Specifications

Ion accelerating voltage		2 to 8 kV
Ion beam diameter		500 μm (full width at half maximum)
Milling speed		500 μm/h (Average over 2 hours, with accelerating voltage 8 kV, Si equivalent, edge distance 100 μm)
Specimen swing function		During milling, automatic specimen swing of ± 30° (Patent No. 4557130)
Intermittent mode		Included
Finishing mode		Included
Maximum specimen size		11 mm (W) × 10 mm (L) × 2 mm (T)
Specimen movement range		X-axis ± 10 mm, Y-axis ± 3 mm
Specimen rotation angle adjustment range		± 5°
Operation		Touch panel, 6.5-inch display
Positioning for milling		Monitor from above the specimen stage with a CCD camera
Positioning camera		Approx. ×70 (On the 6.5-inch display)
Monitoring camera ※1		Approx. ×20 to ×100 (On the 6.5-inch display)(IB-19510CP)
Preset function		4 sets of milling conditions (accelerating voltage, Ar gas flow, milling time, intermittent milling)
Gas for ion		Argon gas
Gas flow control		Mass flow controller
Pressure measurement		Penning gauge
Evacuation devices		Turbo molecular pump, Rotary pump
Dimensions and masses	Basic unit	545 mm(w) × 550 mm(d) × 420 mm(h)
		Approx. 64 kg(IB-19500CP), Approx. 66 kg(IB-19510CP)
	Rotary pump	150 mm(w) × 427 mm(d) × 230 mm(h)、approx.16 kg

Installation requirements

Power supply	Single phase AC100 . 120 V, 50/60 Hz, 0.5 . 0.6 kV, Permissible input voltage fluctuation less than 10%
Grounding	D class grounding (100 Ω or less)
Argon gas ※2	Dry argon, 99.9999% or more purity
	Pressure: 0.1 to 0.2 MPa (1.0 to 2.0 kg/cm^2)
	Hose joint: JIS B 0203 Rc 1/4
Room temperature	15 to 25 ℃
Room humidity	60 % or less (no condensation)

※1 The IB-19510CP has a built-in camera for monitoring the specimen in real-time. The status of the specimen can be observed while milling is in progress.

※2 The argon gas, gas cylinders and regulator must be prepared by the customer.

Handle materials susceptible to that react to air

Cooling Cross Section Polisher IB-19520CCP

This is a cross section polisher with the added functions of specimen cooling and isolation from the atmosphere.

This is an ideal device for preparing cross sections for SEM of low melting point metals, like solder, which is susceptible to thermal deformation during milling; low glass transition point materials like resins; and materials that react to air, like battery materials.

※ The screen images in the catalog include items that are still under development, and are subject to change without notice.

※ The specifications and appearance of the instrument are subject to change without notice.

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JEOL Ltd.

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No.1201C511C (Kp)

Scientific/Metrology Instruments
Cross Section Polisher

Solutions for Innovation

IB-19500CP/IB-19510CP

Cross Section Polisher

High Throughput & High Quality

JEOL Ltd.

Cross Section Polisher™ (CP)

IB-19500CP/IB-19510CP

- Create clean cross-sections with minimal damage from soft materials, hard materials, brittle materials or even combinations
- Clean, quality cross-sections, with less operator variation compared to the conventional mechanical polisher
- Touch panel provides easy set-up and operation

