma source ion implantation

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Polystyrene-based ionomers were modified to improve the wettability by Plasma Source Ion Implantation (PSII). Surface energies of polystyrene ionomers treated by PSII were investigated to get an understanding of the hydrophobic recovery which is time-dependent properties making the treatment less effective. Many polymers modified by the insertion of polar groups lose their polarity over time after the surface treatment.

Ionomers contain a small amount of ionic groups, which attach either directly to the relatively non-polar polymer backbone or exist as pendant groups along the polymer chains. In ionomers strong attractive Coulombic forces between ionic groups lead to ion aggregation, termed multiplets, within the relatively non-polar polymer matrix, and the mobility of polymer chains surrounding the multiplet is restricted. Incorporation of ionic groups in polymer structure will lead to more hydrophilic and less hydrophobic recovered polymer surface after PSII treatment due to higher glass transition temperature(T_g).

To observe the dependence of the ion size and ion content on the wettability and aging behaviors, ionomers of poly(styrene-co-styrenesulfonic acid)(PSSA) polymer series such as PSSLi, PSSNH4, PSSNa. PSSZn, PSSCs, and PSSBa having different ion content, and poly(styrene-co-methacrylic acid)(PSMAA) polymer series were treated by O_2-PSII with 5 keV for 1 min. PSII-treated polystyrene ionomers were aged in air for various periods of time and the wettabilities were measured by the contact angle goniometer. Surface free energy(γ_s) made up of two components, dispersive force(γ_s^d) and polar force(γ_s^p) were calculated by the water and diiodomethane contact angle. After the treatments, a sharp increase in the polar force is

observed, but the dispersive, nonpolar part of the surface free energy is much less affected. Modified structures in ionomers were maintained for a long time because of the restricted marcromolecular motion .