Single Crystal Silicon & Polysilicon

I. Sample Description

- Seven (7) samples of single crystal silicon, approx. 4 mm T x 11 mm Ø.
- Six (6) polysilicon samples, approx. 4 mm T x 15 mm Ø.

II. Objective

- Develop a grinding/polishing procedure using the MultiPrep™ System to prepare both sides of the samples to a 1 µm finish within 8 minutes for metallurgical analysis.

III. Sample Preparation Process

A. Mounting

The MultiPrep™ System was aligned according to the operation manual to achieve optimum results. Alignment is necessary to ensure that the rotation axis is perpendicular to the platen and the fixture mounting reference is parallel with the platen. Failure to do this could affect accurate and uniform removal of material.

The parallel polishing fixture that was used for alignment was heated on a hot plate at 150º C. Sheet wax was applied to the fixture, the sample was placed onto the wax and, while the wax was still soft, light pressure was applied with a cotton-tipped applicator to assist in parallel registration of the samples to the fixture (Figure 1).

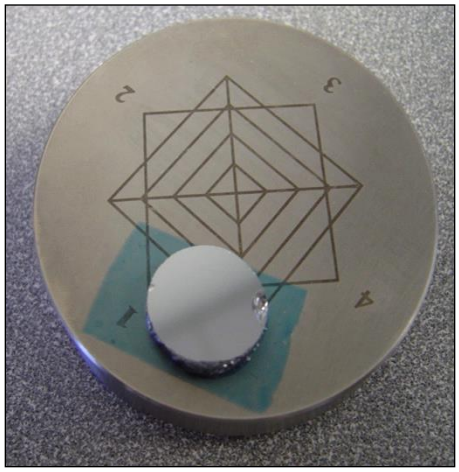

Figure 1: The sample was waxed onto a parallel polishing fixture.

B. Grinding & Polishing

The sample was prepared using the MultiPrep™ System. The procedure is outlined in Table 1.

The sample was prepared with a series of silicon carbide (SiC) abrasive discs – 500 grit and 1200 grit – followed by 3 µm diamond lapping film (DLF) and RedLube until the desired finished was reached. DLF was used as an intermediate step, to remove the course grinding scratches from previous steps. RedLube is a viscous glycol-based lubricant used to reduce frictional heat and extend cloth life.

The final polishing step was accomplished with a 1 µm polycrystalline diamond suspension on a White Label polishing cloth, with RedLube. White Label is a durable, densely woven, napless silk which provides excellent edge retention and sample flatness.

The AD-5™ fluid dispenser was used to provide automatic dosing of the polishing suspensions and lubricant, allowing for easy, repeatable and more consistent sample preparation. The dispensing parameters are listed in Table 2.

Table 1: MultiPrep™ System Grinding/Polishing Procedure for Single Crystal Silicon & Polysilicon

	Step	1*	2	3	4
Consumables	Abrasive Size	500 Grit (P-1000)	1200 Grit (P-2400)	3 µm	1 µm
	Type	Silicon Carbide	Silicon Carbide	Diamond	Poly Diamond
	Carrier	-	-	Lapping Film	Glycol Suspension
	Polishing Cloth	-	-	-	White Label
	Lubricant	Water	Water	RedLube	RedLube
Settings	Platen Speed (RPM)/Direction **	150/CCW	150/CCW	120/CCW	150/CCW
	Sample Rotation	Full (Speed 1)	Full (Speed 1)	Full (Speed 1)	Full (Speed 1)
	Sample Oscillation ***	1" Sweep (Speed 1)	1" Sweep (Speed 1)	1" Sweep (Speed 1)	1" Sweep (Speed 1)
	Sample Load †	Full	Full	Full	Full
	Target/Time †	20 sec.	1 min.	1-2 min.	1 min.

* Caution was taken not to grind the sample too thin.
** CCW: Counterclockwise
*** During oscillation, the sample should not go over the edge or the center of the platen.
† If the surface area changes, the load and time values may need to be adjusted accordingly.

