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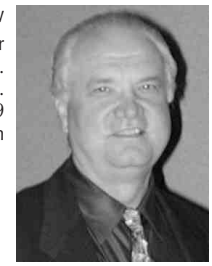

Adhesion to Plastic Substrates Depends on Type of Plastic

Dear Advice & Counsel,

I am a purchasing manager and I don't know much about plating, especially when the substrate is plastic. I have been told that some plastics, such as something called ABS, is easier to plate than others. What happens if you have a plastic that is a blend? We had a blend of ABS and Polystyrene plated and it failed miserably in service. The plating peeled from the plastic.

Signed,
A.B. Simon

Dear Ms. Simon,

Adhesion of plated metal deposits to plastic is produced by processing the plastic through numerous steps that are designed to create surface porosity that acts as anchor points for the plated metal. Adhesion is benefited by use of a plastic material that is easily etched by the chemical process steps. The plastic considered to be the most easily plated (yields the highest level of adhesion) is ABS (acrylonitrile-butadiene-styrene). The plastic that you provided us is a blend of ABS and polycarbonate (PC). Such plastics are typically 40-60 percent ABS, and it has been reported that ABS-PC blends yield a lower level of plating adhesion than ABS, and that the higher the polycarbonate of the blend, the more difficult it is to obtain an adequate level of adhesion.

The key to obtaining adhesion of the plated metal is to obtain a highly porous etch of the plastic. Some proprietary preparation processes employ a "conditioning" step ahead of the etch, which swells the plastic, causing cracks to form on the surface when the plastic shrinks back down in the subsequent process steps. The etch step dissolves the butadiene from the acrylonitrile-styrene-polycarbonate matrix, leaving surface pores. The butadiene particles present in the plastic should be numerous and oblong in shape to enhance the number and shape of anchor points. Ideally, the surface of the etched plastic is "tufted."

If the butadiene particles are round instead of oblong, the etch on this plastic may be only what is considered to be marginal. Such etches can result in service failure, because of thermal cycling and corrosion that results from exposure of plated parts to the elements.

Typical adhesion failures may be caused by:

a. An inadequate amount of plating thickness resulting in premature corrosion.
b. A weak etch obtained, caused by the plastic having a low (and in some cases poorly shaped) butadiene content.
c. Failure to neutralize/reduce leftover hexavalent chromium after etching
d. Use of electroless nickel instead of electroless copper as the first metallic layer

You may wish to look up "On the Mechanism of Plating on Plastics" by N.V. Mandich and G.A. Krulik, in the December, 1993 issue of *P&SF* for a highly detailed explanation of what goes on when plastic is processed for plating. Dr. Richard Wedel researched blistered plastics and authored an article in January 1975 titled "Characteristics of Corrosion-Associated Blisters on Plated Plastics." ***P&SF***

Rectifier Clinic

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the existing design or a complete redesign, which may add reliability or features.

Certain components (often capacitors or some micro-chips) have a shorter working life than others and may, therefore, require replacement. The frequency of the need for replacement will depend on the manufacturer's design, the components themselves, and the ambient conditions where they operate. A board that is housed in a clean, moderate temperature environment will have a longer operating life.

Generally speaking, the older a circuit board gets, the shorter the mean time between failure. Because repairing a board is less expensive than replacement, it will require tracking the frequency of repair to determine when replacement is warranted. Because replacement will increase reliability, requirements for operating without interruption may influence a decision.

Board Replacement

Many finishers will have more than one brand of rectifiers in their shop. Consequently, when the decision to replace a firing board system is made, the finisher may opt to have his repair service replace the old firing boards with those made by a different manufacturer. This decision may be warranted by cost, competitive advantages of one brand over another, or a desire to have all of the firing boards in the shop to be from one manufacturer. Your internal or external rectifier technician can help you make this decision.

Although electronic components are very reliable, failures will occur over time. Knowing the design and operating tendencies of your equipment will allow you to manage your operation with greater confidence and less downtime. ***P&SF***