Controlling PTFE surface chemistry with gas plasma technology

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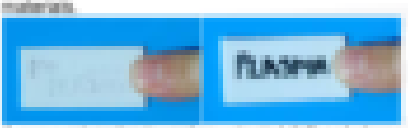
PTFE is used in a broad spectrum of applications that exploit its unique combination of bulk properties. Often however the application of PTFE in device manufacture encounters problems related to its surface properties. Poor surface wettability leads to bonding problems, not just for adhesives, but also for inks, coatings and bio-materials.



A permanent marker is used on untreated (left) and plasma treated (right) PTFE coupons. After plasma, the ink cannot be removed by finger rubbing.

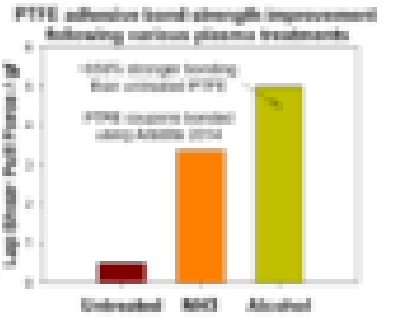
Gas plasma surface modification has solved many of the compromises between bulk and surface properties of fluoropolymers and PVA TePla America's new plasma activation processes provides PTFE with increased wettability and bondability to adhesives, inks, and selective biomaterials with remarkable improvements in stability and treatment lifetime. Better control of specific chemical functionality on PTFE has also been attained, adding flexibility to its use in biological media by enabling the conjugation of bioactive molecules to its surface.

What is plasma?

Plasma is a state of matter just as a solid, liquid or gas. Add enough energy to a gas and it becomes ionized into the plasma state. Chemically it is a highly reactive environment that is used to change the properties of surfaces without affecting the bulk material. Gas plasma processing is a powerful tool in solving surface preparation problems. It provides a reliable, consistent, and environmentally friendly method of nano-scale cleaning, activation for increased surface wettability, chemical grafting, and coating deposition.

Adhesion promotion.

The role of plasma surface modification of PTFE is to provide reactive chemical functionalities that promotes the binding of adhesives, inks, and the conjugation of molecules that encourages biocompatibility. Adhesion properties of PTFE are improved more than 8 times by the plasma induced copolymerization of alcohol to the surface. This process shows significant improvements over ammonia plasma treatments.



PTFE bonding strength has a direct relationship to surface energy, quite independent of the drivers causing the surface energy change (defluorination and surface polarization). This has interesting implications for in vivo applications that require the preservation of low surface energies while at the same time grafting specific chemical functionalities to PTFE.

Treatment lifetime

Plasma induced alcohol copolymerization of PTFE has also extended surface activation lifetimes well beyond those previously attained using ammonia plasma. The confinement to a six hour window for downstream processing and staging time has now been extended to beyond two weeks, adding greater flexibility to manufacturing environments.