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Cleaning industrial parts with plasma

The cleanliness of functional and connecting surfaces is critical for the quality of subsequent processes like bonding, coating and printing. That's why manufacturers may want to consider using atmospheric pressure plasma, an environmentally friendly cleaning technology suited to inline applications. Here Peter Swanson, Managing Director of adhesives specialist Intertronics, explains the benefits of [plasma for industrial parts cleaning](#).

Contamination on industrial components can lead to considerable difficulties, affecting the quality of bonding, painting, coating or printing on functional and connecting surfaces. Historically, manufacturers have used wet chemical cleaning but, now, an increasing number of businesses are turning to more environmentally friendly and in-line alternatives. Applications range from selective fine cleaning of wire bonding pads in microelectronics, to removing microcontaminants from and functionalising specialist medical device plastics prior to bonding or printing, to removing process lubricants, coolants and release agents from metallic components.

One such alternative is atmospheric pressure plasma, which can be incorporated into a range of processes, from fully automated cleaning solutions at high processing speeds to flexible use at manual workstations.

The fourth state of matter, plasma, is created by the energetic excitation of gas. Under atmospheric conditions, an electric arc can excite gas into plasma. Plasma initiates a multitude of physical and chemical processes that treat the surface and remove contaminants without any additional chemicals - for example, by breaking the organic bonds of heavy organic materials to form lighter, more volatile ones. Unlike wet chemical cleaning, the waste products are gaseous or volatile and can be easily extracted or neutralised. The properties of the treated part are not altered, marked or discoloured.

Fine tuning your process

The types of contaminants the manufacturer is aiming to remove can help determine the choice of process gas. If they are removing an organic film, formed by a previous process, active oxygen species in compressed air plasma can oxidise the organic material. Simultaneously, the temperature of the plasma causes sublimation or evaporation of residues on the surface. By selecting the process parameters, manufacturers can alter the process temperature in the plasma flame from a few hundred degrees centigrade, up to 1000°C.

With conductive, grounded substrates, the arc can be transferred directly onto the surface. Because this method has a high power density, manufacturers may want to consider it to remove thicker layers from a surface, or to effectively clean and slightly roughen metal surfaces. Cathodic cleaning is possible, due to the arc's generation of unipolar pulses between 40 and 64 Hz, which improves capacitive coupling in the layer that is being removed.

Removing multiple contaminants

In another configuration, the plasma generated emerges as a controlled plasma flame from a nozzle. Surfaces can be cleaned of a variety of contaminants by the plasma flame — for example, cleaning metals before roll cladding in the production of bimetallic strips. The two metallic substrates will be treated to remove a combination of oil, lubricating films and oxide layers. One suitable technology might be the [plasmabrush PB3](#) because it can be operated with different process gases to remove different contaminants. The manufacturer could first use compressed air plasma to remove organic impurities, and then reduce oxides on the surface by switching to a hydrogen-containing process gas, such as forming gas.

Cleaning different materials

Our customers have seen success using atmospheric pressure plasma cleaning for numerous substrates including metals, glass, ceramics and natural materials. With many polymers, plasma treatment leads to “activation” of the surface as well as cleaning, and

the modification of molecular end groups improves wetting and optimises subsequent processes.

Manufacturers are turning to plasma surface treatment to achieve high levels of cleanliness on their functional and connecting surfaces, and better prepare for subsequent bonding, coating or printing. For further information on plasma cleaning or surface preparation, call 01965 842842 to speak to a specialist, or visit <https://www.intertronics.co.uk/product-category/cleaning-surface-preparation/>.

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Image caption:

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