

Technical Bulletin

Conformal Coating Curing and Drying

One of the final processes after conformal coating application but possibly before inspection is the drying or curing of the conformal coating material. Curing and drying are distinctly different processes in conformal coating and are defined for ease of understanding.

Conformal coating curing and drying definitions

The difference between drying and curing are important in processing.

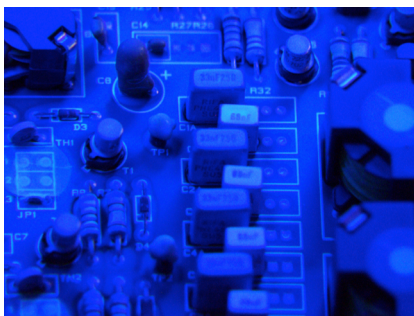
Drying is where the coating is fit to be handled after application of conformal coating. Curing is where the optimum properties of the conformal coating are reached for full performance protection.

Actually, there are three stages that are useful to consider. These are:

1. **Tack free** – This is where the coating is dry enough to handle CAREFULLY.
2. **Fully dried** – the conformal coating and PCB can be handled normally but the coating is not fully cured.
3. **Fully cured** – Conformal coating has reached its optimum properties.

For all three stages, it may be that air drying at room temperature achieves the state required for the conformal coating.

Alternatively, accelerated heat or moisture must be applied, or the application of UV light may be needed to achieve the desired result.



Do you need to cure the conformal coating?

Curing implies that the optimum properties of the conformal coating are met, such as the electrical & physical characteristics, and that the conformal coating does not impede the operation of the printed circuit board (PCB).

A conformal coating could be applied to a PCB and after a period of two hours and look fully cured. However, this may not be the case.

For instance, if a solvent based conformal coating is applied to a PCB and allowed to air dry at room temperature, although the board may be fit to handle, there would almost certainly be trace solvents after that period in the film which have not evaporated.

Also, with polyurethane conformal coatings, they have a characteristic of cross linking to give the chemical resistance they tend to be required for in the field. This cross linking can take days at room temperature, depending on the conformal coating chosen,

The question to ask then is a fully cured PCB with optimum properties required at each stage of the electronics manufacturing process and also in the period before service, where it may be held in storage or stock?

If the answer is no, then it's unnecessary to fully cure. However, if the conformal coating affects the electrical output of a device that needs to be calibrated on the PCB and the output varies with curing then not fully curing before calibration could be a problem!

Accelerated and artificial curing methods

Conformal coatings can be dried and cured quicker by used accelerated methods. These curing techniques can include:

- Heat
- Moisture
- UV Light

Heat Curing

Most conformal coatings benefit from raised temperature curing. This is because the carrier of the conformal coating resin (solvent, water) dries out, speeding up the FILM FORMING PROCESS.

Film forming is where the majority of the coating solvent or liquid has been removed and a stable dry film has been formed on the PCB.

For pure solvent based acrylics this is generally the only cure mechanism and optimum properties are reached when the solvent in the conformal coating is no longer significant to affect performance.

Moisture Curing

As the name suggests the application of moisture creates a chain reaction in many conformal coatings such as polyurethanes that effectively cures the coating.

This normally is a one way process and once a conformal coating is exposed to moisture it is difficult to reverse the process.

Moisture cure conformal coatings therefore need to be handled carefully in process and storage to avoid premature curing before application.

UV Curing

UV curing is normally only used for curing UV conformal coatings that react to specific wavelengths of the UV light applied.

UV coatings require very specific UV light to cure instantly and the conformal coating reaches its optimum properties extremely quickly.

Dual Cure

Some UV cure have a dual cure process where UV light and moisture can cure the coating to ensure any coating not cured with the UV eventually cures.

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