UNCOVERING HIDDEN ASPECTS OF ELECTRONICS CORROSION PROTECTION

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Corrosion protection is an important aspect in manufacturing electronics, and OEMs do their best to ensure components and final products stay clean and corrosion-free. Nevertheless, despite tight controls, corrosion can still pose problems during the manufacturing process and after shipment. The introduction of Vapour phase Corrosion Inhibitor (VpCI) technology in a few strategic areas offers effective solutions.

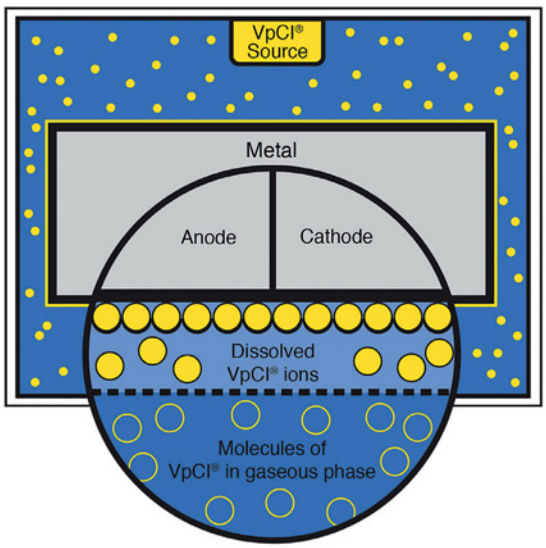

Figure 1: VpCI molecules vapourize from a source material, such as a packaging film, fill the enclosed space and adsorb on metal surfaces to provide a monomolecular layer of corrosion protection. When the package is opened, the VpCI layer evaporates, leaving the electronics clean and ready to use

Cleanliness And Reliability

There's no doubt that electronics manufacturers take various measures to keep their premises, equipment, systems and components clean and contaminant-free. Clean rooms, air showers and various control procedures are all strategies to ensure that no microscopic contaminants remain on electronics to foster a corrosion initiation site and potentially cause failure. A variation as simple as a discolored circuit board could be a possible link to corrosion and failure.

Unfortunately, discoloration and actual corrosion can still occur after electronics exit the highly controlled area of a plant, leaving quality engineers wondering what went wrong with the process. While often a corrosive shipping environment is at fault, it is helpful to take advantage of innovative packaging technologies and look at additional ways corrosion can be prevented from slowing manufacturing and wasting raw materials.

VpCI Technology

VpCI is a unique method for combating corrosion, a technology that uses amine salts of carboxylic acids to deposit microscopic protective film that is self-regulated by equilibrium and molecular attraction to metal surfaces. VpCI molecules are so tiny that they do not interfere with electronic functions. Further, they evaporate off the surface of the metal when not confined in an enclosed space.

VpCI molecules work by vapourizing from their source material and dispersing throughout an enclosed space until they reach equilibrium. As the molecules come in contact with metal, they adsorb and form a highly effective protective-layer against corrosive elements. If the enclosed space must be briefly opened, allowing some of the molecules to escape, other molecules from the VpCI source soon flow in to replace any displaced molecules and form a new protective layer; see Figure 1.

VpCI technology can be adapted to many applications – including a simple cup or pouch filled with VpCI powder, VpCI-impregnated foam, VpCI-fortified coating, VpCI film, VpCI paper or a VpCI-desiccant combination. These varying applications allow the VpCI to be applied to suit the special circumstances and needs.

VpCI can also be combined with other properties for special requirements, such as ESD film (Figure 2) and bubble sheeting (Figure 3), or conformal coatings, to protect the sensitive electronics.

Preventive Packaging

In some cases, it may actually be the packaging that is to blame for the appearance of corrosion.

Finding effective corrosion protection solutions for packaging may be one of the biggest challenges in electronics manufacturing. Once a product leaves the facility, it is beyond the protection of precise quality controls of the manufacturing process.