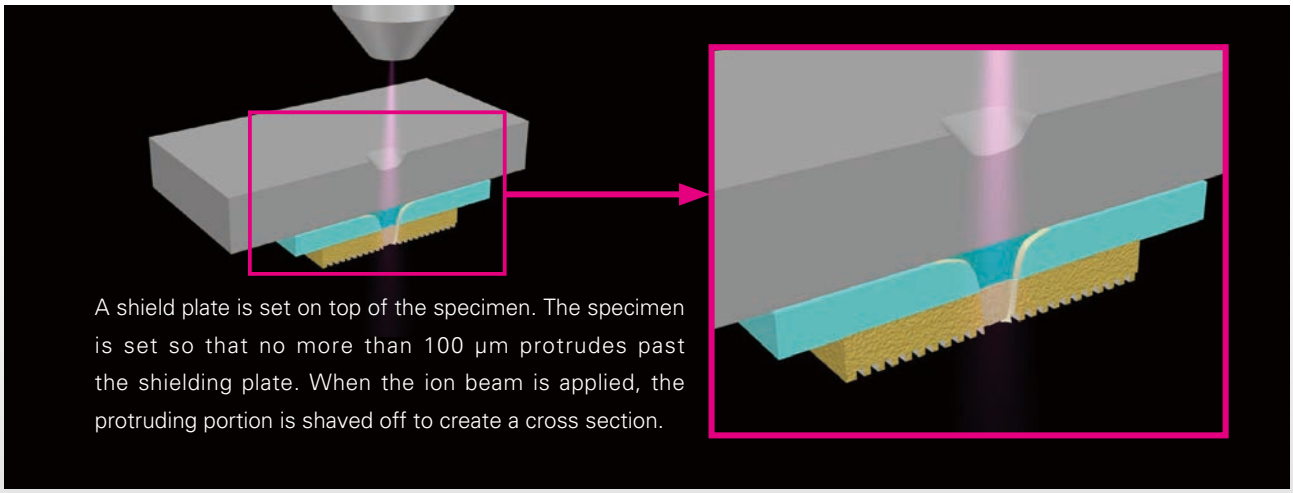
New Functions

- Improved throughput with the high-speed ion source and Quick-Start function
- Reduced thermal damage with intermittent milling mode
- Prepare high-quality cross-sections using finishing mode
- High quality carbon coating is also possible (option)

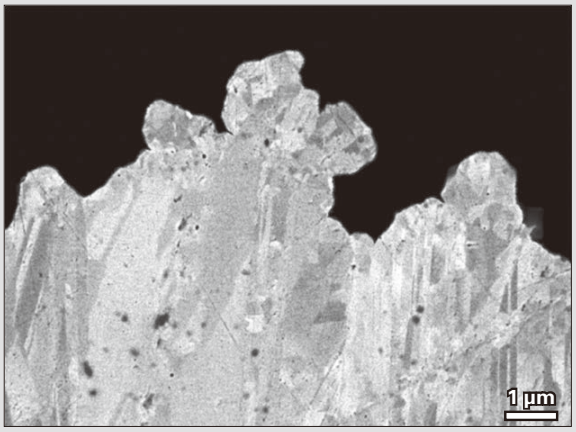
Principles of cross-section preparation using CP

This is a device for creating cross-section slices of sample materials by setting a shield plate on top of the specimen in the Cross Section Polisher, and applying the wide argon ion beam, so that the portions left uncovered by the shielding plate are milled It is possible to prepare quality cross-sections from a wide range of materials (composite materials and laminar materials).

Patent: No. 4557130 Patent related to rocking function

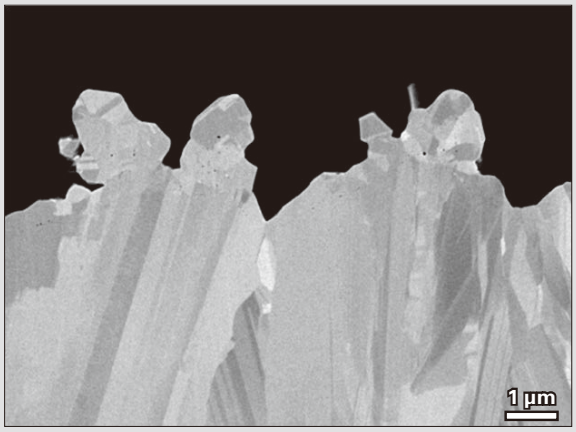


Comparison and mechanical polishing and CP milling



Cross-section created using mechanical polishing

Skill and experience is required to create smooth cross sections of soft metals like copper or gold. The image above is a backscattered electron image of mechanically-polished copper. The channeling contrast is not clearly visible, and the crystal grains have been damaged during the mechanical polishing.



Cross-section made using CP

A smooth cross section with minimal damage to the sample can be made using the argon ion beam. It is also possible to clearly observe the channeling contrast due to the different crystal orientations.

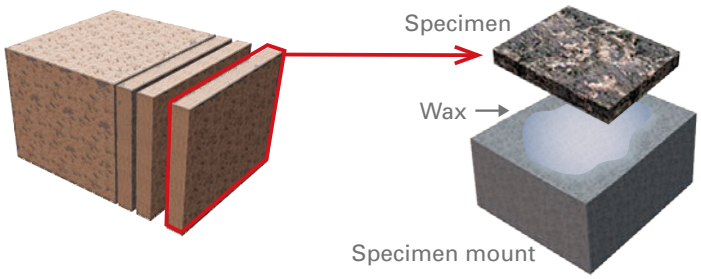
Sample: Copper

CP Work Process

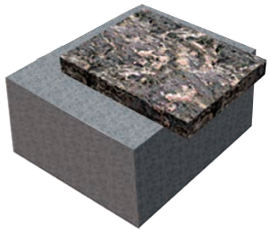
High quality cross sections can be created with

