

Preparation to Target: Hit Target within $\pm 10 \mu\text{m}$ and a line of Target with in $\pm 25 \mu\text{m}$ with Common Metallographic Equipment.

B. Rasmussen, M.Sc.

Struers A/S, Valhojs Allé 176, DK-2610 Rodovre, Denmark.

Components and Parts becomes smaller and with that a demand for precise metallographic preparation. In most cases an investigation of these small parts demands repeatedly fine grinding and polishing with subsequent examination of the sample; this requires patience and a skilled metallographer to hit the target.

In this paper using Solderballs on BGA's mounted on PCB as example is described a fast procedure to hit a target within $\pm 10 \mu\text{m}$ and a row of targets 15 mm long within $\pm 25 \mu\text{m}$ and still obtain an excellent finish for metallographic investigation. Fig. 3, 4 and 5.

The precision of a preparation is a result of many uncertainties introduced during the procedure: alignment of the sample, precision of measuring system, precision of material removal and rigidity of the system. Most important is measuring system, which is used to align the sample and measure the amount of material to be removed to meet the specified precision.

The precision of the measurement should at least match the specified precision of preparation. Depending of the sample, visible or hidden target, either Microscope or X-ray can be used. In this case X-Ray has been used. The precision was $\pm 10\text{-}15 \mu\text{m}$.

Preparing to this level of precision demands a good alignment of the sample and usual very rigid special equipment. By using relative measurements only (measure from referent point to target) special equipment can be avoided. In this case normal laboratory preparation equipment was used, a Cutting/Grinding machine Accutom-50 for grinding and a fully automatic Polishing machine, Prepamatic-2, for polishing. Plan grinding and grind to $50 \mu\text{m}$ from target whilst keeping the alignment is possible moving the sample for and back ward over an abrasive cup wheel. Moving the sample in step of $5 \mu\text{m}$ against the cup wheel it is possible to grind to $50 \pm 5 \mu\text{m}$ from target. Final preparation to target is only possible by knowing removal rates on different surfaces. Thus it is essential that all parameters are kept constant is essential; a full automatic machine is the best choice.

Alignment of the sample can be obtained by clamping the sample on a Goniometer*. This can tilt the sample up to 5° in increments of 0.1° around two axes. With the sample clamped on the Goniometer during plane grinding, grinding to near target and in the X-ray the surfaces of the mount can be used as reference for measuring the material to be removed.

With these basic information the procedure will be:

Cutting and mounting of sample.

Alignment by X-Ray (Microscope in case of visible target)

Plan grinding on cutting machine

Measure amount of material to remove in X-Ray

Grind to $50 \mu\text{m}$ from target.

Fine grinding and polishing to target on full automatic Grinding and Polishing machine.

Total time is 1 hour 20 minutes (with put cutting and mounting).
20 minutes to handling and measuring, 1 hour full automatic grinding and polishing.

*Goniometer: small device for measurement of angles in Crystallography.

Preparation Method

Step	Surfaces	Lubricant	Time
PG	SiC cup wheel		Removal
FG	MD-Largo 9 μm	DP-Green	4 min.
P	MD-Dur 3 μm	DP-Green	5 min.
OP	MD-Chem		1 min.

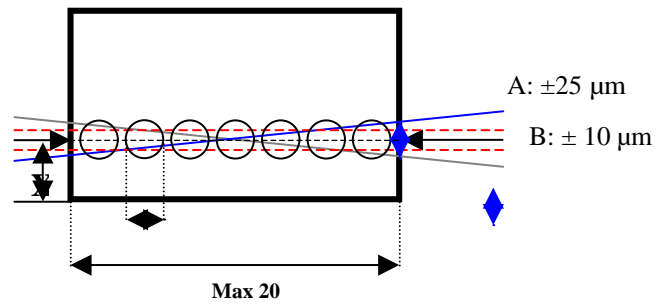


Fig. 1. $\pm 10 \mu\text{m}$ to Target,

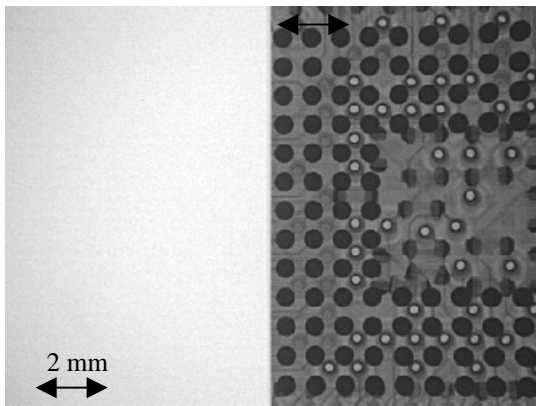


Fig. 2 By X-Ray. Sample after cutting

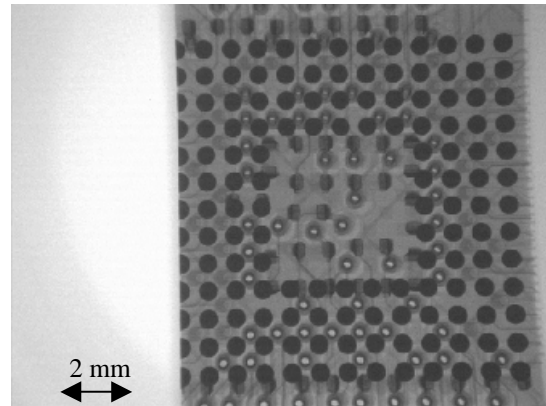


Fig. 3. By X-Ray. Sample after Polishing.

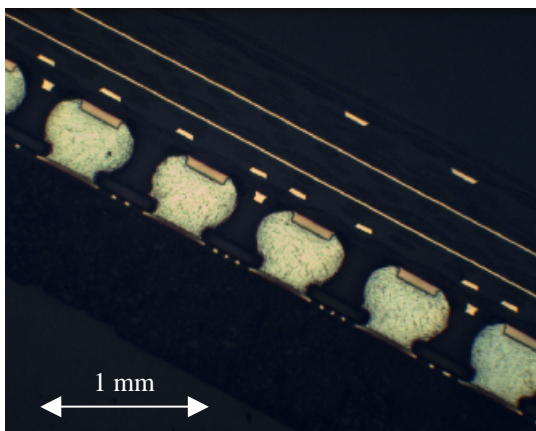


Fig. 4. x 50 Bright field. After Polishing.

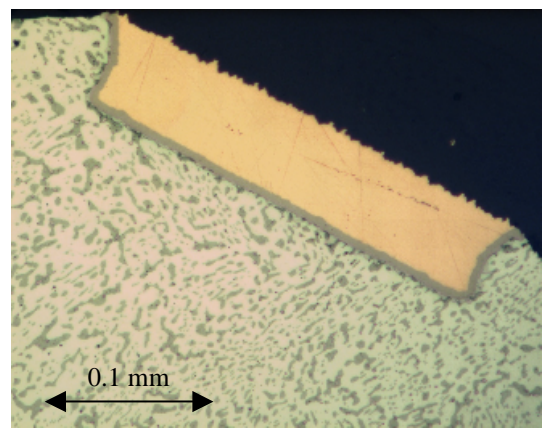


Fig. 5. x 200 Bright field. After Polishing.