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Handbook on Adhesive Bonding in Electronic Assembly Operations

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Handbook on Adhesive Bonding in Electronic Assembly Operations

Developed by the Electronic Assembly Adhesives Task Group (5-11c) of the Assembly & Joining Committee (5-20) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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Introduction

As available materials have improved and as manufacturing efficiency drives consideration of alternatives to traditional processes, adhesive bonding has become increasingly more important industry wide. The major function of adhesives is to fasten two or more ''adherents'' (i.e., materials and/or parts which are to be bonded) together. This document covers known terminology associated with these materials and processes as related only to electronic assembly.

Adhesives are increasingly being used in applications, replacing the more traditional methods of fastening. In spot welding and mechanical fastening, the strength of the structure is limited to the areas where the members of the structure are in contact with the weld or fasteners. But when parts are bonded together with adhesives, the stress is transmitted from one member to another in such a way that stresses are uniformly distributed over the entire surface area of the bond. Adhesives can be used to bond together dissimilar materials, whereas welding and soldering are limited to a few materials that can be bonded together by these methods. In addition, adhesives are being specified in applications which require reduced weight and space that preclude the use of hardware fasteners. Adhesive bonding is used in conjunction with various types of assemblies and components (e.g., printed circuit assemblies (PCA), connectors, transformers, enclosures, etc.). The designer and the users of adhesive bonding for electronic applications must be aware of the properties of various types of adhesive bonding and their interactions with assemblies and components to protect them in the end-use environment for the design life of the end item. This document was written to assist designers and users of adhesive bonding in understanding the characteristics of various adhesive bonding types, as well as the factors that can modify those characteristics when the adhesive bonding is applied. Understanding and accounting for these materials can ensure the reliability and function of electronics.

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the Electronic Assembly Adhesives Task Group (5-11c) of the Electronics & Joining Committee (5-20) are shown below, it is not possible to include all of those who assisted in the evolution of this handbook. To each of them, the members of the IPC extend their gratitude.

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Handbook on Adhesive Bonding in Electronic Assembly Operations

1 SCOPE

For the purpose of the initial version of this document, the discussion of adhesives will be limited to liquid, paste and gel materials and closely related film adhesives, which require some form of ''cure'' mechanism to achieve their full performance. Materials that rely primarily on pressure-sensitive bonds, whether coated on an inert film or not (generically ''tapes'') will not be addressed at this time. Similarly, though there is much overlap in material chemistry and application, the subcommittee has chosen to defer the discussion of underfill materials at present. Underfill materials are discussed in J-STD-030. Surface mount adhesives are also not addressed in this document. Surface mount adhesives are discussed in IPC-SM-817.

Adhesives, for the purpose of this document, are defined as a material (e.g., epoxy, silicone, urethane, cyanoacrylate, polyimide, etc.) that is applied in an uncured state and subsequently processed (i.e., cured) to form a rigid or rubber-like state.

Processing characteristics and curing mechanisms are dependent on the adhesive chemistries used. The desired performance characteristics of an adhesive are dependent on the application and must be considered when selecting adhesive bonding materials and adhesive bonding processes. Users are urged to consult their suppliers for detailed technical data.

This guide enables a user to select an adhesive based on industry experience and pertinent considerations. It is the responsibility of the user to determine the suitability, via appropriate testing, of the selected adhesive and the application method for a particular end-use application.

Adhesive bonds may have several functions depending on the type of application. The most common are to:

- Attach one or more electronic functional devices to a substrate.
- Absorb mechanical stresses that would otherwise compromise electrical (e.g., solder) joints.
- Inhibit corrosion.
- Improve fatigue life of solder joints to leadless packages.
- Inhibit arcing and corona, in particular for high-voltage applications.
- Provide mechanical support and prevent damages due to mechanical shock and vibration.
- Provide a mitigation method for the growth of tin whiskers.

1.1 Purpose The term ''adhesive bonding'' can be ambiguous and be interpreted to mean many things in various industry assembly processes.

The purpose of this handbook is to assist individuals who must either make choices regarding adhesive bonding or who must work in adhesive bonding operations and also to provide guidelines for the design, selection and application of adhesive bonding as it pertains to electronic assembly only.

2 APPLICABLE DOCUMENTS

2.1 IPC[1]

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits[2]

IPC-CH-65 Guidelines for Cleaning of Printed Boards and Assemblies

IPC-TM-650 Test Method Manual

2.6.1.1 Fungus Resistance - Conformal Coating

2.6.3.1 Solder Mask - Moisture and Insulation Resistance

1. www.ipc.org
2. Current and revised IPC Test Methods are available on the IPC Web site (www.ipc.org/html/testmethods.htm)