

PCB Conformal Coatings Guide - II

In the previous post, we discussed the importance of conformal coatings, materials used for coatings, and methods of application. In this post, we shall look at various conformal coating curing methods, and analyze their immediate benefits.

Understanding the Difference between Curing and Drying of Conformal Coatings

Most times, curing and drying arise confusions. Knowing this difference is very important to gain benefits from conformal coatings. These three stages will help you differentiate between the two:

- **Tack Free:** This is the first stage of drying, when it is dry enough to be used.
- **Fully Dried:** In this stage, the conformal coating, and PCB can be easily handled.
- **Fully Cured:** Conformal coating has achieved its optimum properties.

Conformal Coating Curing Methods

Conformal coatings are dried and cured using any of the following methods:

- **Evaporative Cure:** In this method, the liquid carrier is allowed to evaporate, leaving behind the final coating. This is one of the simplest curing methods used by PCB manufacturers. The circuit boards need to be dipped at least twice to accumulate adequate coating on the sides. The liquid carrier may be water or solvent-based. The solvent based system is easy to cure, and provides brilliant coverage. Adequate extraction and ventilation are necessary when working with inflammable, solvent-based systems. Water-based solvents are safer to work with, but they take a long time to cure.
- **Moisture Cure:** This type of curing is employed for urethane and silicone materials because they react with moisture. In this method, the moisture reacts with resin to initiate the curing, post-evaporation of solvent-carrier. However, this type of curing is coupled with evaporative curing for achieving desired curing benefits.
- **UV Cure:** In this method, coatings are cured by UV radiation produced from curing equipment. This is normally done for UV-reactive conformal coatings. It

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is also done for conformal coatings that react to typical UV wavelengths. This method is usually combined with a secondary curing method for desired benefits. This method requires some special precautions to be taken due to the exposure to harmful UV radiations.

- **Heat Cure:** This method is used as a supporting mechanism for moisture, UV, and evaporative cure. The coating is cured by heating. The method is beneficial when desired curing properties are not gained from the previous method. While conducting heat curing, the thermal sensitivity of the PCB board should be considered.

Inspecting for Coating Defects

After the completion of curing, the coating is thoroughly inspected to ensure it is free from:

- Fisheyes
- Dewetting
- Voids and Bubbles
- Delamination
- Creep Corrosion
- Cracks
- Ripples
- Contamination
- Orange Peel

Selection Criteria for Coating Material

The selection of a coating material will depend on the following factors:

- Temperature ranges of the PCB
- Chemical, electrical, and physical requirements of the coating material
- Compatibility of the material with PCB parts, and substances

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Benefits of Conformal Coatings

The following are some benefits of conformal coatings:

- **Reduces Labor:** Conformal coating is an easy process and requires less labor. However, manual dipping process can be laborious, and managing consistency can be a problem.
- **Reduces Conductor Spacing by 80%:** The conformal coating helps reduce the conductor coating by 80%, and makes the circuits lightweight.
- **Helps Save Money on Additional Enclosures:** Conformal coatings help avoid excess expenditure on additional enclosures, and minimize risks of environmental exposure.
- **Helps Eliminate Potential Performance Degradation:** Conformal coatings protect PCBs against chemicals, corrosion, contamination, and other hazards.
- **Minimizes Environmental Stress and Creates Safe Work Environments:** Automated conformal coating applications promote a safe work environment in factories. This is because proper filter and exhaust systems are used for the purpose. Dangerous fumes produced can be easily controlled, and captured, thereby ensuring a safer environment for workers. The method reduces labor costs, material waste, and environmental stress on the [PCB assembly](#).

After reading the two posts, readers will get an idea of the conformal coating procedure, methods, materials, and specific benefits. This will answer the question of why PCBs require conformal coatings.