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EMC Protection for Plastic Housing

Arc-Spray Technology cuts Costs

Thanks to a fully-automatic, robotic-based coating plant, it is now possible to plate, at low cost, a variety of different plastic housings. The new method is based on arc-spray technology and uses zinc as the coating metal.

This innovative method offers numerous advantages. It is possible to use all plastics in every-day use without restriction. The zinc coating applied is extremely robust and offers outstanding attenuation values. The variety of possible applications ranges from parts that are the size of a small coin, mobile phone covers and monitor housings all the way through to passenger cabins. The high degree of flexibility of automatic units and plant provides the ability to introduce prototypes and small lots without significant production losses.

WHY EMC PROTECTION?

EMC protection is essential if electronic components and equipment are to function without interference. At its most basic, the electronic unit is embedded in a metal housing. The metal housing prevents both the emission and absorption of electromagnetic waves, which could lead to malfunctioning. However, for a variety of reasons, many devices have a plastic body rather than a metal housing. Plastic injection molded parts are economical to produce and also offer maximum design diversity. However, when produced according to the conventional manufacturing techniques, they are not capable of offering EMC protection because the insulating plastic body cannot act as a shield against any electrical radiation disturbance.

While there are various well-known methods that can be used to make the plastic body electrically conductive, all of these methods have disadvantages, however. The standard method is the electroplating of plastic bodies. But: the most well-known method is restricted to ABS plastics. The spherical elastomers embedded in the ABS initially have to be etched out in order to roughen the surface of the plastic body. This is the only way of creating sufficient engagement with and adhesion to the metal coating that is later applied by electroplating.

Masking for partial coating causes a considerable amount of work, time and costs. Primers, or protective metallic coatings, are not particularly robust, nor are they in widespread use; the same is true of special plastic granulates with embedded, electrically-conductive fibers.

In addition to the technical limitations, all the above-mentioned coating technologies lead to a significant increase in unit costs.

ADVANTAGES OF USING ZINC IN THE ARC-SPRAY METHOD

Zinc is highly conductive and inexpensive, two advantages that are combined to optimum effect in the new method.

Two zinc wires are fed continuously into the tip of a spray gun where they melt due to the heat of an electric arc, which they themselves initiate. As when applying a coating, the molten zinc is sprayed onto the plastic body via a jet of compressed air.

In order to achieve good adhesion, the plastic surface first has to be activated. This step is extremely important and demonstrates HARTING's expertise in this field.

METHOD

To activate the plastic surface, it is bombarded with particles in a specific targeted manner. The angle of incidence, particle size, shape and quantity, as well as the speed of impact, all determine the final result.

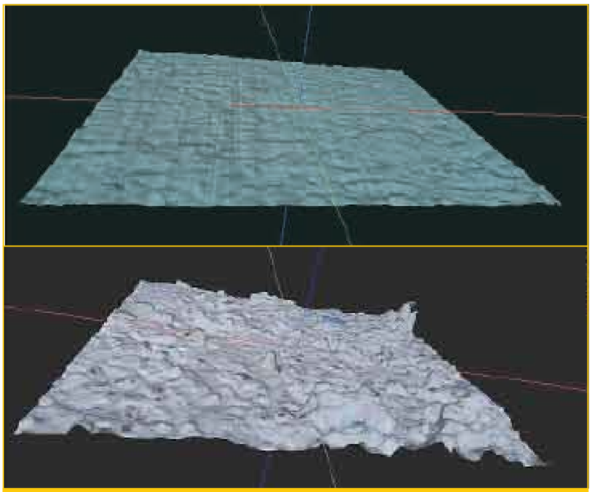


Fig. 1: Untreated and roughened plastic surface (images obtained via non-tactile 3D surface reconstruction on the basis of light microscopy)

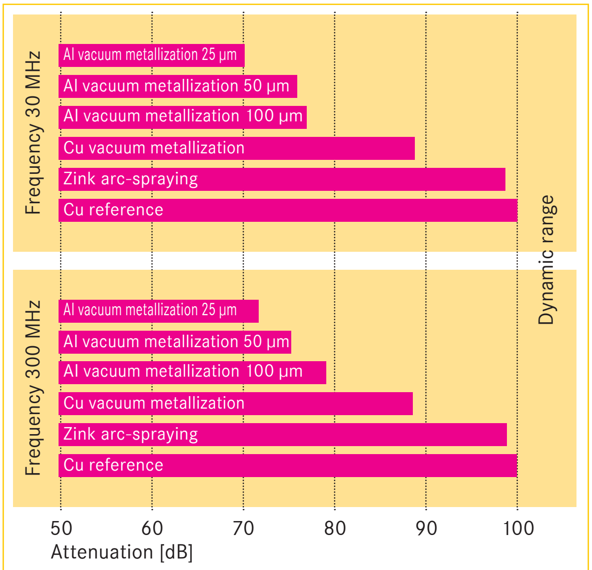


Fig. 2: Screening attenuation at different frequencies

Fig.1 shows the difference between the untreated and the roughened surface. After being bombarded with particles, the surface is much rougher and this results in the optimum bonding of the zinc layer applied with the plastic surface. The resulting adhesion is 3-5 N/mm², which corresponds to UL 746C.

The optimum plating layer is typically between 100 µm and 150 µm. It thus offers a large degree of robustness and a long service life, together with sufficient elasticity to compensate for the different coefficients of thermal expansion.

