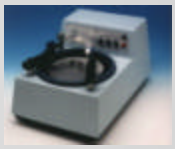

Preparing Planar Specimens of Entire PC Board Components

SBT
Lapping and Polishing

1.0: Purpose

Often times it is necessary to evaluate many structures present on complete components of devices, such as small PC Board assemblies. The challenge of these multi component devices is the various material types which exist in them, ranging in hardness from Si, plastics, and solder materials. In this experiment, planar grinding of a small PC Board assembly is done to demonstrate both the possibility of producing planar specimens of this type but also the ability to prepare these materials which facilitates examination of all components which exist on the assembly.

2.0: Experiment and Procedure

The PC Board sample of interest contains several different device structures which are to be thinned down and polished to a mirror finish as is the case in most metallographic procedures. The initial size of the PC Board contained structures which did not need preparing, so the board was cut down to size using a Model 865 Diamond Band Saw. Below is a micrograph illustrating the composition of the specimen for processing.

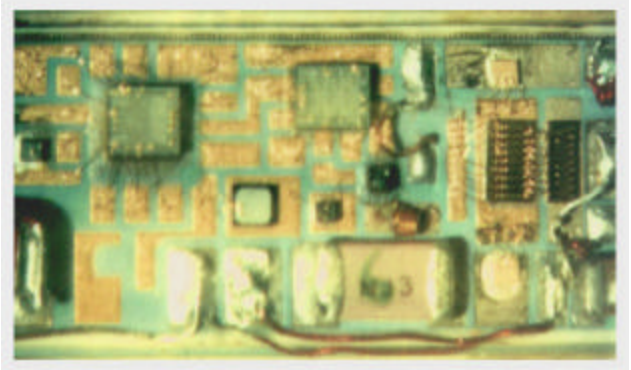

Figure 1: Micrograph of the PCB assembly prior to lapping and polishing processes. The primary area of interest are the Si die which are mounted to the board and the solder of the other components.

For grinding and polishing, a Model 920 Lapping and Polishing machine was used with a Model 92003 Non Contact polishing workstation to produce the flat, polished specimen. The Model 92003 was selected so as to minimize wear on the abrasive papers and to possibly help planarity. There are several different aspects to the process and each will be discussed below in detail.

2.1: Planarizing the Workstation

Prior to mounting the specimen, the Model 92003 must first be planarized to ensure that the block and workstation are both in the same plane as the polishing wheel, allowing a flat, planar specimen to be produced. Once adjustments had been made to make the block flat with the lapping plate surface, the mounting block was planarized using 320 grit SiC abrasive papers mounted to the polishing wheel. Below is an illustration of the Model 92003 planarized to the wheel.

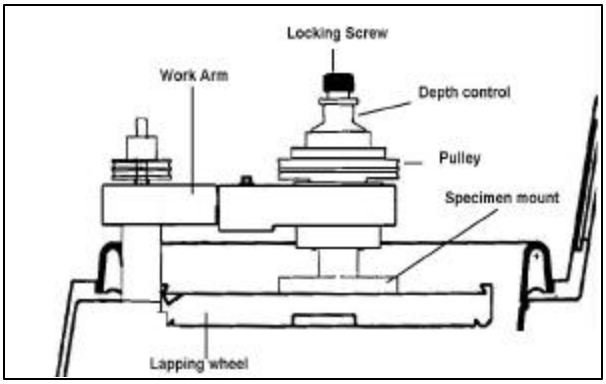

Figure 2: Illustration of the setup of the Model 92003 Non Contact Polishing arm. The specimen mount is first leveled with respect to the lapping wheel, followed by a planarization grinding step for making the block face parallel to the lapping wheel. High loads can be placed onto the specimen mount and specimen by adding weight to the top of the locking screw. Depth control is carried out via a micrometer dial above the fixture housing.

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2.2: Specimen Processing

Once the specimen mount had been planarized, the PCB was attached to the specimen mount using a low melting point wax. In this case, wax which melted at 70°C was used to prevent any possible heat transformations or microstructural changes as a result of the mounting method. The PCB was then clamped down to create a very thin, uniform wax layer to ensure planarity between the board and the mount. The specimen and specimen mount were then attached to the Model 92003 and locked into position for bulk thinning and polishing.

60 µ SiC Film: 60 micron film was used to bulk thin the components on the PCB and to coarse polish them. The instrument parameters were 100 g load; lapping wheel speed @ 50 rpm; workstation rotation set at 7; total time: 20 minutes.

30 µ Al_2O_3 Film: Specimen was thinned using the aluminum oxide films to remove the damage created by the 60 micron stage. Instrument parameters were: 50 g load; lapping wheel speed @ 50 rpm; workstation rotation set at 7; total time: 20 minutes.

12 µ Al_2O_3 Film: Coarse polishing was done to remove 30 micron damage. Instrument parameters were: 50 g load; lapping wheel speed @ 50 rpm; workstation rotation set at 7; total time: 20 minutes.

3 µ Al_2O_3 Film: Specimen was polished using fine aluminum oxide film to remove damage from 12 micron film. Instrument parameters were: 50 g load; lapping wheel speed @ 50 rpm; workstation rotation set at 7; total time: 10 minutes.

1 µ Al_2O_3 Film: Final stage of polishing films prior to final polishing with a polishing cloth. Instrument parameters were: 50 g load; lapping wheel speed @ 50 rpm; workstation rotation set at 7; total time: 5 minutes.

0.05µ Colloidal Silica on Multitex Cloth: Final polishing with colloidal silica to produce smooth finish. Instrument parameters were: 50 g load; lapping wheel speed @ 30 rpm; workstation rotation set at 7; total time: 3 minutes.

Results

Following the protocol and parameters listed above, the PCB specimen was successfully polished to a smooth mirror finish. Below is a micrograph illustrating the specimen following the polishing procedures.

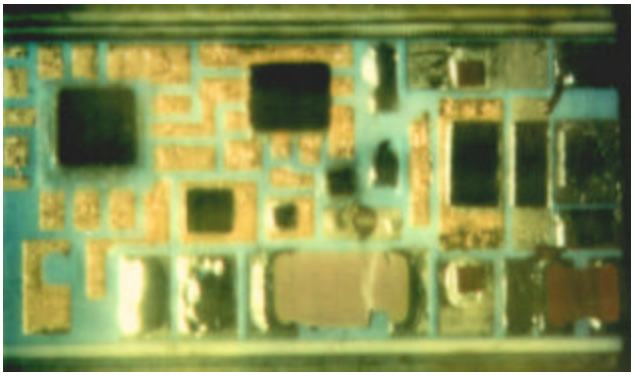

Figure 3: Illustration of the final polished specimen following the protocol as described above. Note the preservation of structures and planarity of the specimen, with no uneven polishing produced across the surface.

As can be seen in the micrograph, all of the structures of interest remain intact and are well polished. No problems with planarity are seen as a result of the workstation and specimen mounting procedures used for this specimen.

With careful consideration of polishing materials, equipment setup, and proper technique, successful preparation of any composite materials can be achieved with relative ease.

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