Plasma Cleaning, Activation and Modification of Surfaces for Improved Adhesive and Bonding Strength

Uwe Beck, Jennifa Baier, Gundula Hidde, Stefan Hielscher, Thorid Lange, Renate Mix

BAM, Berlin, Germany

uwebeck@t-online.de

Plasma technology is a key technology for surface engineering as also processes beyond the thermo-dynamic equilibrium can be realized for a huge variety of functional properties almost independent of the material class. Thin film and coating technology are based on plasma processes, for printing and bonding technology plasma processes are at least essential. Hence, the determination of adhesive and bonding strength on stratified interfaces is of general interest.

However, the quantitative determination (in MPa) of adhesive and bonding strength has been a challenge until the availability of centrifuge technology. This multiple-sample tensile testing techniques allows the quantitative evaluation of adhesive and bonding strength on a statistical basis without any sample clamping.

The composite, either a coating/substrate system or an adhesive-bonded joint, is only inserted and one-sided supported. As a result, a wide range of tensile strength can investigated from below 1 MPa up to 100 MPa without any effect of shear forces within a short period of time. This again, is a prerequisite for reliable and reproducible determination of the effect of plasma cleaning, activation and modification in particular on polymer and glass surfaces prior to deposition or bonding.

A variety of examples (metallized polymers, coatings for precision and ophthalmic optics, curing conditions of adhesives, adhesive-bonded joints with low surface energy materials) is discussed regarding the effect of plasma-treatment, the presence of functional groups and adhesion promoters. It is shown that the use of centrifuge technology and the evaluation of failure pattern are pointing the way ahead for improved adhesive and bonding strength by means of plasma technology.

Keywords
plasma treatment
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adhesion promoters
centrifuge technology