EMC PROPERTIES OF ZINC

The electrical screening properties of various coating methods were investigated at the Fraunhofer-Institute for Surface Engineering and Thin Films (IST) in Braunschweig and the results obtained were compared with those of the zinc layer.

The results with the zinc layers shown in fig. 2 are impressive. Across the entire spectrum (which is not shown here), it is possible to achieve attenuation in the range 70 to 110 dB in the frequency range between 10 MHz and 1 GHz.

The flow chart shown in fig. 4 depicts demonstrates the operating steps of the system.

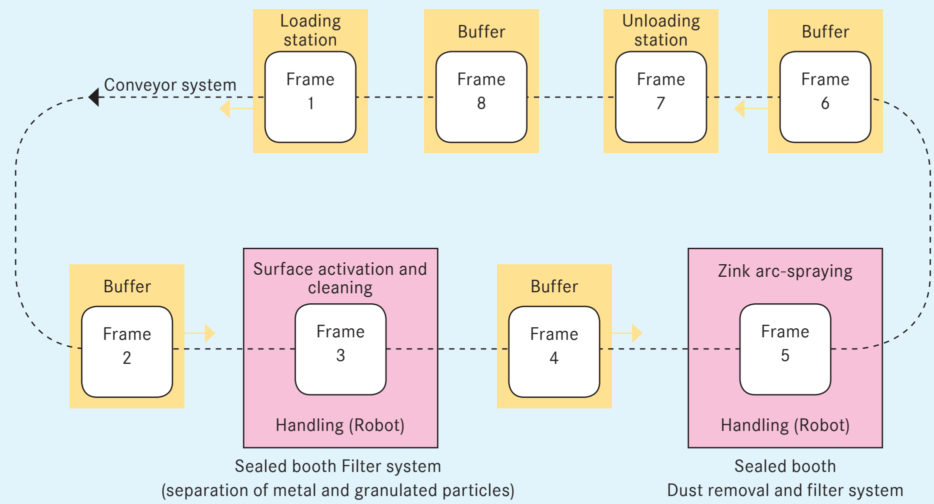
METALLIZATION PROCESS

The plastic housings are mounted into carrier frames measuring 1500 mm * 1200 mm and are transported through the plant or unit by a fully-automatic conveyor system. Eight frames are, at all times, available to the conveyor system. Each individual frame carries four masking tools that, on one hand, hold the part of the housing to be plated and, on the other hand, screen the external side, or other parts of the front, from any plating. In this way, a maximum of 32 different orders can be processed in a single production run.

This is enabled by transponders connected to each masking frame.

When entering the two hermetically sealed booths for surface roughening and arc spraying, the program is

Fig. 3: Fully-automatic, robotic-based coating plant



Operating steps:

1. Carrier frames are manually loaded with housings
2. Buffer station
3a. Surface activation through bombardement with granulated particles
3b. Surface cleaning with compressed air
4. Buffer station
5. Surface coating with zink (arc-spraying)
6. Buffer station
7. Manual unloading of the housings
8. Buffer station

Fig. 4: Flow chart demonstrating the operation steps of the system

Fig. 5: Masker on work carrier

read out and the information is transmitted to the two robots. In this way, it is possible to combine the volume production of individual articles with small lots and prototype orders. Fig. 7 shows a typical housing that was selectively coated by means of partial masking in an automated procedure.

In addition to the fully automatic plant or unit, there are also manual plants or units for very large, bulky housings. In this way, HARTING commands the necessary flexibility to meet all customer requirements.

SUMMARY

Not only can the fully automatic arc spray method be used to produce technically sophisticated layers for EMC-compatible housings it also demonstrates how innovative technology can be applied to meet increasing cost pressures.

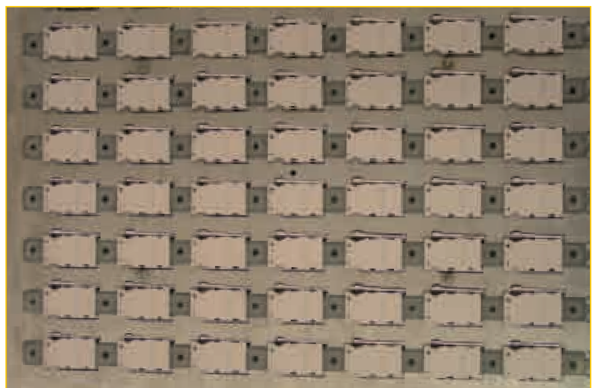


Fig. 6: Masker assembled with customized housings for D-sub connector

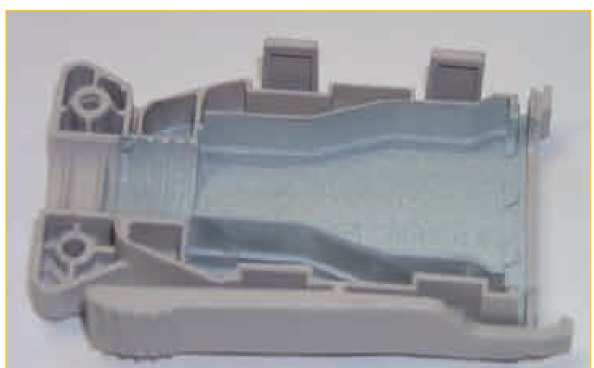
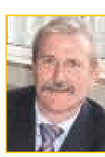


Fig. 7: Housing for D-sub connector 68 mm * 41 mm



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