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Fabrication Method Reference Guide

Standard Thermabond® Compliant Thermal Interface Adhesives

Arlon STD Product Numbers 99000WXXX, 99510NXXX, 99710WXXX, 99720WXXX, 99730NXXX

I. Overview

Thermabond® Adhesives are used to bond two interfaces that require a thermal path between them. Thermabond accomplishes this by using mineral or metallic fillers incorporated into a catalyzed silicone rubber base. Thermabond® vulcanizes and bonds to surfaces when heat and pressure are applied. In order to accomplish this, a few conditions must be met to ensure successful adhesion.

- 1) The surfaces to be bonded must be clean and free of contamination.
- 2) The surfaces must be treated with an adhesion promoter such as a silane primer.
- 3) The Thermabond® material must be in shelf life.
- 4) Adequate heat and pressure must be maintained to fully vulcanize the adhesive.

II. Cleaning and Surface Preparation

Cleaning of circuit board and heat sink can be accomplished with most any standard solvent provided a residue is not left behind. Ideally, untreated aluminum should have the oxide layer removed with an aluminum cleaner or by abrasion. Anodized and other metal treatments should always be tested for bonding compatibility prior to writing production methods or specifications. The cleaning system chosen should be matched to solder mask system. Solvents such as acetone and isopropyl alcohol are well suited for cleaning and degreasing most metal surfaces and circuit boards. Optimal cleaning can be achieved by wiping the surface with a solvent-soaked lint free cloth, followed by a solvent rinse.

III. Priming

Applying a primer to board and heat sink surfaces is required to ensure that optimum bond strength is achieved. Silane primers are specially formulated to bond a molecular layer of silicon to the surface of a substrate. This allows Thermabond® to chemically bond to the surfaces, which provides mechanical stress decoupling. Silane primers can be applied by wiping or spraying in very low volumes. These processes should be tightly controlled to prevent over-priming, contamination, and aging. Typically, primers are diluted with a water-free solvent such as Isopropyl Alcohol or Methanol. The amount of dilution depends on the brand of primer and the substrates to be bonded. Experimentation should be performed to determine the optimum dilution ratio. Typically a good starting point is 2:1. Dilution ratios 1:1, 4:1, 8:1 are also common. Some primers require a hydrolization step, please follow the manufacturer's recommendations. The following silane primers have been thoroughly tested for retention of bond strength after environmental conditioning and provide satisfactory adhesion. Dow Corning p/n S2260 Silicone Primer, Customer Service 1-800-248-2481. Lord Chemical p/n Chemlok® 607 Customer Service 814-868-3611. Reference the section on testing for more information.

IV. Shelf Life and Bonding Conditions

The shelf life of Thermabond® 99510NXXX is 6 months after the date of manufacture when stored at 70°F +/- 5°F. The shelf life of Thermabond® 99000WXXX, 99710WXXX, 99720WXXX, and 99730NXXX is 6 months after the date of manufacture when stored at 45°F +/- 5°F. After this period has expired, reliable bond cannot be achieved. Refrigeration does not adversely affect the material. When Thermabond is removed from refrigerated conditions, care should be taken to ensure that condensation does not form on the adhesive surface. Storing the material in plastic bags provides protection from condensation. Bonding operations should be performed in a clean environment with adequate safety controls in place. Please read all appropriate MSDS for reference.

V. Application

Thermabond® is shipped in a number of forms; as cut sheets, in die cut pieces, as slit rolls or in full width (36") rolls. The material has fluoropolymer liners on both sides to ensure easy material removal: 3 mil brown PTFE coated glass on one side and 1 mil clear FEP on the other side. Typically, the FEP liner is removed first, and the material is placed onto the flatter of the two surfaces. A mechanical roller or a light hand pressure should be used to guarantee intimate surface contact. Then, the brown liner is removed and the other half of the assembly is put into place. Both liners should be removed by pulling them back at a 180° angle (flat to the Thermabond® surface) to avoid wrinkling. Although Thermabond® is formulated to flow slightly under pressure to fill air gaps, care should be taken to remove air bubbles if present.

VI. Curing

Thermabond® adhesives must be cured with heat and pressure in order to bond properly. The material has been specially catalyzed with low-temperature peroxide catalysts. Recommended cure temperature range is 212-300°F (100-150°C). Please note that the specific temperature required depends on the assembly design as heat flows through the assembly and Thermabond® comes to temperature. Thermocouples should be used to establish the heat lag time for the assembly. Pressure can be applied in one of two methods; platen press or a vacuum bag. Platen press curing is preferred due to its direct heat and pressure control. For populated boards, vacuum bag processing is required to apply pressure without disturbing the components. The amount of pressure required for optimal flow and bond strength should be determined experimentally for each assembly design. However, pressures between 10 and 50 psi are recommended. For vacuum bag processing, a silicone reusable vacuum bag or a polyester turkey bag can be used to apply pressure and cured in a conventional hot air oven. Vacuum bagging procedures are similar to that for composites processing. Contact an Arlon Engineer for details.

VII. Testing

Testing for determination of optimum cleaning, priming, and cure process variables is typically accomplished using a lap shear test modeled on ASTM D1002.