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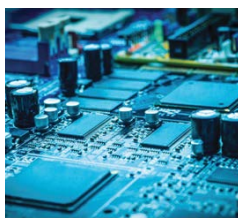
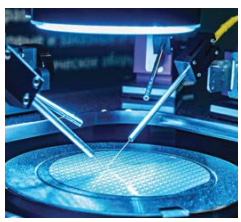
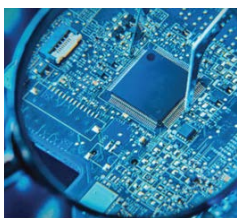
Technology behind Specimen

METKON SOLUTIONS FOR

ELECTRONICS INDUSTRY

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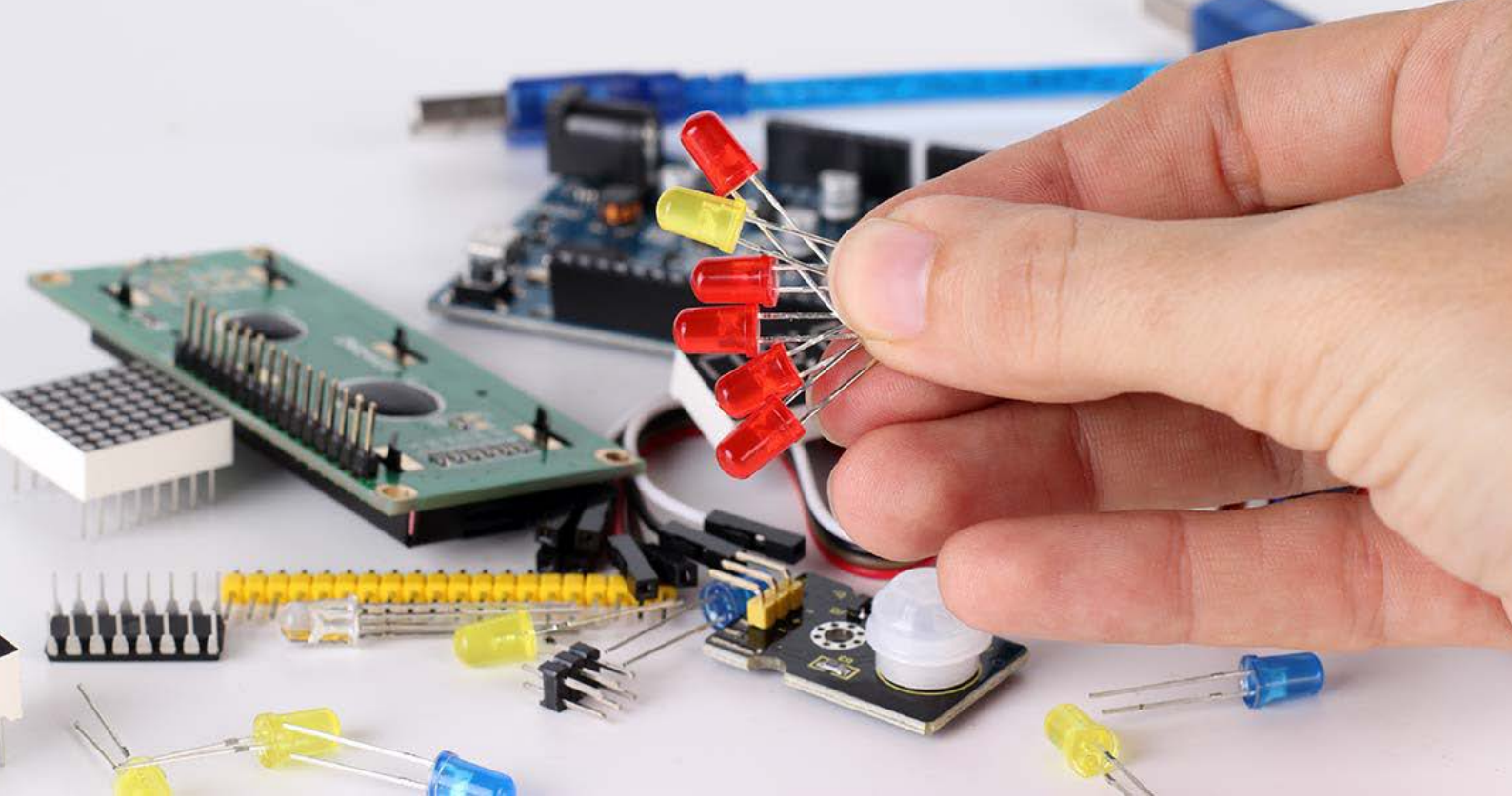


ELECTRONICS

Electronics comprises the physics, engineering, technology and applications that deal with the emission, flow and control of electrons in vacuum and matter.

