

APPLICATION INFORMATION

Openair-Plasma® in multicomponent injection molding and extrusion

Openair-Plasma® makes it possible to use low-cost structural components in rigid-flexible and rigid-rigid composite

Joints between different materials in composites play a major role in various industries. By joining different components a product can be given new physical properties which the individual materials do not possess. Thus, by this means products can be obtained which, on the one hand, exhibit great rigidity and strength but, on the other hand, simultaneously have a surface that is both flexible and pleasantly tactile.

For example rigid-flexible composites of low-cost materials such as polypropylene (PP) with TPUs (thermoplastic polyurethanes) have not been possible to date because the TPU did not adhere to the PP. When designing components recourse had to be made to the more expensive ABS/PC. Pretreatment by means of Openair-Plasma® now makes it possible to achieve joints between PP-PA, PA-PA, PA12-PA6, PE-PA6, PBT-PA6 and between unmodified TPUs. Today, across Europe some 52 million t of PP pa are produced. Of this on average ca. 100 kg are fitted into every European motor car. Due to the process now available this volume will rise distinctly higher. Thus, parts coated with a thin skin of TPU affording attractive tactile properties can now be produced. By this means PU soft-touch paints that give rise to some problems can be replaced. PP is also used ever more frequently to manufacture products in which the described rigid-flexible characteristic is a requirement, e.g. in tools, suitcases, housings and functional parts for household systems such as coffee machines and toasters.

Material Combinations			
ABS		P	
ABS/PC		P	
PA 6		P	
PA 6 25GF		P	
PA 6.6		P	
PA 6.6 25GF		P	
PBT		P	
PC		P	
PS		P	
SAN		P	
PP		P	

Legend	
P	plasma treated (very good adhesion)
	without plasma treatment
	very good adhesion
	moderately good adhesion
	adhesion
	bad adhesion
	no adhesion

Operating at normal pressure (ambient conditions) and the compact structure of the plasma generator allow numerous novel applications in two-component injection molding and in two-component extrusion. With the aid of Openair® Plasma technology TPU can now be injected directly onto materials that previously could not be joined to it. Example applications include injection embedding of handles and seals injected on top of another material. In rigid-rigid composites, in housings for example, this innovative advance also affords quality and cost advantages. As the table shows, however, PP is not the only plastic for which Openair® Plasma can be used to produce rigid-rigid joints. Numerous new combinations of materials can now be implemented.

Two-component composites produced by the Openair-Plasma® process allow:

- Powerful adhesion
- Enormous cost savings (use of alternative combinations of materials)
- Simple processing with pretreatment in the mold or inline in extrusion
- Extensive quality improvement

With reference to the example of TPU, treatment with Openair-Plasma® brings about activation of the surface of the material. OH groups are formed on the surface which undergo strong chemical bonding to reactive constituents of the second component (TPU). Through isocyanate functional groups durable bonds are produced.

Process:

After extrusion or injection of the first component the contact surface between the materials is briefly activated with plasma. After this the mold is closed again and the second component is injected on top. In extrusion the second component is extruded with a second die.

- Adhesive bonds with TPU brought about by Openair-Plasma® withstand all common tests for long-term bonding strength.
- Pretreatment can take place both directly in the mold and when transferring to another mold.
- Inline use: By means of a simple electric connection/extension Openair® Plasma technology can be integrated equally well into existing and new production lines and processes.
- The process is environmentally friendly and reduces costs.

Mode of operation of the plasma process:

- Activation: Physicochemical preparation of the surface onto which injection is to take place
- Cleaning: Ultrafine cleaning of the surface to remove organic residues
- Electrostatic discharging of the surface of the part
- No mechanical machining steps required

Openair-Plasma® as a key technology

Constantly rising raw material prices and growing demands for quality call for new technologies. For car users TPU is a modern material which is not only lightfast and resistant to discolouration but can also be employed in relatively light colours. The creation of new adhesive composites using this material means a signifi-

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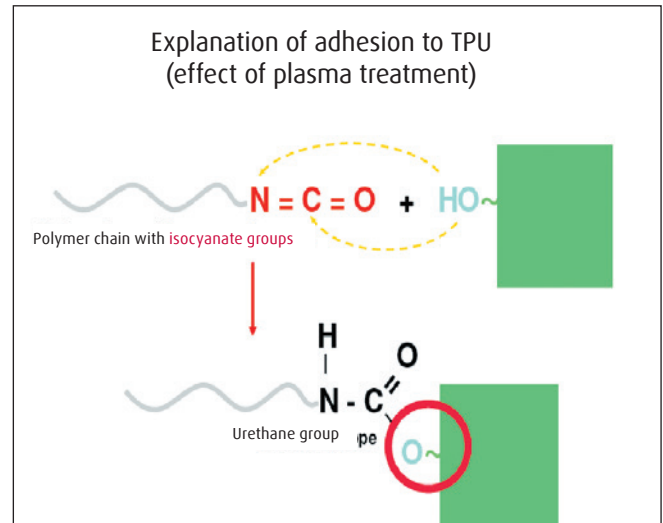


Fig. 3: Surface activation



Fig.4: Car door panel with a soft-touch covering

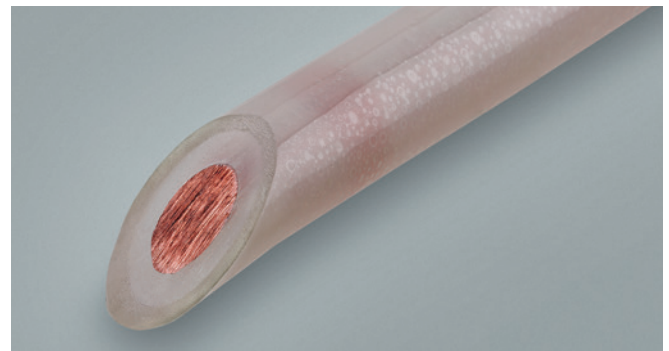


Fig.5: Plasma-treated extruded part

cant expansion of its fields of application. Atmospheric-pressure Openair-Plasma® technology provides the decisive conditions for this in two-component injection molding and in two-component extrusion.