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Mechanism for Ring-Opening of Aromatic Polymers by Remote Atmospheric Pressure Plasma ELEAZAR GONZALEZ, MICHAEL BARANKIN, UCLA, PETER GUSCHL, Surfx Technologies, ROBERT HICKS, UCLA — A low-temperature, atmospheric pressure oxygen and helium plasma was used to treat the surfaces of polyetheretherketone, polyphenylsulfone, polyethersulfone, and polysulfone. These aromatic polymers were exposed to the afterglow of the plasma, which contained oxygen atoms, and to a lesser extent metastable oxygen ($^1\Delta_g$ O_2) and ozone. After less than 2.5 seconds treatment, the polymers were converted from a hydrophobic state with a water contact angle of $85\pm5^\circ$ to a hydrophilic state with a water contact angle of $13\pm5^\circ$. It was found that plasma activation increased the bond strength to adhesives by as much as 4 times. X-ray photoelectron spectroscopy revealed that between 7% and 27% of the aromatic carbon atoms on the polymer surfaces was oxidized and converted into aldehyde and carboxylic acid groups. Analysis of polyethersulfone by internal reflection infrared spectroscopy showed that a fraction of the aromatic carbon atoms were transformed into C=C double bonds, ketones, and carboxylic acids after plasma exposure. It was concluded that the oxygen atoms generated by the atmospheric pressure plasma insert into the double bonds on the aromatic rings, forming a 3-member epoxy ring, which subsequently undergoes ring opening and oxidation to yield an aldehyde and a carboxylic acid group.

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