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Table 2: AD-5™ Dispensing Parameters for Single Crystal Silicon & Polysilicon

Step	4	
Type	Diamond Suspension	RedLube
Pulses/Min	4	6
Pulse Length	0.5 sec.	
Water Flush	Off	

C. Cleaning

To remove debris and abrasive particulates after each grinding and polishing step, the platen was wiped with water and spin-dried. The samples and fixture were cleaned with Micro Organic Soap, rinsed with isopropyl alcohol and then dried using compressed air spray. This reduces the likelihood of scratches on samples due to abrasive contamination.

IV. Imaging & Analysis Results

Figure 2 is a micrograph of the sample. These images were taken with the ZEISS Axio Imager.A2m™ upright microscope, Axiocam 506 color™ digital camera and ZEN core imaging software.

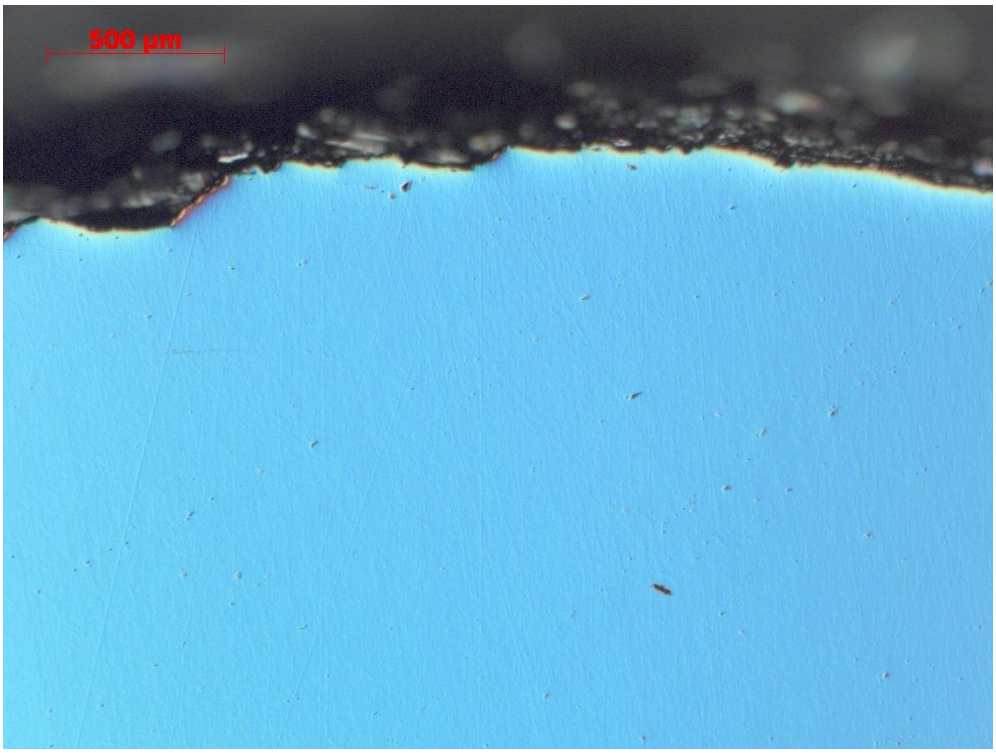

Figure 2: Silicon after the 1 µm polishing step, as-polished, 50X objective, C-DIC

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V. Equipment & Consumables Used

A. Equipment

- MultiPrep™ System
- Mounting Leveling Press Kit
- Magnetic Platen 8"
- AD-5™ Automatic Fluid Dispenser

MultiPrep™ System & AD-5™ Fluid Dispenser

B. Consumables

- Mounting Wax Discs
- 500 Grit Silicon Carbide Abrasive Disc
- 1200 Grit Silicon Carbide Abrasive Disc
- RedLube Polishing Lubricant
- 3 µm Diamond Lapping Film
- 1 µm Polycrystalline Diamond Suspension
- White Label Polishing Cloth
- Micro Organic Soap
- Compressed Air Spray

C. Imaging & Analysis Products

- ZEISS Axio Imager.A2m™ Upright Microscope
- ZEISS Axiocam 506 color™ Digital Camera
- ZEISS ZEN core Imaging Software

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