EMI/RFI Shielding by Electroplating Techniques

1. INTRODUCTION

Electroplating is widely used for depositing a variety of metallic coatings onto plastic and metal substrates. Although most widely used for coating ABS or ABS blends many other plastics can now be coated. These include polypropylene, polysulfane, polyester, polycarbonate and other engineering resins. Electroplated coatings are unique in their ability to combine aesthetic appeal, wear and corrosion resistance with very high levels of shielding.

Two types of electroplating process are commonly used for EMI shielding of plastic enclosures:

The electroless plating process allows for an extremely uniform duplex layer of copper and nickel to be deposited. Typically a 0.3-0.5Φ layer of nickel is deposited over a 1.0 - 1.2Φ layer of pure copper (APPLICOAT EP305). This coating provides over 80dB of shielding over a wide frequency spectrum and is ideal for coating of internal shields designed for board level shielding.

The electrolytic plating process deposits a multi-layer coating with a total thickness in the range of 20-25Φ (APPLICOAT EP325). Coatings produced by this process are extremely wear resistant, environmentally stable and provide very high levels of shielding. An added feature of this process is the Adecorative/aesthetic≅ appeal of the coating. These coatings are widely used for the shielding of D-Sub connectors where shielding, wear and corrosion resistance, as well as an external decorative finish, are required.

2. PROCESS DETAIL

2.1 Electroless Plating

Electroless plating also known as autocatalytic plating is a chemical process for depositing certain metals onto a variety of materials including metal and plastics. In contrast to electrolytic plating no external electrical current is required to sustain the process. The Electroless Plating process is based upon the catalytic reduction of metal ions on the surface of the substrate being plated.

There are essentially 4 steps in the process of depositing a coating for EMI/RFI shielding:

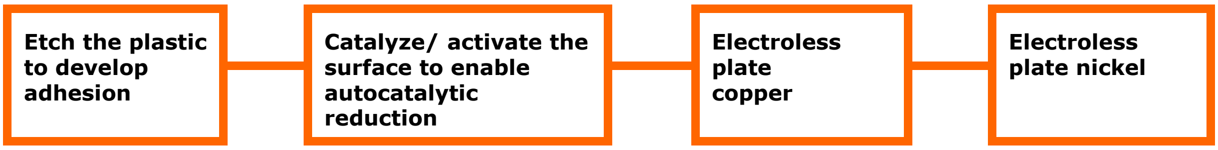


Figure (1)

For APPLICOAT EP305 a nominal copper thickness of 1.0 to 1.2Φ is deposited. The copper deposition rate is typically 3.0Φ/hour and coatings up to 4.0Φ thickness can be deposited. The coating process normally takes about 90-120 minutes to complete.

Applicoat coatings are produced in a state-of-the-art plating line incorporating ENSHIELD® chemical technology. The jigs holding the parts to be coated are moved from one tank to the next using a computer-controlled robotic arm. Many of the key chemical processes are continuously monitored and automatically controlled to ensure consistency and repeatability.

One of the key advantages of the electroless plating process is that all surfaces of a component will be coated evenly, even complex shapes with deep recesses. Jigging is very simple and a very large number of parts can be held on a fixture, thus making the process very cost-effective.

2.2 Electrolytic Plating

In electrolytic plating the part being coated is immersed in an aqueous solution of dissolved metal ions. These ions typically come from metal salts dissolved in the process tank. Once the part is fully immersed in the solution an electrical current is passed through the part into the solution. The part acts as a cathode attracting metal ions from the solution and reducing them to their metal state on the surface of the part. This process is regulated through the control of voltage, amperage, temperature, residence times and bath purity.

For the electrolytic process to occur, the surface of the part must be conducting. When plastics are to be coated this is achieved by first electroless plating the plastic. Typically a 0.3-0.5Φ layer of electroless nickel phosphorous alloy is deposited. Varying the amount of phosphorous in the alloy can vary the properties of the nickel phosphorous coating. Typically, the phosphorous content can range from 3 up to 20%. High phosphorous coatings tend to be very ductile and corrosion resistant.

Once the plastic component has been made electrically conducting, it can be electroplated by standard procedures. Typically a 12-15Φ layer of copper is deposited in 30 minutes. To provide corrosion protection and wear resistance, the copper layer is then overcoated with electrolytically deposited nickel phosphorous. An 8-10Φ thick layer is deposited. To enhance the aesthetic appeal an, additional layer of chrome or tin can be applied if required. Figure (2) illustrates the basic processes in depositing an electrolytic shielding coating. As with the electroless plating, the electrolytic process is also carried out in a fully automatic plant ensuring consistency and quality at all stages of the process.

