



FUNCTIONAL SURFACES BY TREATMENT WITH ATMOS- PHERIC PRESSURE PLASMA COATING

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM – Adhesive Bonding Technology and Surfaces –

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New products via innovative surfaces

The coating of materials, semi-finished products, and consumer goods allows products with significantly improved and in some cases totally new properties to be manufactured.

Typical examples are coatings for

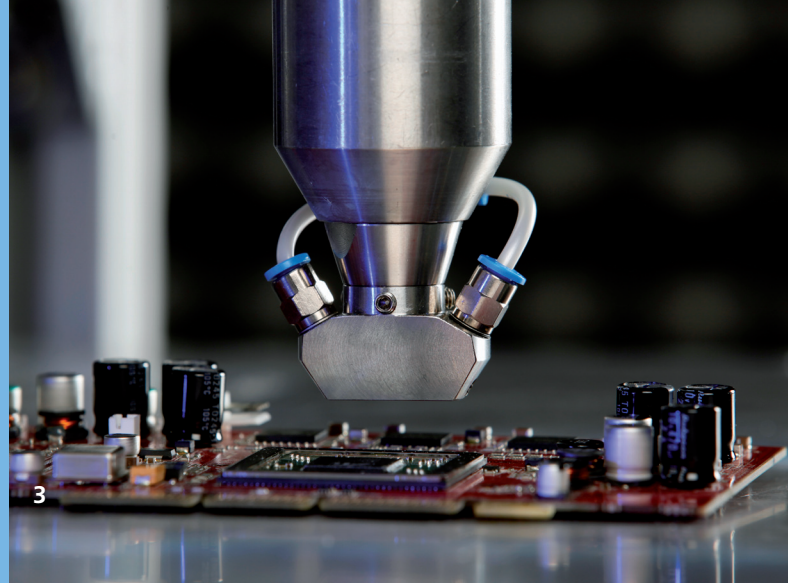
- Resistance against soiling
- Corrosion protection
- Adhesion promotion

Plasma methods are particularly suitable for depositing high quality layers at favorable cost. Atmospheric pressure (AP) plasma processes require no vacuum equipment and are hence ideal for in-line applications, even for existing process chains, and for automation with robots.

Applications

Examples of AP plasma-polymer layers include **hydrophobic layers**, for example, for use as permanent release layers, and **hydrophilic layers**, which can be used for adhesion promotion.

The deposition of **corrosion protection** layers, for example, on sealing flanges on cast aluminum components, has been implemented in the automobile industry in 2007. The processes are already in use in the solar energy sector and also make a contribution there for cost reduction and efficiency increase.



In ongoing development work, deposition rates are being achieved which allow in-line coating at rates of up to 200 m/min.

Other R&D activities of the Plasma Technology and Surfaces experts at Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM include the deposition of **functional layers** for

- Anti-adhesion
- Adhesion promotion
- Active corrosion protection
- "Easy-to-clean" functionality
- "Anti-fog" effects
- Protection of metals against tarnishing
- Scratch protection
- Electrical conductivity, e. g. for antistatic effects
- Biofunctional surfaces, e. g. for amine functionalization

Methods

Commercial plasma systems are used, which are modified by Fraunhofer IFAM for layer deposition. These methods involve generating a plasma inside a nozzle. On exiting the nozzle the plasma is mixed with a chemical compound. Layer deposition occurs when the plasma jet contacts the substrate surface.

Research projects – many of which are carried out in collaboration with partners from industry – are constantly improving the layer functions and layer properties and tailoring

these to the specific requirements of customers, for example, adaptation of coating adhesion to different substrates.

The use of a single nozzle allows individual points and sections to be coated. By using several nozzles in suitable combination, however, large complex components can be coated.

The properties of the layers and coatings are evaluated by carrying out practical functional tests and by surface analysis using state-of-the-art instrumental techniques for the deposited layer.

Advantages of AP plasma technology

- Suitable for in-line applications
- Suitable for robot technology
- Customized, localized coating
- Low cost process gases, e. g. compressed air
- Environmentally friendly
- Low usage of chemicals

Portfolio of the Fraunhofer IFAM

- ➔ Adaptation of the coatings to specific customer requirements
- ➔ Development of new layer properties
- ➔ Provision of samples
- ➔ Plant transfer to the production processes of customers
- ➔ Technology transfer

- 1 *Water-repellant layer on aluminum having a contact angle of > 100 °, produced by coating using atmospheric pressure plasma.*
- 2 *Aluminum sheet after exposure for 96 h in a salt spray test. The shiny region has a protective coating deposited using atmospheric pressure plasma technology and shows no corrosion.*
- 3 *AP plasma coating for localized, customized aging protection for electronic components, leading to enhanced reliability and improved heat dissipation.*