1 Cutting a piece of material for the specimen

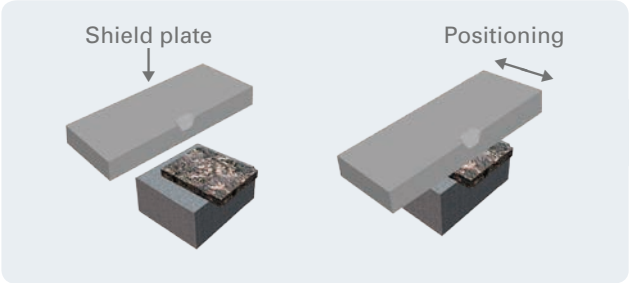
The material is cut using a diamond cutter or similar tool to obtain a piece that can fit onto the specimen mount.



・Wax is used to attach the specimen to the specimen mount.

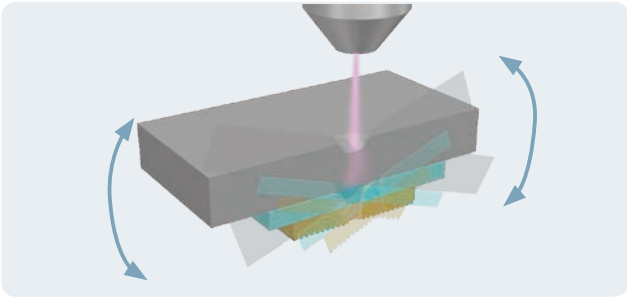


2 Mounting the specimen and aligning the milling position



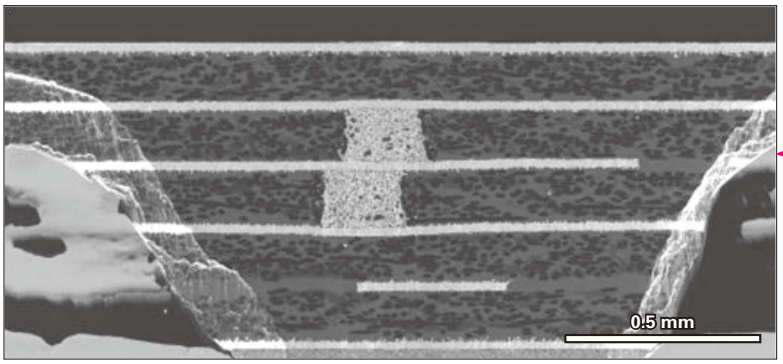
Setting the shield plate　　Positioning

3 Surface milling with the ion beam



Since the specimen is rocked while the ion beam is irradiated, a good quality cross section is obtained　※ Patent No. 4557130

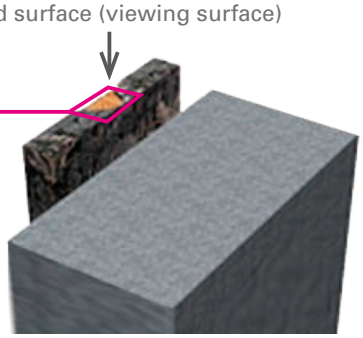
4 SEM observation



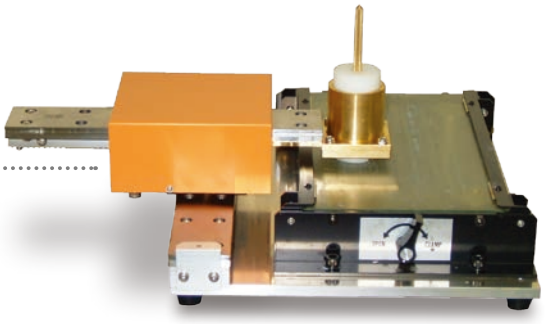
A large cross section area can be obtained.

Specimen: SEM image of a cross section of a printed circuit board

Milled surface (viewing surface)

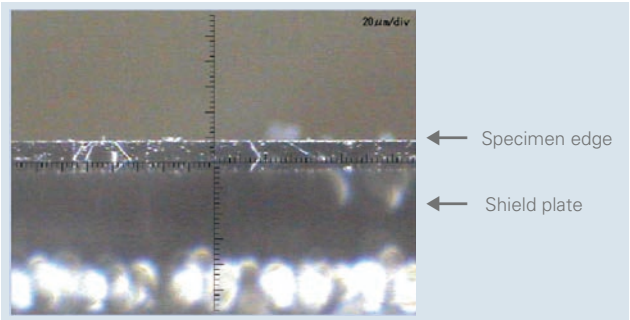


simple pre-processing and operation.