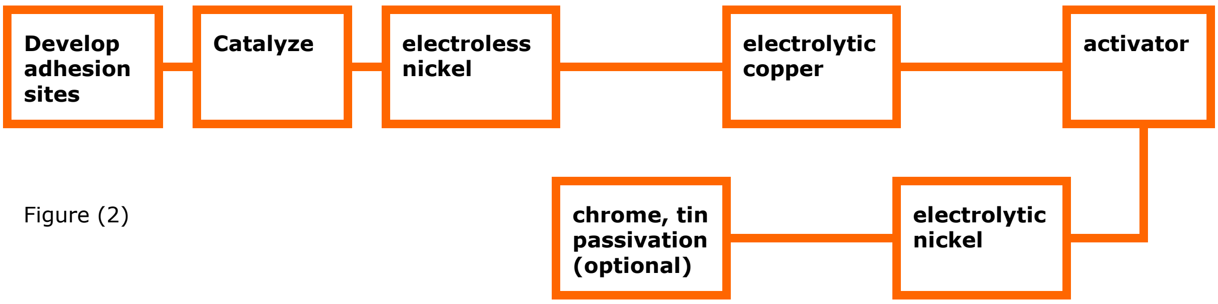
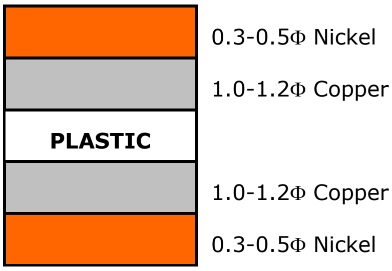
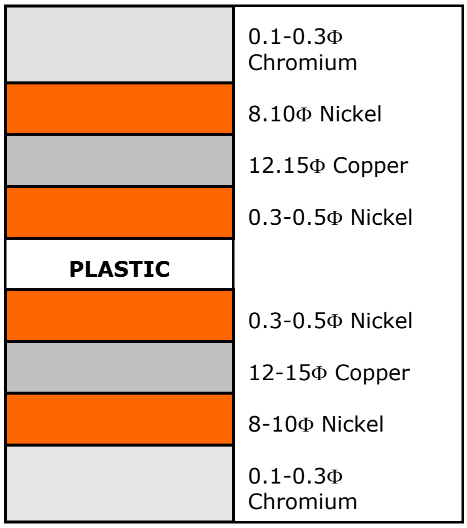


Figure (2)

3. PHYSICAL AND ELECTRICAL DATA

PROPERTIES	APPLICOAT EP305	APPLICOAT EP325
Coating Process	Electroless Plating	Electrolytic Plating
Coating Structure		
Total Thickness	1.5 - 2.0Φ	20 - 25Φ
Sheet Resistivity (Ω~)	<0.03 (Ω~)	<0.02 (Ω~)
Typical Shielding Effectiveness	70-80 dB	> 80 dB
Adhesion (on ABS) (Tested to ASTM-D-3359-83)	>4B	>4B
Environmental Stability **UL-746-C** **IBM 14/4/16**	 PASS PASS	 PASS PASS

4. COMPARISON OF PROPERTIES AND TYPICAL APPLICATIONS

Electroplating is an ideal process for shielding where the design allows for the part to be coated all over. Selective plating or masking of small areas is difficult. ABS is the most commonly used plastic substrate, although several other engineering polymers can now be coated. Plated coatings are used widely for shielding a variety of components. Two particular applications are worth noting:

4.1 Board Level Shielding

One of the most efficient and low-cost methods of shielding is to encapsulate the PCB with an RF shield. Shields are designed with multiple compartments to encapsulate the various active components on the PCB. Shields are produced by thin wall injection moulding and coating with APPLICOAT EP305, electrolessly deposited coating. Key advantages of this coating are:

- Light weight, up to 80% less than pure metal
- Uniform coating of all surfaces
- Flexible, durable structure
- Environmentally stable

RF shields are commonly used in the manufacture of mobile phones. Our capacity to produce several million components per year is an added advantage.

4.2 D-Sub Connectors

To allow efficient grounding when shielding connectors they need to be coated internally and externally. The external coating must be wear and corrosion resistant and extremely durable. APPLICOAT EP325, electrolytically deposited coatings exhibit all of these properties. Key advantages are:

- Extremely high level of shielding
- Durable Achrome≅ finish
- Wear/scratch resistant
- Does not tarnish or oxidise

For further information, please do not hesitate to contact our sales department:

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