It uses active devices to control electron flow by amplification and rectification, which distinguishes it from classical electrical engineering which uses passive effects such as resistance, capacitance and inductance to control current flow.

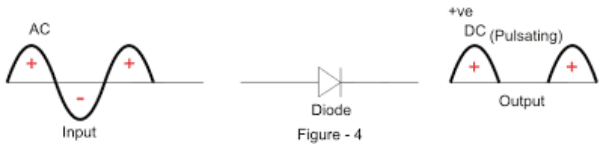
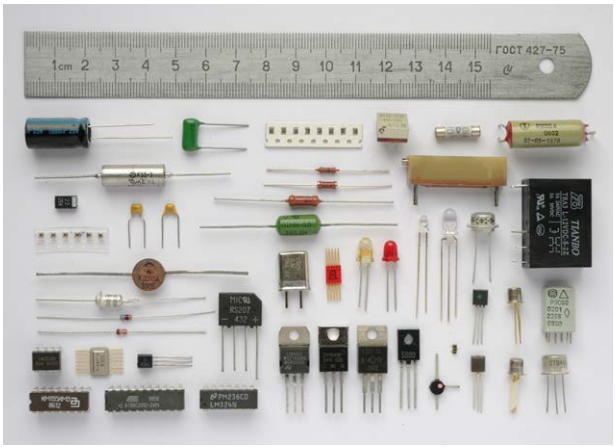
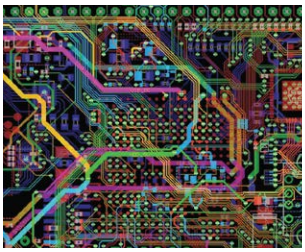


Figure - 4





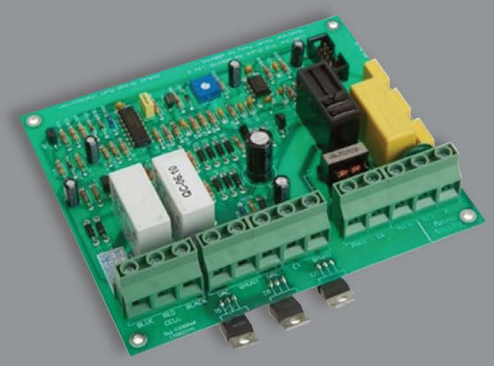
MICROELECTRONICS

Microelectronics is a subfield of electronics. As the name suggests, microelectronics relates to the study and manufacture (or microfabrication) of very small electronic designs and components.

Usually, but not always, this means micrometre-scale or smaller. These devices are typically made from semiconductor materials. Many components of normal electronic design are available in a microelectronic equivalent. These include transistors, capacitors, inductors, resistors, diodes and (naturally) insulators and conductors can all be found in microelectronic devices. Unique wiring techniques such as wire bonding are also often used in microelectronics because of the unusually small size of the components, leads and pads. This technique requires specialized equipment and is expensive.

Digital integrated circuits (ICs) consist of billions of transistors, resistors, diodes, and capacitors. Analog circuits commonly contain resistors and capacitors as well. Inductors are used in some high frequency analog circuits, but tend to occupy larger chip area due to their lower reactance at low frequencies. Gyrators can replace them in many applications.As techniques have improved, the scale of microelectronic components has continued to decrease. At smaller scales, the relative impact of intrinsic circuit properties such as interconnections may become more significant. These are called parasitic effects, and the goal of the microelectronics design engineer is to find ways to compensate for or to minimize these effects, while delivering smaller, faster, and cheaper devices.

Today, microelectronics design is largely aided by Electronic Design Automation software.



SAMPLE PREPARATION FOR ELECTRONICS & SEMICONDUCTORS

Electronics & semiconductor samples can be grouped in four different groups: Silicon wafer, chip based components, electronic components and printed circuit boards (PCB).

