

## In-line plasma treatment before painting

# Perfect hold and flawless finish

As painting technologies become increasingly similar, the decision to purchase a high-end product frequently comes down to appearance alone. Brilliant colors, unusual paint effects and a creative design are the main distinguishing characteristics. A surface pretreatment with atmospheric pressure plasma creates the optimum requirements for paint adhesion and appearance.

The industry is continuously striving to improve its painting processes. In addition to the material and paint themselves, the success of the end result is determined above all by an effective surface pretreatment. Surfaces must be ultraclean, completely free from dust and contamination and at the same time, the surface energy must be suf-

ficiently high to ensure complete wetting and long-time stable adhesion of the coating.

There are several types of pretreatment, although the use of wet-chemical, environmentally harmful substances is still one of the most widely used. But there are alternatives: A pretreatment with atmospheric pressure

plasma (AP plasma) is not only environmentally friendly, it is also far more efficient, faster and more reliable.

### Clean pretreatment with plasma

The Openair plasma jet technology from Plasmatreat is one such method (Fig. 1). This technology, used worldwide in virtually all sectors of industry, needs only compressed air as the process gas and electrical energy. This prevents the emissions of VOCs (volatile organic compounds) during production from the outset. The highly effective procedure is used mainly on materials such as plastics, metals, glass and ceramics.

The in-line process, which is equally effective with water-soluble and solvent-based paints, takes only a matter of seconds and is extremely uniform. The automated pretreatment is simultaneously accompanied by comprehensive monitoring of the plasma process and storage of the process data. The entire process is computer-controlled and the pretreatment results are precisely reproducible. The manufacturer has developed special nozzles which discharge the electrical potential to the extent that the plasma beam impinging on the material surface is virtually potential-free, thus enabling a more reliable pretreatment of sensitive SMD assemblies and other electronic components.

### Electrostatic discharging and cleaning

Despite considerable efforts, the scrap rate in production caused by painting over dust particles is often significantly higher than 10 percent. Stat-



Fig. 1: The automotive industry has been using the Openair plasma technology for over 20 years to clean, activate and apply functional coatings to interior and exterior components



Fig. 2: The flawless paint finish of plastic surfaces that have been cleaned to a microfine level, electrostatically discharged and simultaneously activated with atmospheric pressure plasma.

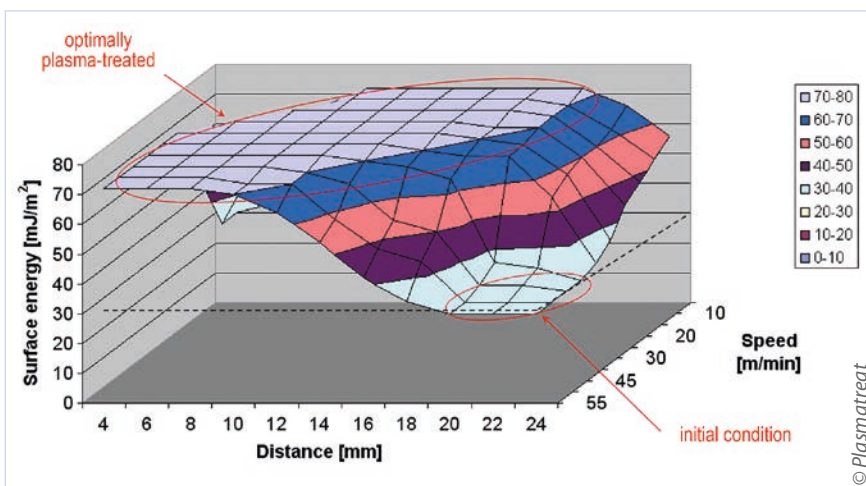


Fig. 3: The diagram shows a plastic surface which has been pretreated with atmospheric pressure plasma as a function of distance and speed. Treatment renders the surface polar and the surface energy rises to >72 dyne with a large process window.

ically charged surfaces and small but unacceptable amounts of particulate matter remaining in the lower layers are one of the most common problems. Treatment with AP plasma combats this directly: In addition to dry, microfine cleaning and simultaneous activation, the treatment also electrostatically discharges the surface. The discharge action of the free plasma beam has an added benefit for the user: Fine particles of dust in the air are no longer attracted to the surface, resulting in a flawless paint finish (Fig. 2).

This effect is further reinforced by the very high outflow rate of the plasma, which ensures that even particles loosely adhering to the surface are removed. During cleaning the high energy level of the plasma fragments the structure of organic substances on the surface of the material and removes any

contamination even from sensitive substrates. The use of this plasma technology entirely eliminates the need for an additional pretreatment such as manually wiping with alcohol, brushing or rinsing.

### Plasma activation

Without the high level of activation which a non-polar plastic such as polypropylene receives during the plasma process (Fig. 3), wetting problems would arise, making coating impossible. Dr Alexander Knospe, Director of

fects; firstly it enables the paint or adhesive to completely wet the surface, and secondly it creates a covalent bond, i.e. a very stable atomic bond, at the surface.” The result is a homogeneous paint finish and long-time stable adhesion of adhesives and coatings even under challenging load conditions.

Metals such as aluminum or glass have naturally polar surfaces, but the surface energy which gives them their adhesive characteristics can be compromised by layers of dust deposits, grease and oils or other contaminants. Some years ago the plasma systems engineer based in Steinhagen made a significant breakthrough in painting technology for aluminum strips. The company replaced the entire wet-chemical cleaning line in the pre-cleaning process of a new coil coating plant at leading Swiss solar shading manufacturer Griesser AG with a 48-nozzle system. The deep-pore microfine cleaning action of the plasma comes into its own here, revealing once again the high surface energy already present in the aluminum (Fig. 4). Plasma-treated materials can be further processed immediately after cleaning and activation.

### Summary

Pretreatment of the material surface is the starting point for meeting the rigorous quality requirements of the paint process. The triple action of the plasma process described above, consisting of microfine cleaning, electrostatic discharging and simultaneous surface activation, far outweighs the effectiveness of conventional pretreatment processes. Atmospheric pressure plasma offers a particularly effective and environmentally friendly alternative to companies in search of new solutions for pretreating their painted products.

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Fig. 4: AP plasma treatment of aluminum trims before painting: The deep-pore cleaning action of the rotating plasma beam reveals the high surface energy already present in the aluminum.

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