



Encapsulating Electronic Circuits

Epoxy and Polyurethane compounds are widely used to encapsulate electronic circuits. Depending on the type of components contained in the circuit and the performance requirements for the finished components, it is critical to select the appropriate formulation. The type of fillers, pigments, thermal conductivity, the electrical properties, the amount of shrinkage during cure and adhesion to containers can all effect the output of an encapsulated circuit.

The most common causes of change in circuit output or failure are as follows:

1. Incorrect pigments in the formulation

Some pigments are more conductive than others. Changes in output can occur when resins containing more conductive pigments come in contact with high impedance devices.

2. Excessive amounts of impurities in the filler or the liquid components of the formulation.

Conductive impurities in any of the components of the formulation used can effect the output if the circuit especially those containing high impedance devices.

3. Excessive shrinkage during cure.

Excessive shrinkage during the curing process will result in pressure on the components. As a general rule, filled products and slower curing materials shrink less. Some pressure sensitive components such as discrete FETs may have to be cushioned with a softer material to eliminate this problem.

4. The dielectric strength of the material is too low.

Especially with high voltage devices, increased leakage currents can cause a change in the output of the circuit. Dielectric breakdown in certain areas could also cause changes in output.

5. The thermal expansion is too great.

Operation at elevated temperatures will cause the encapsulant to expand. This expansion can cause internal pressures to be exerted on embedded components. Further to this, dielectric heating can cause expansion resulting in pressure on internal components.

6. Components degraded by excessive exotherm during cure.

Highly reactive materials, especially when applied in larger masses, can generate heat in excess of 150⁰C during cure. This heat can degrade the components being encapsulated.

The probable solution to the above problems is to select a product with the correct filler content deigned to meet the desired operating criteria. In some cases cushioning extremely pressure sensitive devices may be necessary. Slowly curing systems with maximum filler content are best suited to these applications.

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