While electronics may not experience corrosion failure once in service, they are still vulnerable to corrosion from extreme temperature variations and consequent moisture condensation during transit. For this reason, a common packaging method is to place desiccant in the packaging to absorb moisture that builds up during shipment. For some high-tech equipment, this well-known danger leads to extensive packaging efforts that may nonetheless fail.

One large company had trouble preventing corrosion on equipment shipped worldwide, despite extensive efforts to safeguard it by vacuum wrapping and treating with desiccant. The corrosion problem went away when the company began protecting its equipment with VpCI film wrap and foam pads, which exposed metal components to protective VpCI vapours inside the packaging. The process proved much simpler and more cost-effective.

In another case, a telecommunication equipment company experienced 86% failure on its packaging shipped from North America to the Far East; the corroded equipment required return and repair. While the barrier bag packaging was initially labour-intensive to apply, another problem arose when customs officers opened the bags for inspection, destroying the protective environment. The company decided to compare this method with protection using VpCI film and emitters. When test results showed corrosion on four out of six units using the previous packaging, with no failure on VpCI packages, the company adopted the latter strategy. Labour cost went down by 63%, while material costs dropped by 54%.

Another example is a mobile phone company that combined vapour barrier material, desiccants and antistatic bags to protect cellular-phone enclosures, PCBs and accompanying equipment. Again, the use of assorted VpCI emitters, VpCI antistatic bags and VpCI foams helped the company save on packaging material and labour.

An important factor in adapting VpCI technology to electronics packaging is the use of its electrostatic discharge (ESD) protective capabilities. Without protection from ESD, electronics can easily be damaged from friction during shipment.

But, by combining VpCI technology with its static dissipative properties, electronics manufacturers can make use of both protective methods in one recyclable packaging medium, such as film or (for extra cushioning of sensitive materials) bubble wrap.

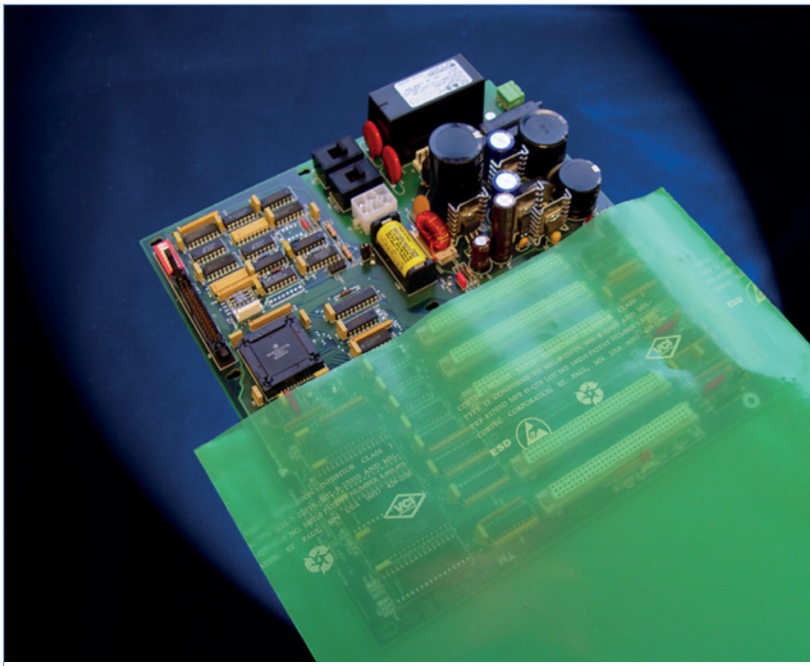

Figure 2: The use of ESD VpCI film is an excellent strategy for reducing corrosion claims and reducing packaging labour and material costs

Figure 3: VpCI technology can be combined with ESD properties in the form of bubble wrap to provide cushioning, and ESD and corrosion protection for sensitive electronics

