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KUNSTSTOFFANWENDUNGEN IM AUTOMOBILBAU

EINE VERLAGSBEILAGE VON

adhäsion KLEBEN & DICHTEN
ATZ
ATZ produktion
JOT
lightweightdesign

Atmospheric Plasma

Contours-Fit Dashboard Pretreatment

Masking before filling instrument panels with foam is a labor-intensive process. A way out of masking and what other advantages can be derived therefrom is shown by an atmospheric plasma process from Plasmatreat GmbH that has been in use by a South German automotive component supplier for the Audi Q5 series for two years now.

Three years ago the plastic component supplier Peguform received an order for manufacturing the instrument panel for the Audi Q5 series. The dashboard structure is composed of three material layers: a long glass fiber-reinforced plastic structural member, a PUR foam layer and a so-called slush skin which is a molded PVC skin. Peguform produces the structural members in polypropylene (PP) by injection molding. This type of nonpolar plastic material mandatorily requires pretreatment to allow for the subsequent adhesion processes. The objective of such a pretreatment is to increase the surface energy. The higher it is, the better the subsequent adhesion to the foam. For manufacturing the Q5 dashboard structural member, the company planned to construct a new pretreatment plant at its factory in Neustadt. After completion of a test phase, the advantages of the plasma-based pretreatment plant - over the previously employed flaming technique - were quite obvious. Besides operating cost savings, it were above all the patterned plasma treatment and the associated elimination of masking tasks combined with the strong adhesion effect due to the high activation energy of plasma that convinced Peguform. Series production with the new plant started early in 2008.

PLASMA ACTIVATION

The atmospheric plasma process developed by Plasmatreat, Steinhagen, in 1995 and nowadays in use all over the world is based on a nozzle principle for the most varied component geometries. The systems work under normal ambient conditions and are solely operated with compressed air and high voltage. The plasma strongly activates the surfaces of metals, plastics, glass or ceramics by selective oxidation processes, simultaneously discharges the former and brings about microfine cleaning of the surfaces, Fig. 1. The surface energy is the most important measure for evaluating the probable adhesive strength of an adhesive layer or coating. Tests on nonpolar thermoplasts such as PP indicate low surface energies, mostly between 28

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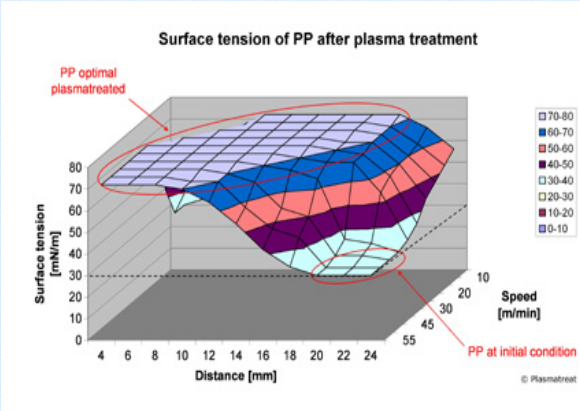
FIGURE 1 The atmospheric Openair plasma beam operates in a patterned manner and brings about microfine cleaning and strong activation of the polypropylene surface of the dashboard.

mN/m and 32 mN/m. But good conditions for adhesion can only be obtained by experience from 38 to 42 mN/m onward. A plasma treatment, i.e. a strong activation of the material surface, can bring about a distinct increase in surface energy. Trials at Plasmatreat have revealed that values up to over 72 mN/m become possible for most plastic materials, Fig. 2. The system excels by its high process safety which in turn has a positive effect on the adhesion and the product quality.

PATTERNED PRETREATMENT

The plasma system equipped with three rotary nozzles operates with an emission speed of approx. 250 m/s. The activation is therefore also effective in the case of complex geometries - such as small recesses and undercuts. The working range of the plasma is close to the nozzle so that variations in distance due to different tolerances on components and tools hardly become noticeable in the pretreatment track width. One of the positive effects is the true-to-contour scanning of the plastic surface, Fig. 3. The plasma nozzle can make changes in direction over the component and is capable of passing over tracks, not only over lines, whereas major changes in direction must be made outside the component when applying the flaming

FIGURE 2 Trials at Plasmatreat revealed a high process safety



technique since the thermal impact on the point of reversal could otherwise cause burns on the surface.

UNMASKED

The foam injected by the foaming installation between the PP structural member and the slush skin for the soft touch of the instrument panel must adhere at certain places but not at others. Areas not to be treated include, for example, bolt-on points or add-on parts or - in the case of exclusive designs - places where the back-foamed slush skin is to be replaced by real leather later on. All areas where no foam adhesion is desired must be masked with thermally stable masks for the flaming process. The Openair technique eliminates the work step of masking since the robot-guided plasma beam operates in a patterned manner. Unlike the flaming process, it is capable of following the component geometry with millimeter precision. In the untreated areas, the spot-faced slush skin with the back-foamed PUR foam can be easily peeled off, Fig. 4. Areas where complete openings of the structural member are to be provided for instrument installation, are milled out separately, Fig. 5.

FIGURE 3 The plasma nozzles mounted to two robot arms pass over the surface true to contours and exactly keep those areas untreated where no PUR foam adhesion is desired.

FIGURE 4 View of the open foam installation

FIGURE 5 A milling system provides for the instrument openings. The back-foamed slush skin can be easily manually removed from the non-plasma-treated areas.

LONG GLASS FIBER REINFORCEMENT

If the "distance from the component" or "duration of the flaming" parameters deviate from the specification, even if only for a minimum, a 1000 °C hot flame can become detrimental to the thermally sensitive PP. And this is especially true when a long glass fiber-reinforced plastic material is involved. Should the PP melt due to the heat of the flame at one time or another, the fibers would lie loosely on the surface so that good adhesion to PUR foam would no longer be ensured. A heat accumulation could furthermore occur in the area of the recesses of the display instruments while flaming since the heat cannot dissipate which would lead to the same result. The Openair technique excludes these risks. The atmospheric plasma, also known as "cold" plasma, does not heat the plastic material to a temperature over 30 °C during the treatment.

CONCLUSION

Peguform's experience with the stable pretreatment process from Plasmatreat proved to be successful. Not a single field failure was recorded since the start of production of the Audi Q5 dashboards. The decisive advantages include, among others, the reliability and high effectiveness of the Openair method in the production process. Adding to this are the ease of integration into automated process operations and the higher cost effectiveness compared to conventional methods.

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