Handy Lap

After making a slice of the material with a diamond cutter, it is convenient to trim the edge as needed (mechanical polisher), and adjust the size of the specimen.



Enlarged image of the specimen edge using the CCD camera.

The position of the shield plate can be adjusted using the monitor image from the CCD camera.

Example operation screen

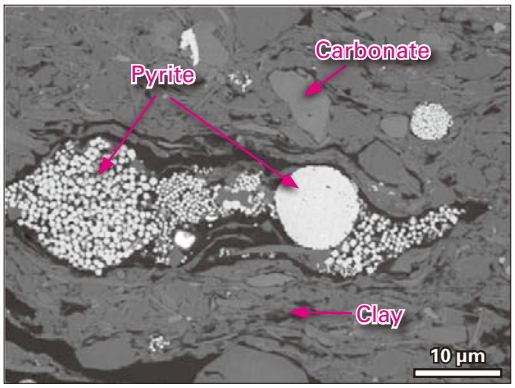
Set the ion gun voltage and etching time from the touch panel.
When the Start icon is touched, after vacuum evacuation is completed, the etching will start automatically.

With the IB-19510CP the milling process can be monitored in real-time with the CCD camera.

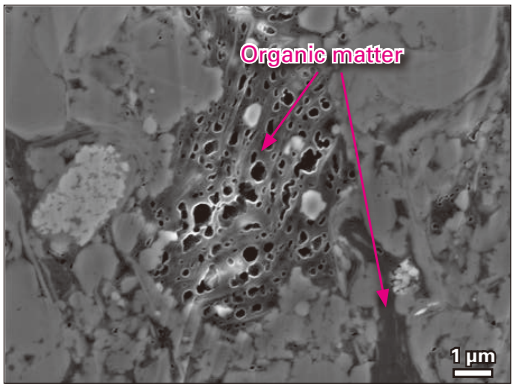
Soft Materials It is possible to prepare perfect, mirror-finished cross sections from soft

Kerogen-rich Oil Shale

Oil shale crumbles easily under mechanical polishing, and it is a difficult material for making cross sections. With the CP, however, such cross sections can be prepared. As a result, it is possible to observe the internal structures of organic matter in addition to those of carbides, silicates and pyrite.



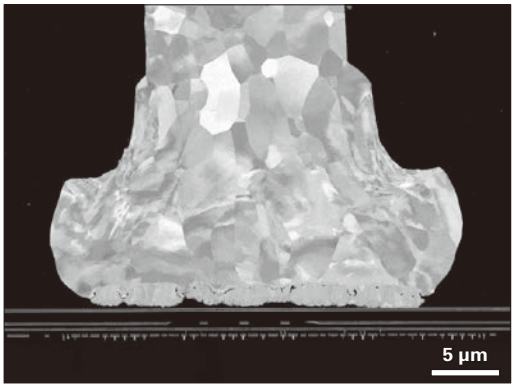
Backscattered electron image



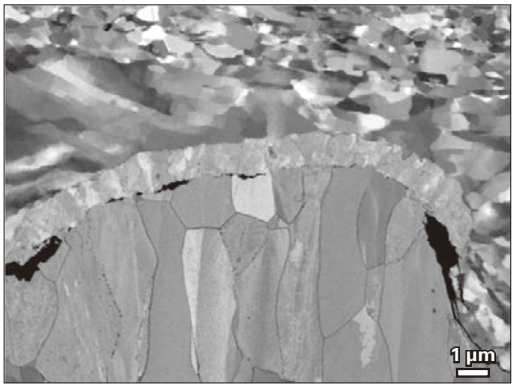
Backscattered electron image

Gold wire bonding

With the mechanical polishing that has been widely used in the past, it is difficult to prepare cross section from soft metals like gold. CP milling makes it possible to obtain good quality cross sections. The milling can be performed to preserve the voids in the bonding connection portions as well.