The metallographic inspection is done usually on chip based components and electronics components for inspecting cavities, cracks, soldering errors, conductive layers etc.

The structrure of chip based and electronics components are very small, which require very high precise sample preparation equipment.

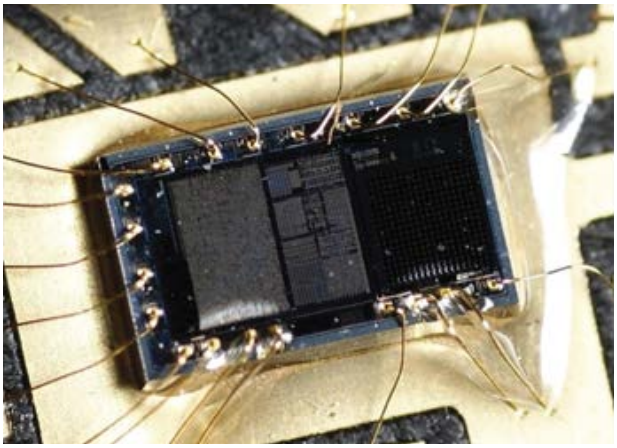
The goal of sample preparation is to make visible hidden layers inside the sample or reveal interested inspection area. This can be done with precise grinding. If inspection area is at very deep from the sample edge, in this case cutting method can be used for reduce total grinding depth. After cutting and grinding, the next step is polishing. After polishing, the scratches are removed and the microstructure can be seen under microscope clearly.

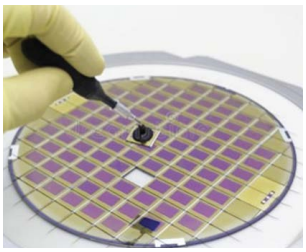
Metkon provides special sample preparation solution for electronic components and semiconductors.

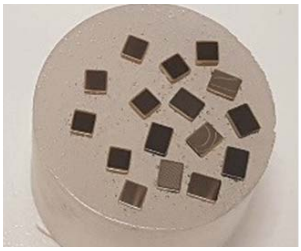
METKON MICRADEPTH is designed for micron size material removing from electronics, semiconductors or any samples that require precise grinding. It has adjustable grinding depth with 5 µm accuracy, with boron-carbide stop.

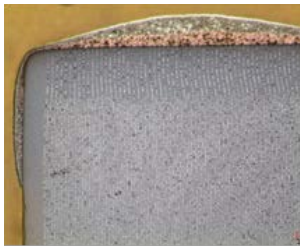
METKON MICRADEPTH-A is another tool like MICRADEPTH, but it has additional angle adjustment feature, which make possible to remove material from sample with a specific angle.

Both **MICRADEPH** and **MICRADEPTH-A** tools can be used for manual controlled material removal and can also be fit inside the sample holder for semi-automatic grinding/polishing on a grinding/polishing machine like FORCIPOL 102/202 or ACCURA 102.









APLLICATION REQUIREMENTS

MICRACUT 200-S

	Order	Description
Equipment Used	16 07	MICRACUT 200-S
Attachment	GR 0215 GR 0216 GR 0222 GR 0223 GR 0434	Fixed Cutting Table Attachment Movable Cutting Table Attachment Parallel slicing tool for Movable/Fixed Cutting Table Vertical clamping fixture for Movable Cutting Table Specimen vise for round cylindrical specimens
Cutting fluid	19 905	METCOOL II 1lt.
Cutting disc	19 150	DIMOS ø150 mm.
Grinding wheel	19 156	Ø 175 Diamond cup grinding wheel, 35 mic

EPOCOLD Cold Mounting Set

	Order	Description
Consumable Used	29-505 29-506	EPOCOLD R Resin EPOCOLD H Hardener
Attachment	29-551 29-552 29-545	Spatulas Mixing Beakers Special embedding form for mounts with flange, Ø40 mm

MICRADEPTH & MICRADEPTH-A

	Order	Description
Consumable Used	34 01 34 02	MICRADEPTH MICRADEPTH-A
Attachment	34 12	Special insert for cross grinding of unmounted samples

