TECHtips

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Electronics Manufacturing Insights from ACI Technologies, Inc.

Conformal Coating Inspection

In the field of electronics manufacturing, the end use of the product will always dictate the processes, procedures, and methods, not only for building the product, but also for testing, cleaning, and protecting the assembly in order to assure the level of quality required for proper operation. The need to protect an electronic assembly from its end use environment may stem from any one of a number of hazardous (or potentially hazardous) conditions. Choosing the type of protective material is dependent upon matching that material's characteristics with the conditions to be overcome. Naturally, the use of a protective (conformal) coating will require some method of verification to ensure the desired level and type of protection is achieved.

There are a variety of reference documents providing specifications for conformal coatings. The intent of this article is to give an overview of inspection methods and considerations when using such coatings in the course of manufacturing an electrical or electronic product.

The five general categories of conformal coatings are:

- Type AR-Acrylic Resin
- Type ER-Epoxy Resin
- Type SR-Silicone Resin
- Type UR-Polyurethane Resin
- Type XY-Paraxylylene (also referred to as Parylene)

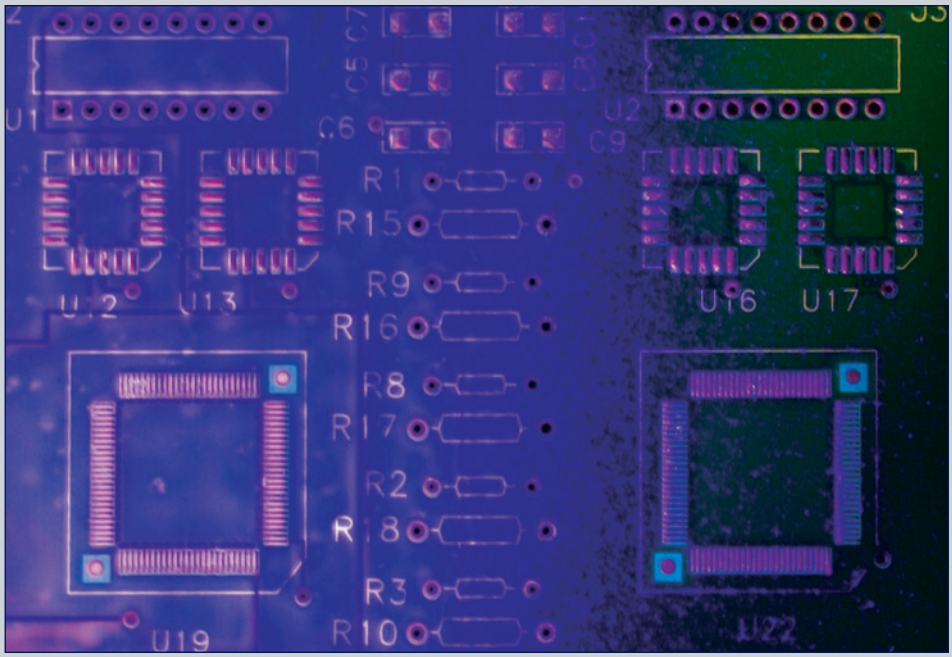

Figure 1: Image of a board under UV illumination with conformal coating only on the lower portion (purple area).

When establishing manufacturing processes which includes the application of a conformal coating, it is recommended that the coating be qualified in regards to physical characteristics including (but not limited to), shelf life, cure time, viscosity, fungus resistance, flexibility, flammability, dielectric withstanding voltage, and thermal shock.[1] (Note: for details on verification methods of the above characteristics consult IPC-TM-650, ASTM D-1084, and UL 94 HB.)

Once the type of coating has been established, qualified, and incorporated into a process, it is necessary to continually verify quality conformance. It is important to check the material for physical appearance, fluorescence, thickness, and full cure.

The IPC J-STD-001 specifies that conformal coatings must be fully cured and homogeneous.[2] Also, because the intent of conformal coating is to provide an immediate barrier to a harsh environment, the standard specifies that conformal coating must be free of delamination which would expose one or more conductive surfaces to the environment.[3] Physical appearance can be easily verified by visual inspection. Magnification may be used up to 4X.[4]

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When conformal coatings contain a UV tracer (dye), inspection can be performed using an ultraviolet (UV) light source (Figure 1). This becomes a valuable tool for verifying complete coverage and any specified areas that should be free of conformal coating (such as electrical contacts).

The specifications for thickness of a conformal coating vary depending upon the type of coating used. The J-STD-001 specifies 0.03-0.13 mm for types AR, ER, and UR, but requires a thicker coverage of 0.05-0.21 mm for SR types. Paraxylylene is only required to have a thickness of 0.01-0.05 mm.[5]

The thickness of the coating can be measured in a number of ways, but most of the methods used fall into one of two general categories.

1. Dry film method: Measurement using a micrometer (or indicator accurate to 12.5 ± 2.5µm)[6], made on a test coupon of the same type of material as the printed board or may be of a nonporous material such as metal or glass. Such measurements are to be made on a flat, unencumbered, fully cured surface of the printed circuit assembly or a test coupon.[7]

2. Wet film method: This alternative method measures the coating while it is still wet (before curing has been completed) and provides for calculations that will indicate the thickness after curing has been completed. This method is preferred when a dry film method is not practical or would be destructive.

For more details on methods and processes regarding the application and measurement of conformal coatings, ACI Technologies offers the IPC J-STD-001 course, as well as the IPC 7711/7721 Rework and Repair course. Please contact the Registrar at 610.362.1295 or visit our website at https://www.aciusa.org/train-main.html.

References

[1] Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies. IPC-CC-830B. Association Connecting Electronics Industries. Table 3-1.

[2] Requirements for Soldered Electrical and Electronic Assemblies. IPC J-STD-001G. Association Connecting Electronics Industries. Clause 10.1.

[3] Ibid. Clause 10.3.6.

[4] Ibid. Clause 10.3.9.

[5] Ibid. Clause 10.3.2.

[6] IPC-CC-830B. op.cit. Clause 4.7.4.

[7] IPC J-STD-001G. op.cit. Clause 10.3.2.

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