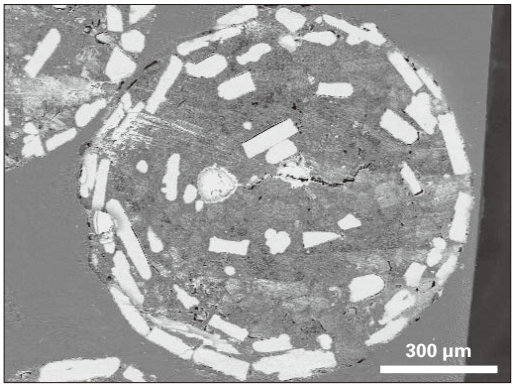
Backscattered electron image



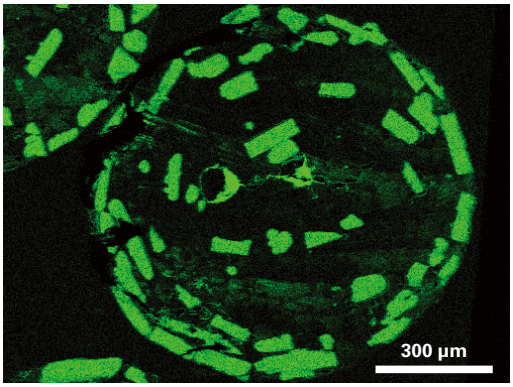
Backscattered electron image

Foaming agent

A foaming agent is a material that generates a gas when mixed with water. It is extremely difficult to obtain good crass sections using conventional mechanical polishing. With CP, quality cross sections can be fabricated. This image shows the Na element distribution.



Backscattered electron image

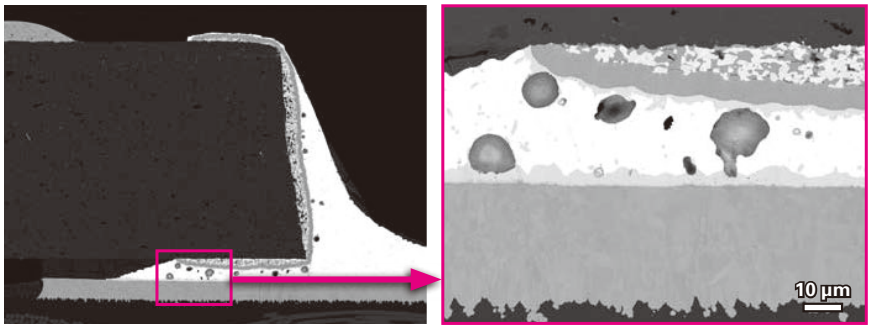


Na element map

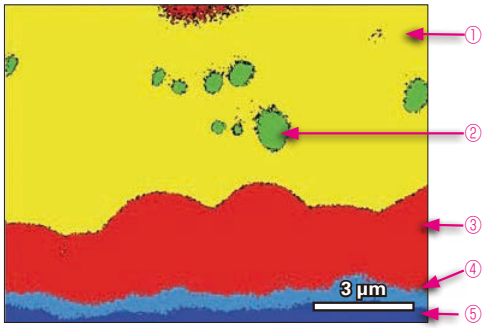
materials, like copper, aluminum, gold, solder, and polymers, a difficult task with conventional polishing

Lead-free solder

Cross section of a substrate onto which electronic components are mounted. The CP has a comparatively large milling area (argon ion beam half width: approx. 500 μm), allowing a wide area to be processed. The images below show the cross sections of soft materials, like tin, copper and silver, and an element mapping result.



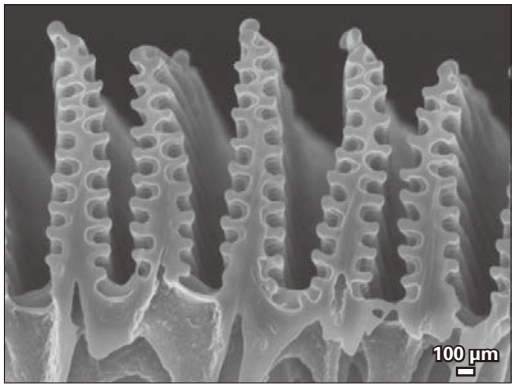
Backscattered electron image



EDS map
① Sn ② Ag ③、④ Sn / Cu reaction phase ⑤ Cu

Butterfly

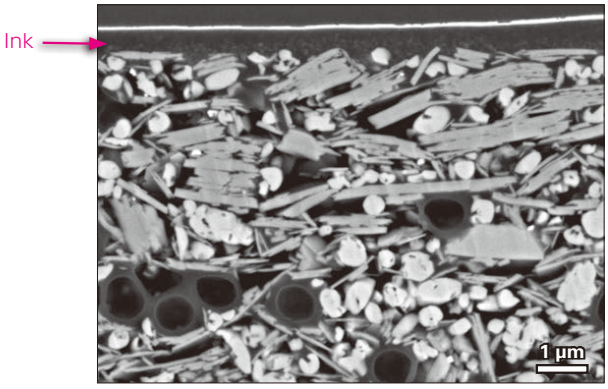
Cross section of a scale from the wing of a Morpho butterfly. Milling was performed without any protective film applied so that the native surface of the scales can be observed.