ACCURA 102

	Order	Description
Equipment Used	45 00-300	ACCURA 102
Attachment	31 52 31 75 39-003-300 39-093-300 39-083-300	Aluminum Disc, 300mm. Splash Guard, 300mm. Ø300mm, Special Magnetic Foil Ø300mm, Thin Metal Plate (5pcs) Ø300 mm, Catchy Fix Plate (1 pcs)
Cutting fluid	34 09	Individual force specimen holder for 3 pcs of MICRADEPTH/ MICRADEPTH-A tools

Using MICRACUT 200-S for Electronics & Semiconductors Sample Preparation

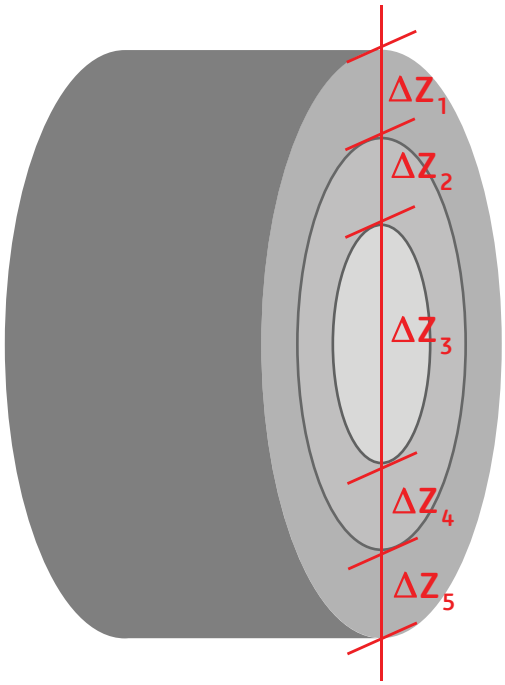
MICRACUT 200-S is the perfect solution for electronics and semiconductor sample preparation. It has semi-automatic grinding capability for precise material removal from electronics and semiconductor samples. Angle grinding is also possible with optional angle cutting arm for MICRACUT 200-S. Electronic micrometers allows precise sample positioning in X-axis with 5µm accuracy. Thus, inspection area can be revealed very precisely.

Once inspection area is revealed, the sample is transferred on a grinding/polishing machine for fine polishing.
Total operation time is significantly reduced if MICRACUT 200-S is used.

The optional cutting table attachments can also be mounted on MICRACUT 200-S. Thus, the electronic components can be easily and quickly removed from the PCB boards by cutting it on MICRACUT 200-S.

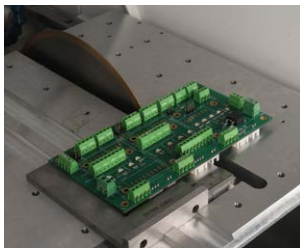
Many electronic or semi-conductor samples consist of different layers with different materials like glass, plastic, metals, ceramics etc. It is very important to use correct cutting parameters according to material type in order to prevent structural damages. But, cutting without any deformation is a real problem on this kind of multi-layer samples.

MICRACUT 200-S brings an innovative solution for deformation-free cutting of samples. This solution is called "Hybrid Cutting" feature, which allows to set different cutting parameters on different zones of sample in the same cutting operation.

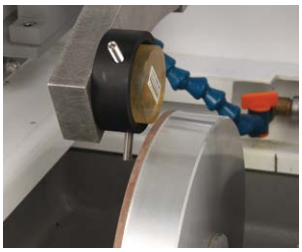


Hybrid Cutting Feature

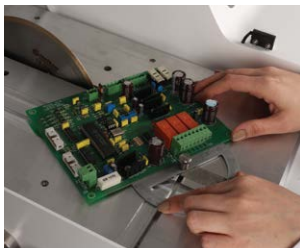
Movable Table Attachment



Fixed or movable cutting table attachments to cut extra flat specimens, sheet metals & PCB's



Precise Grinding



Fixed Table Attachment

STEP BY STEP SAMPLE PREPARATION FOR MICROELECTRONICS

This section will guide you how to prepare microelectronics samples correctly. Follow below steps to prepare perfect microelectronics samples.

STEP-1: Precision Sectioning

The first step is sectioning. The goal of sectioning is to obtain small piece of sample from big specimens. Any type of electronic components including silicon wafer, chip based components, electronic components or printed circuit boards (PCB), can be cut on Metkon MICRACUT series of precision cutting machines.

