Pin-point precision
Openair® plasma for true-to-contour, mask-free pretreatment in the automotive industry

Pretreatments using flame technology require labor-intensive masking of instrument panels before they can be filled with foam. A plasma process used in the Audi Q5 provides an alternative to masking, along with several other advantages.

As well as many other dashboards, automotive component supplier Peguform manufacturers the instrument panel for the Audi Q5 at its production facility in Neustadt an der Donau. This instrument panel is composed of three layers of material: a long-glass fiber-reinforced plastic substrate, a PUR foam layer and a molded PVC skin, known as a 'slush skin'. The structural parts are made from injection molded polypropylene. Pretreatment is essential with this type of non-polar plastic to facilitate subsequent adhesion processes.

Cost-effective and reliable

Instead of using conventional flaming technology to manufacture the instrument panel, Peguform opted instead for a pretreatment with atmospheric pressure plasma. After completing a test phase and comparing the cost with building a flaming plant, the advantages for the manufacturer were plain to see. The decisive factor was the locally selective application afforded by the plasma

Fig. 1: ***Plasmatreat***
Robot-controlled patented Openair® plasma rotary nozzles scan the surface of the instrument panel with pinpoint accuracy, leaving out areas where no foam adhesion is required. This eliminates the need for masking.

nozzles, which also meant that masking was no longer required. Furthermore, the 'cold plasma' does not damage the long-glass fiber-reinforced polypropylene surface, the system has a high degree of process reliability and the technology as a whole significantly reduces operating costs.

Triple action

Invented by market leader Plasmatreat twenty years ago and now used throughout the world, Openair® plasma technology is based on a nozzle principle. The system operates under normal atmospheric pressure using nothing other than air and high voltage. The process performs three operations in a single step lasting only a matter of seconds: It simultaneously brings about the microfine cleaning, electrostatic discharging and activation of the surface **(Fig. 2)**. This triple action far outweighs the effectiveness of conventional systems. The result is homogeneous wettability of the material surface and long-time stable adhesion of the adhesive bond or coating even under challenging load conditions. A special feature of the system is its high process reliability and reproducibility.

True-to-contour pretreatment

Peguform's plasma system with three robot-controlled rotary nozzles operates at flow rate of approximately 250 m/s. As a result, even complex geometries such as tiny recesses and undercuts can be effectively activated. The working range of the plasma is close to the nozzle, which means that variations in distance caused by different tolerances on components and tools are hardly noticeable in the pretreatment track width. A particularly benefit is the true-to-contour scanning of the plastic surface **(Fig. 1)**. The plasma nozzle can change direction on the component and is capable of passing over tracks as well as lines. When applying the flaming technique, however, major changes in direction must be made outside the component since otherwise the thermal impact at the turning point could cause surface burns.

Risk of flaming

If the 'distance from the component' or 'duration of flaming' parameters deviate even slightly from specification, the flame, at over 1000 degrees, can damage the thermally sensitive PP, especially a long-glass fiber-reinforced plastic, as in this case. If the PP were to melt due to the intensity of the flame, the fibers would lie loosely on the

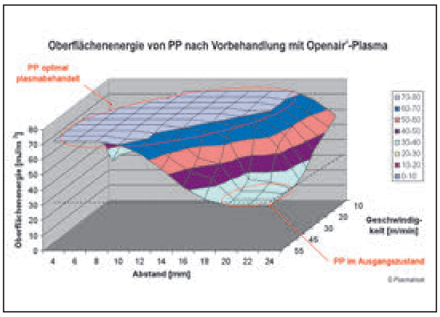

Fig. 2: ***Plasmatreat***
The figure shows a non-polar plastic surface that was pretreated as a function of distance and speed with plasma. Treatment renders the surface polar and the surface energy rises to >72 dyne with a large process window.

surface and consequently effective adhesion to PUR foam would no longer be guaranteed. Furthermore, heat that is unable to dissipate could accumulate in recesses during flaming, which would have the same effect. The Openair® plasma process eliminates these risks. During plasma treatment the temperature of the plastic remains below 30° C.

Unmasked

The foam injected between the PP substrate and the slush skin in soft touch instrument panels has to adhere in certain areas, but not in others. When using the conventional flaming technique, all areas where no foam adhesion is subsequently required must be covered with thermally stable masks. Openair® technique entirely eliminates this working step since the plasma beam operates locally selectively. Unlike the flame, it can follow component geometry with millimeter precision. The milled PUR foam-backed slush skin in the untreated areas can easily be peeled off. Areas in the substrate where openings are provided for inserting instruments are milled out separately (**Fig. 3 and 4**).

***Fig. 3 and 4:* Plasmatreat**
Top: Instrument panel after plasma treatment, slush skin and foam bonding and reverse-side weakening of skin in the airbag housing area.
Bottom: Openings in the instrument panel have been milled out. The foam-backed slush skin can easily be removed from areas left untreated.

Summary

According to Peguform the stable pretreatment process from Plasmatreat has proved successful. Significant benefits include the reliability and high effectiveness of the Openair® method in the production process. Ease of integration into automated process operations, increased cost efficiency compared with conventional methods are further plus-points. And it all goes along with an outstanding environmental compatibility

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