Plasma cleaning of indicator bulbs

Better coating adhesion by removal of organic contaminations

Flg. 1: Coated indicator bulb

Application

Indicator bulbs, which are still being used by automotive manufacturers, often have to be coated (fig. 1) since the grooved diffusion glass of the indicators is colorless for both economic and optical reasons.
The coating is applied in a dipping process.

Durability of the coating depends on the adherence of the coating to the substrate. Even though contamination may only be as few as several µg/cm^2, it reduces adherence considerably. Parts of the coating flake off after only a few hours of operation. Wet cleaning won't help, as liquids would penetrate the gap between glass and metal cup, and would remain in that gap. Plasma, as a dry chemical method, is the perfect way to overcome this problem.

Plasma process

The contaminations on the surface of the glass are mainly organic, so they can be easily removed by a simple oxygen plasma. The approximate cycle time is only 10 minutes.

Organic compounds are decomposed, forming CO_2 and water, which are gaseous and easy to dispose of. With oxygen being a gas and the only cleaning agent, there can't possibly be any remains of detergent or solvent at the surface.

Additionally, the gaseous products are removed continuously from the reaction chamber, hence recontamination is impossible. The surfaces are therefore utterly clean after plasma cleaning. For the bulbs, the plasma-induced reduction in contamination has resulted in significant increase of the durability of the coating. Life cycles have been extended by a factor of more than one hundred.

Systems engineering

PINK offers customized low-pressure plasma systems for full automated cleaning processes.

Handling systems prepare every batch of e.g. 1,400 bulbs by stacking seven trays with 200 bulbs each (fig. 2).

Fig. 2: Handling system

Utilization of gases proves to be an advantage once more as minimal space is sufficient for the plasma to reach the complete surface of all bulbs for cleaning.

While one plasma process is running, the empty trays are filled next to the system to prepare the next batch, while the previous batch is unloaded and fed into the chain conveyor for dip coating. Intelligent handling and automation make continuous coating possible despite of the plasma's batch operation.

PINK GmbH
Thermosysteme
Am Kessler 6
97877 Wertheim
Germany
T +49 (0) 93 42 / 919-0
F +49 (0) 93 42 / 919-111
plasma-finish@pink.de
www.pink.de

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