PCB's

Electronics Components

Sectioning

MICRACUT 152

Manual PCB Cutting
Manual Component Cutting

MICRACUT 200-S

Manual PCB Cutting
Automatic Component Cutting

MICRACUT 202

Automatic PCB Cutting
Automatic Component Cutting

A. MICRACUT 200-S Fixed Cutting Table

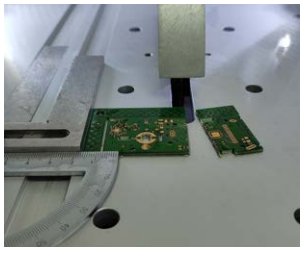
Fixed cutting table can be easily mounted on the MICRACUT 200-S. Extra flat specimens and PCBs can be easily cut by hand on this table.

B. MICRACUT 200-S Movable Cutting Table

Movable cutting table can be easily mounted on the MICRACUT 200-S, just like the fixed cutting table. Specimens can be attached to the table with a simple fixture apparatus, so precise cutting can be performed without the need to hold the specimen by hand and without the risk of the specimen moving during cutting.

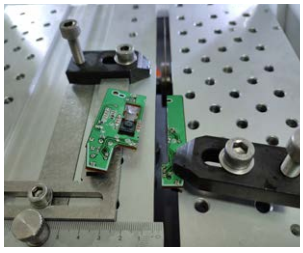
Cutting Parameters	
RPM	3000 r/min.
Force	5.0 A

Fixed Cutting Table



Fixed Cutting Table

Movable Cutting Table



Movable Cutting Table

STEP-2: Cold Mounting

After sectioning operation, the next step is mounting the sample. Mounting is done with special embedding forms that has special flanges. This flange provides easier and more precise fixation for the next steps. Epoxy or acyrilic cold mounting components can be used for embedding the sample.

STEP-3: Precision Grinding

After mounting operation, the next step is to reveal interested inspection area. This can be done with precise grinding. If inspection area is at very deep from the sample edge, in this case cutting method can be used to reduce the total grinding depth.

The precision grinding can be done in two ways:
1. Grinding on MICRACUT 200-S
2. Grinding on FORCIPOL or ACCURA using MICRADEPTH.

If MICRACUT 200-S is choosen for grinding operation, the mounted sample should be fixed in a specimen vise (GR 0434).

In order to measure grinding depth precisely, it is recommended to use a Special Measurement Stand(34 20). Set the micrometer of the Measurement Stand to zero by placing the mounted sample with specimen wise together under the micrometer. Then continue the grinding operation on MICRACUT 200-S. After the target material removal rate is reached, verify the total grinding depth on the Measurement Stand. It is also recommended to check if inspection area is visible under the microscope. If removal rate is not enough, continue operation on MICRACUT 200-S.

Mounted samples grinded on MICRACUT 200-S by the help of Programmable automatic precision grinding software.

Before Grinding Operation

After Grinding Operation

If MICRADEPTH or MICRADEPTH-A is choosen for grinding operation, directly fix the mounted sample inside the MICRADEPTH. Set the wear-resistant ring same level with the sample. Set the desired removal depth on the MICRADEPTH.
(If MICRADEPTH-A is used, also set the angle)

Precision Grinding Parameters	
Feed rate	25000 µ/sec.
RPM	2500 r/min.
Travel	60 mm.
Force	5 A.
Slice	40 cycle – 0,05 mm. – 20 steps

Mounting Parameters	
Resin	5 part
Hardener	1 part
Mixing Time	About 2 min.
Curing Time	About 6-8 hours.

Continue the grinding operation on grinding/polishing machine (FORCIPOL 102/202 or ACCURA 102) until the desired material is removed from the mounted sample. Grinding operation can be done manually by hand or automatically by using an automatic head (FORCIMAT 52/102 or ACCURA 102 Head). If automatic operation is choosen, up to three specimens can be prepared at the same time.

