Micro-Sectioning of PCBs for Failure Analysis

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Micro-sectioning (sometimes referred to as cross-sectioning)is a technique, used to characterize materials or to perform a failure mode analysis, for exposing an internal section of a PCB or package. Destructive in nature, cross-sectioning requires encapsulation of the specimen in order to provide support, stability, and protection. Failures that can be investigated through micro-sectional analysis include component defects, thermo-mechanical failures, processing failures related to solder reflow, opens or shorts, voiding and raw material evaluations.

A micro-sectioned electronics package or PCB can be effective for viewing and studying a variety of conditions. Micro-sectioning is often applied in failure analysis to study comparisons of materials through changes in structural forms. Such changes can indicate damage through thermal cycling, embrittlement, or fatigue.

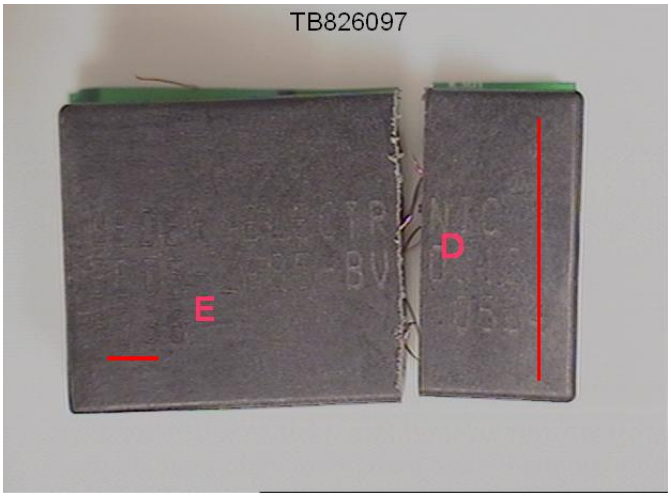

Figure 1- Careful marking area of interest to be micro-sectioned

The process of micro-sectioning begins with sample preparation. The area of interest is identified and marked carefully. Parts may need to be removed from the surrounding area of interest. This is followed by the mounting, sawing, grinding, polishing, and staining of the specimen and finally recording and analysis of the findings based on the images. At the completion of these processes, the plane of interest has been made ready for optical microscopy or SEM analysis.

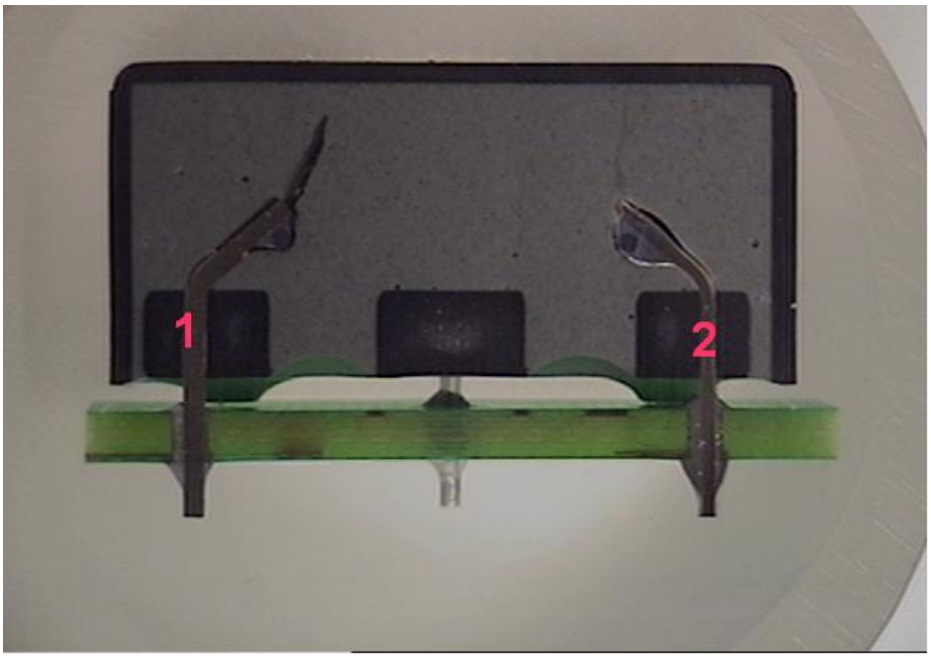

Figure 2- Encapsulated "puck" prior to analysis

The IPC TM-650 2.1.1 procedure defines the preparation of a metallographic specimen of printed wiring products. The finished microsection can be used for evaluating the quality of the laminate system and the plated-through holes (PTHs) as well as for the examination of area on the assembled PCB. While manual microsectioning sample preparation is regarded as an art form, this IPC method describes those techniques that have been found to be generally acceptable. It does not attempt to be so specific as to allow no acceptable variations that can differentiate metallographers. Furthermore, the success of these techniques remains highly dependent upon the skill of the individual metallographer and even more importantly the analysis of the sectioning part. BEST follows these guidelines in preparing its samples.

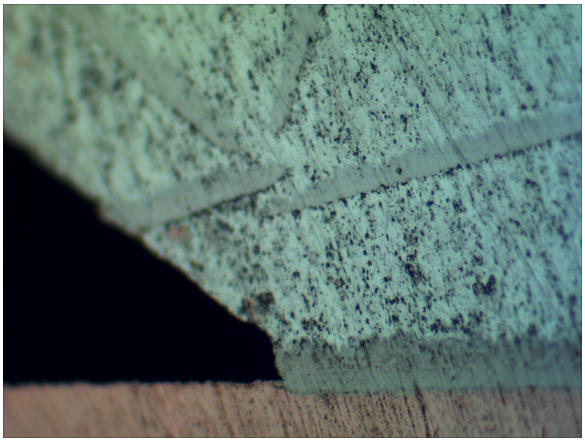

Figure 3- Microstructure of BGA/pad interface at 500X

The interpretation of the microstructure is important when evaluating the solder joint cross sections. The intermetallic regions and grain structure of reflowed solder joints are used for

process optimization and troubleshooting. The majority of tin-based lead free alloys exhibit intermetallic structures within the tin-matrix. These intermetallic structures are composed of a ratio of tin and some other elemental constituent of the alloy such as Ag_3Sn. These intermetallic structures comprise of small percentage of the total volume within the solder joint as their relatively low percentage of alloying elements. The morphology of these lead free solders generally exhibits a round, lathlike, blocky or needle-like structure.

It is important that whoever performs the micro-sectioning that the service provider can document high powered magnification of prepared samples including bright field, dark field and polarized light source images. BEST has the capability to look at cross sections with up to 1000x magnification.

BEST not only can perform these micro-sectioning techniques but more importantly it can help you determine root cause of process anomalies/defects and suggest corrective actions.