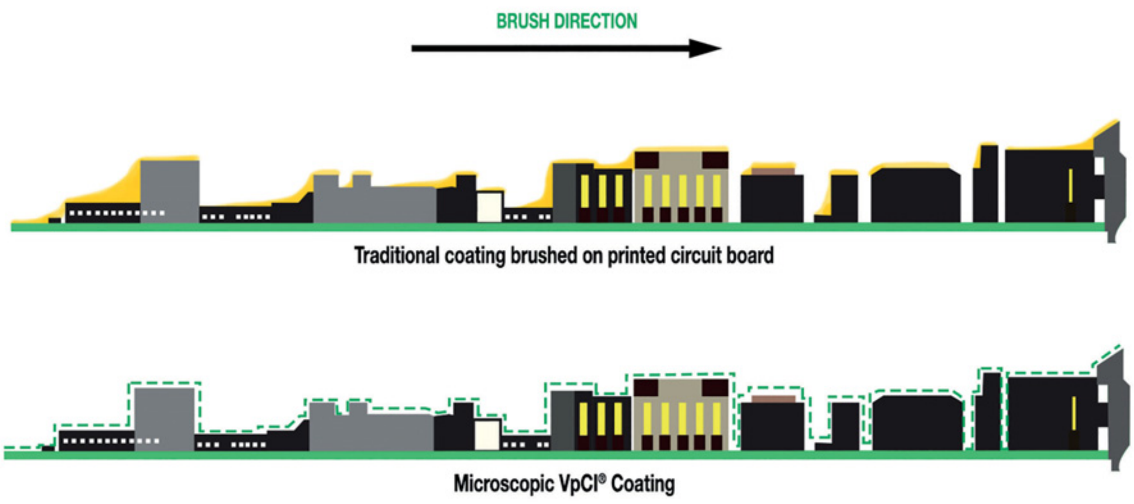

Figure 4: Brushing a protective coating on a printed circuit board can result in gaps in the protective layer or encourage contamination. In contrast, VpCI packaging and conformal coating deposit a continuous microscopic layer of corrosion protection that guards against micro-corrosion

Corrosion Protection In Manufacturing

Although wise packaging strategies can cut down on labour costs, material costs and corrosion claims, the manufacturing plant itself can still benefit from additional techniques, despite already strict controls on the cleanliness process.

Some electronics manufacturing steps produce a very corrosive environment, particularly in the wet process area where chemicals and fumes abound, as in the etching of PCBs. In environments like these, manufacturers may be challenged by corrosion on the electrical panels that control the manufacturing, resulting in failure and interruptions to production.

Corrosive elements also attack the metal pieces of equipment that produce electronic components – for example, chemical etching equipment and dry film developing machines in the wet process area – and can therefore lead to shorter asset service life.

Protecting the electronic equipment and machines that run the system is a simple and cost-effective way to save on plant maintenance costs and promote top efficiency of continuous-process machines. VpCI emitters – self-adhesive cups or foam devices filled with VpCI – are a low cost and effective way to protect enclosed spaces like electrical cabinets, filling them with a VpCI vapour that condenses on metal surfaces to protect from corrosion. Circuit boards and electrical contacts can also be sprayed with a VpCI cleaner/protector that creates a thin film without altering electrical resistance properties. For wet process equipment, applying a water-based corrosion inhibitor spray on exposed metal surfaces will leave a thin clear film to protect against the attacks of corrosive chemicals and moisture.

Another interesting consideration is the preservation of raw material during in-process storage. In particular, freshly etched copper, such as that on PCBs, is more vulnerable to oxidation. If oxidation occurs, the PCB will need another round of chemical etching. Because copper panels must be a certain thickness in order to function properly, this etching can only go so far before the manufacturer needs to scrap the material.

Instead of risking this costly loss of material, manufacturers facing corrosion problems after etching may want to consider the simple step of interleaving a stack of freshly-etched PCBs with VpCI papers in between each layer while awaiting the next step in the manufacturing process.

Important Advance

VpCI technology has been an important advance in corrosion protective packaging for the electronics industry. VpCI compatibility with electronics and ESD film material is an important factor in its usefulness, enhanced by its ease of application and disposal as recyclable packaging material.

Its possibilities for corrosion prevention during manufacturing demonstrate simple but innovative strategies for lowering maintenance and repair costs and cutting down on scrap. By combining innovative technology with practicality, VpCI technology lowers costs in ways that might normally be overlooked. ●