Tech Tip 8

Reworking, Removing and "Decapsulating" Cured Epoxies

What > Removing Cured Epoxy

Why > There are several techniques which have shown to be effective tools in removing cured epoxy from substrates.

A major advantage of using an epoxy is that it provides a very strong, permanent bond in adhesive applications. This permanence can also act as a limitation when needing to rework, remove or "decapsulate" the cured epoxy. This document lists several techniques which have shown to be effective tools in removing cured epoxy from substrates.

1. Chlorinated solvent is the most aggressive way to attack cured epoxy. Methylene chloride (dichloromethane) has shown the most success but does require the material to be soaked for several hours. Stripping Agent MS-111 (which contains approximately 85% methylene chloride) from the Miller- Stephenson Chemical Co. in Danbury, CT is a product that works very well. Dynaloy LLC also has several epoxy solvents and removers based on which type of epoxy hardener is used in a product.

2. A warm solution of sulfuric acid will dissolve the cured epoxy. This, like the chlorinated solvents, also requires a good soaking. An effective technique that some customers have used is repeatedly dropping the acid on the top surface of the epoxy to facilitate the removal.

3. Other chemicals which have shown to be effective: toluene, NMP (n-methlypyrollidone) and MEK (methyl-ethyl-ketone).

4. Combination of heat and pressure. Since epoxies are thermosetting resins, they have a softening point called the glass transition temperature (Tg). Heating above the Tg will soften the material slightly and allow the epoxy to be pried away more easily. The tip of a soldering iron can be used as the heating mechanism and can be applied directly on the epoxy or at the bond line. When the adhesive becomes soft and "gummy", de-bonding can occur. Heating of the substrate using a hot plate is another common technique, as well as using a conventional box oven.

5. Degradation temperature of the epoxy. Most epoxies will decompose and turn to carbon ash at temperatures of 400°C and above. By heating the unit above the degradation temperature (found on the data sheet), the epoxy adhesive simply burns away.

6. Boiling water. Epoxies, when exposed to boiling water for an hour or so, will lift away from any surfaces in most cases. Some prying action may be needed and this technique can vary widely depending on epoxy and bonding surfaces.

7. Thermal shock. Large differences in thermal expansion rates between a substrate, adhesive or component can stress the epoxy and create joint separation as well as bond line lift. Thus, by imposing severe thermal fatigue on the adhesive joint, de-bonding can be accomplished simply by the thermal-mechanical differences of adhesive and substrate.

Several of the techniques listed are destructive in nature and can be suicidal in terms of re-usable parts for manufacturing. This document makes no attempt to suggest how manufactured parts can be saved or reclaimed. Its intention is to provide means of solving erroneously placed epoxy or components, and failure analysis.

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