Secondary electron image

Paper

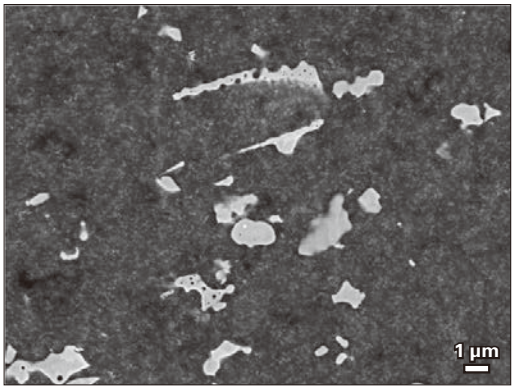
An example of a cross section of paper. It is possible to see the distribution of the clay, calcium carbonate and pigments. It is also possible to observe the thin ink layer on the surface.



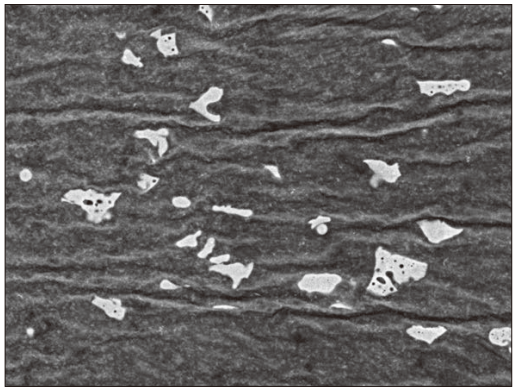
Backscattered electron image

Urethane rubber

Cross section of urethane rubber, a material susceptible to thermal damage.
By placing a protective material between the specimen and the shield plate, thermal damage is suppressed during milling. (Patent No. 4922632)



Cross section with a protective material



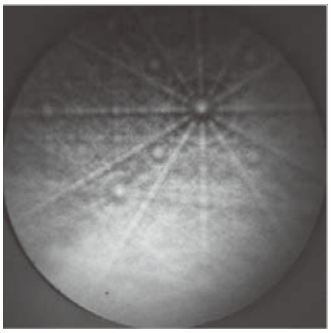
Cross section using a conventional method

Hard Materials

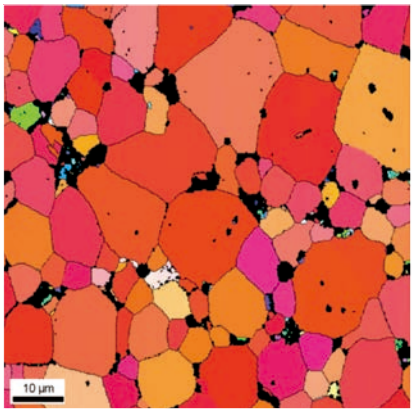
Create cross sections of hard materials, like ceramics and glass, or

Crystallography of magnetic material

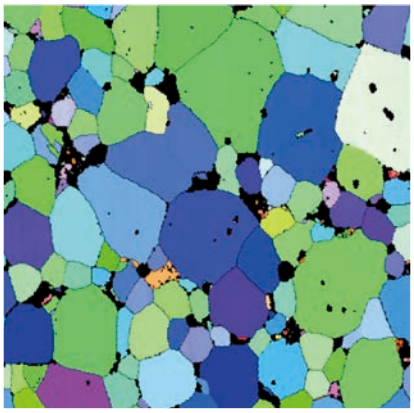
A neodymium magnet is a high-tech material that is used in the motors of hybrid vehicles. The images below show the results of EBSD measurements of a cross section of a neodymium magnet prepared with CP.



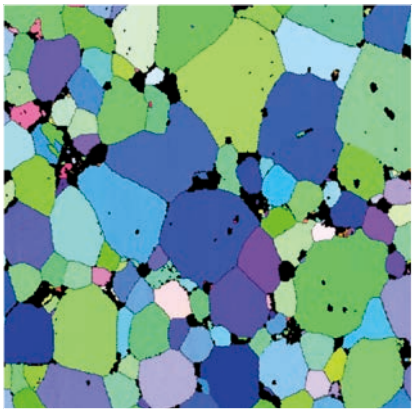
EBSD pattern of NdFeB



IPF Map (ND)

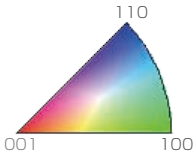


IPF Map (TD)



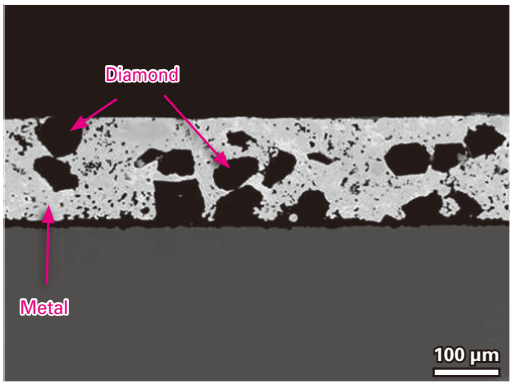
IPF Map (RD)

