TIGRES
Dr. Gerstenberg GmbH

Open atmospheric plasma in arbitrary width

Increase of wettability and adherability of thick substrates

OPEN ATMOSPHERIC PLASMA IN ARBITRARY WIDTH

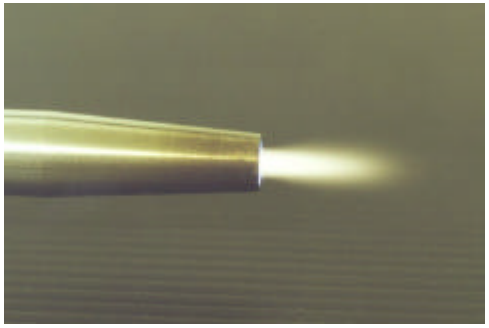
Atmospheric pressure plasma (APP) sources, which produce an open, freely accessible and potential free plasma in atmospheric environment were up to now restricted to a width of several centimetres. Now, TIGRES have succeeded in developing a new electrode to produce this interesting plasma in arbitrary width.

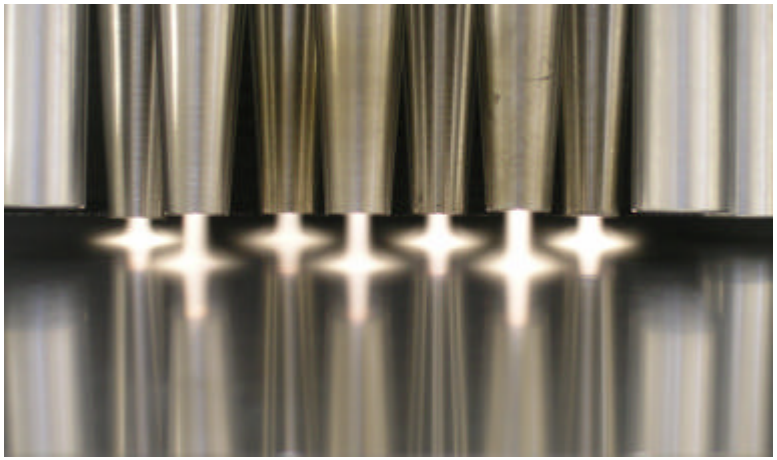
The pretreatment of surfaces of plastic parts in process lines before gluing, coating, printing and lacquering using an electrical produced, open plasma is an established technology in modern industry. Widely known is the direct corona treatment, which is common in the film producing industry. In these stations film webs are guided in free air through a discharge gap, which is formed by an electrode and a roller as a counter electrode. The “lightnings” of the discharge in the aprox. 1,5 mm wide gap produce a strongly oxidising plasma, which removes thin layers from surfaces by a cold combustion and oxidises plastics up to a depth of several atomic layers at moderate temperatures. It has been proved, that this corona treatment occurs without any changes of electrical, mechanical or optical properties of the film. Stations for web widths of 10 m are possible. For a typical average application and a web speed of 150 m/min the discharge is fed with a power of 3 kW for one meter web width.

Thick plastic parts, which cannot be introduced into the discharge gap, are treated with an indirect corona discharge. Airflow vents the current filaments of a medium frequency, electrical controlled discharge, which occurs inside an electrode head in front of the substrate, towards the surface to be treated. The core temperature of the discharge of the Korona-GUN® from TIGRES does not exceed 50°C, so that also the treatment of thermally sensible substrates is possible. Multi-GUN-electrodes are available for the treatment of thick sheets of 2 m width, for instance. The discharges need a power of 10 kW/m. Typical treatment speeds are restricted to approx. 10 m/min, so that arbitrary thick substrates can be treated with this technology, however the efficiency is too low for many industrial applications.

Atmospheric Pressure Plasma nozzles have obtained a significant progress at the development of indirect treatment electrodes. Herewith, plasma gets produced at atmospheric conditions, which has analogous properties to the well-known low-pressure plasma, but which is “open”, freely accessible, since a vacuum vessel is not necessary. The obvious difference to indirect corona electrodes is, that an air driven AP-plasma does not contain current filaments, but seems to be complete homogenous in space and time. The absence of current filaments indicates, that the plasma does not exhibit an electrical potential: While touching the discharge region of a corona discharge leads to heavy electrical current hits, touching of the AP-plasma is harmless. Due to the high efficiency of the AP-plasma, high treatment speeds can be obtained with indirect electrodes for the first time. Treatment width of a Plasma-BLASTER nozzle from TIGRES, which is fed with a power of 200 W, is at about 10 mm, while the typical treatment speed of 150 m/min comes in the region of „classical“ corona applications.

Due to the small treatment width of the APP-nozzles, many applications are not possible. In principle, it is possible to operate simultaneously several nozzles side-by-side. However, the construction gets very fast „bulky“, since you need a separate electrode head every centimetre to enable a treatment without stripes. Now, TIGRES have succeeded in combining the nozzles in a way, that the nozzles are mounted at one profile, which contains a common air- and current connection. This compact design results in an APP-electrode, which exhibits low need of maintenance, since it does not contain mechanically movable parts or ceramic insulators. Since the Plasma-BLASTER does not produce the plasma as common with a thermal arc, but with a controlled electrical discharge, heat production and energy consumption are within a reliable range: no built-up of heat occurs at the substrate surface and the power amounts to tolerable 16 kW/m. The typical treatment speed of 150 m/min leads to the expectation of many interesting applications.





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