

Tech Tip 6

What > Minimum Bond Line

Why > Minimum bond line cure and thickness play an important role in adhesive properties and performance.



Minimum Bond Line (Cure and Thickness)

Introduction

Epoxies cure by a kinetically favored process known as an exothermic reaction. By adding a part B curing agent to the part A monomer, the result is a cured polymer network. Some proceed very rapidly at ambient conditions, others need to be catalyzed with a temperature or light source, but all require a minimum amount of time for a complete cure. Epoxies also require a minimum bond line thickness in order for sufficient adhesion and performance in a specified application. This document provides recommendations on best practices for successful curing and bonding.

Minimum Bond Line Cure

All epoxies must be cured in order to achieve optimal mechanical, electrical, or optical properties. There are numerous methods of curing epoxies (ambient, box oven, tunnel oven, hot plate, heat gun, UV, etc.) and each can result in varying properties. For each product that is developed, a unique cure schedule is devised which includes a “minimum cure” reported on each product data sheet. This “minimum cure” is the worst case scenario cure for minimal properties. Furthermore, the “minimum cure” temperature is the actual temperature of the epoxy bond line and should not be confused with the temperature setting of the heating source. It is important to note that the thermal masses of trays, parts, accessories, and opening and closing the oven door will slow down the time it takes for the epoxy to reach the minimum temperature; so special care should be taken to incorporate these thermal lags when determining the optimum curing profile. Curing conditions reported on data sheets are guidelines and should not be confused with specifications. Contact techserv@epotek.com for cure recommendations per your specific application, process, and product.

Minimum Bond Line Thickness

Minimum bond line thickness often receives special attention in part specifications but, is often overlooked and seldom controlled or monitored during process and manufacturing engineering. The risks of inadequate bond line could be low strength, poor electrical properties, high thermal resistance and optical scattering. The following is a suggestion of minimum bond line thickness as a function of adhesive type and application:

Adhesive Type	Minimum Bond Line Thickness	Comments
Silver-filled	12 micron (0.5 mil)	-Less than this can become electrically insulating -Best thermal pathway is 0.5 to 3 mils - Die attaching and SMD caps and resistor mounting
Thermally conductive	25 to 75 micron (1 to 3 mils)	- Thermal interface materials for heat sinking -Potting several layers that can be several mm to inches deep
Optical / UV cured	3 micron in fiber optic connectors	-Optical beam pathway for fiber optic, optical and medical optics bonding -LCD laminating layers -LED encapsulation
Polyimides	10-20 micron up to 100 micron	-Semiconductor wafer passivation

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