Analysis points: 118585, Phases: Nd2Fe14B
Dimensions: X Max: 80.00 microns,
Y Max: 79.89 microns,
Step: 0.25 microns

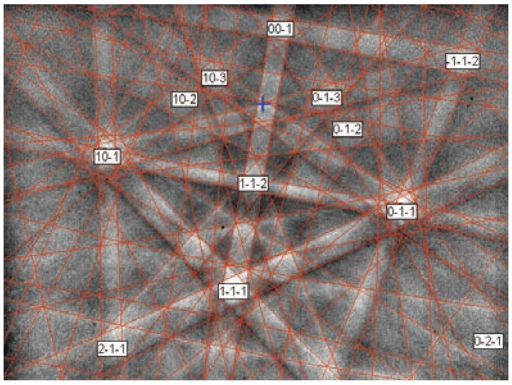


Diamond blade

Cross section of the diamond layers of the diamond cutter.
Even for diamond embedded in a relatively softer metal a smooth cross section can be made.



Backscattered electron image



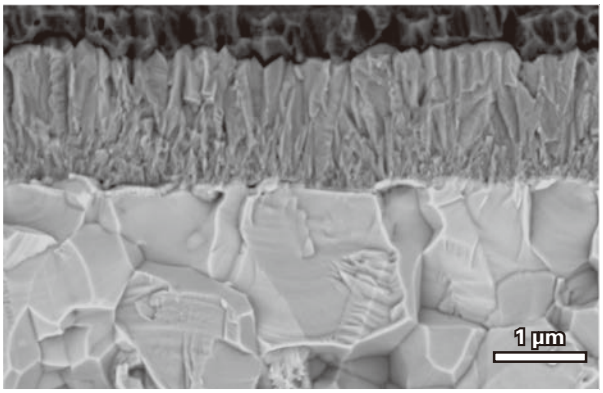
EBSD pattern of diamond

even using samples that are a combination of hard and soft materialstask with conventional polishing

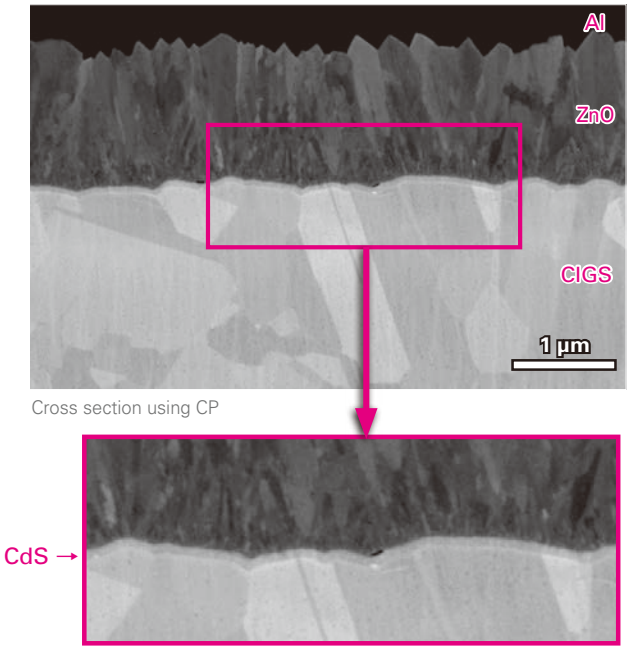
Thin film and interface of solar panel (cross section)

The specimen courtesy of
Yamada Laboratory Tokyo Institute of Technologya

The backscattered electron image observation results of the fractured cross section and the CP cross-section of solar cells are shown. In the fractured surface the cleaved surface with unevenness along the grain boundaries is clearly seen.
In contrast, a smoother cross section can be obtained by using the CP. For this reason, it is possible to observe the contrast due to differences in the composition of the CdS layer that exists between the ZnO and CIGS, which could not be seen in the fractured surface. Moreover, the channeling contrast due to differences in crystal orientation can also be clearly seen.