After grinding operation is completed, verify the removal depth on the Special Measurement Stand. It is also recommended to check if inspection area is visible under the microscope. If removal rate is not enough, continue the grinding operation until the desired removal rate is reached

STEP-4: Polishing

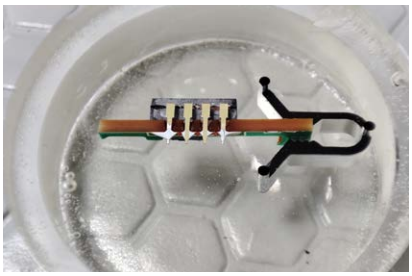
After interested inspection area becomes visible, the surface needs to be polished for microscopic inspection. Since material removal rate very low on polishin operation no need to use MICRADEPTH tool for this step. The mounted sample (or special insert for cross grinding) can be directly polished on the Grinding/Polishing machine. Both manual polishing operation or automatic operation can be preferred. For the most precise, fastest and easiest sample preparation, **MICRACUT 200-S + MICRADEPTH + ACCURA 102** combination is recommended microelectronics sample preparation.

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	DEMPAX-F 38-050-1200F	1200 Grit SiC	Water	15 N	90 sec.	250 CW	100 CW
Grind. Step 2	DEMPAX-F 38-050-2500F	2500 Grit SiC	Water	15 N	90 sec.	250 CW	100 CW
Final Grinding	WOOL 39-095-300	DIAPAT-P 3µ 39-420-P	Water	15 N	3 min.	150 CCW	75 CW
Polishing Step 1	FEDO-1M 39-067-300	DIAPAT-P 1µ 39-410-P	DIAPAT [39-502]	15 N	5 min.	150 CCW	50 CW
Final Polishing	COLLO 39-085-300	Colloidal Silica	COL-K(NC) [39-502]	15 N	4 min.	100 CCW	50 CW

A. POLISHING OPERATION OF MOUNTED SAMPLE

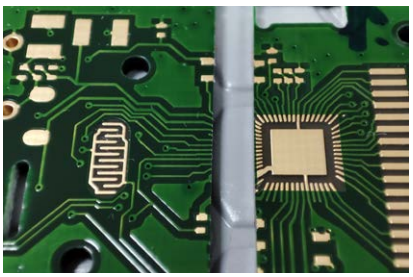
Grinding and polishing depth is adjust by the help of movable ruler on MICRADEPTH. In this way, investigation area is protected from excessive grinding.

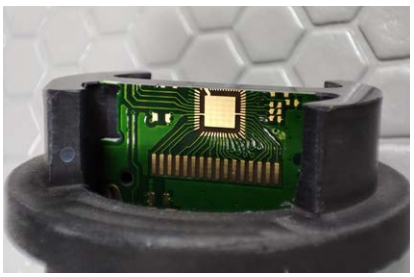
Sample is placed to MICRADEPTH and polished on ACCURA 102.

B. POLISHING OPERATION OF UNMOUNTED SAMPLE

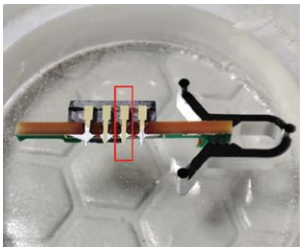
Alternatively, sample can directly be sticked on a special insert for cross grinding. This provides easier observation of interested inspection area by an optical microscope or X-ray investigation for hidden layers. Unmounted sample was fixed with glue to cross section polishing attachment and placed to the MICRADEPTH-A.



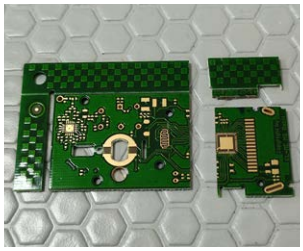
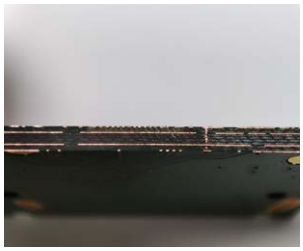
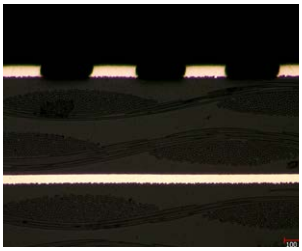


STEP-5: Microscopic Inspection

After polishing step, the sample is ready for microscopic inspection.



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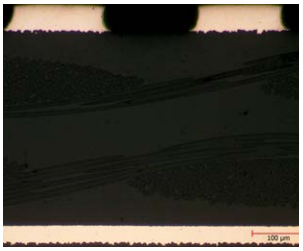
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Technology behind Specimen

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