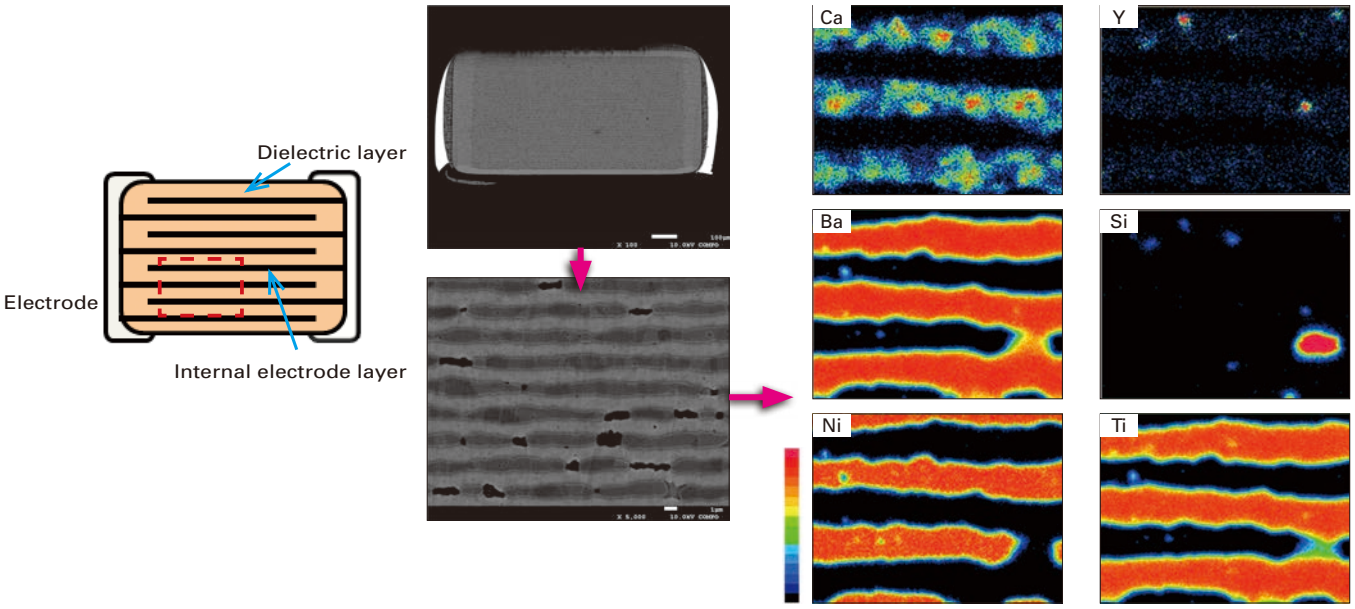
Fractured cross section



Cross section using CP

EPMA analysis of cross section of a multi-layer chip capacitor

EPMA analysis was made on the principal and trace components of a highly-integrated multilayer chip capacitors using a CP processed cross-section. The distribution of Si, Ca, and Y, which is added in small amounts to the dielectric layer, can be analyzed with EPMA.



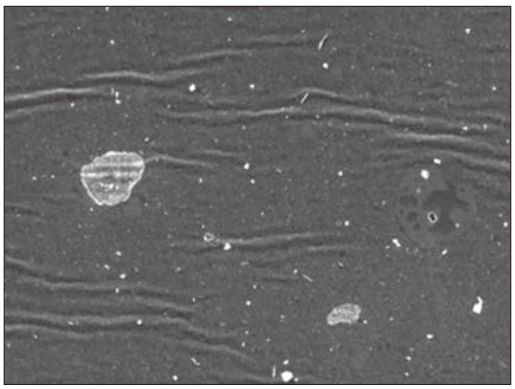
Milling Modes

Intermittent mode

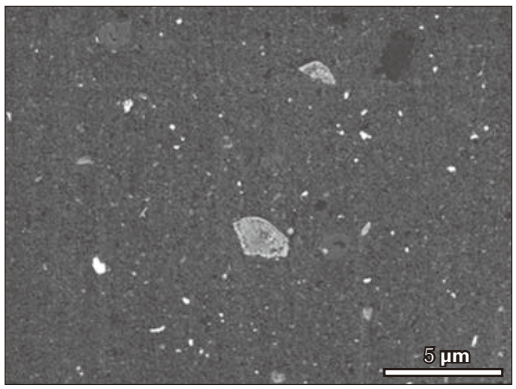
This is a mode to minimize the heat that is generated by the milling with the ion beam.
Setting times for repeatedly turning the ion beam On and Off allows the radiation dose per unit of time to be controlled, and suppresses heat generation.
For the intermittent milling, the temperature is determined by the repeated heating by the ion beam alternated with the natural heat dissipation. The saturation temperature is proportional to the (ion beam accelerating voltage) × (ion current irradiated onto the specimen).

Using the intermittent milling mode allows cross sections to be prepared while artifacts are suppressed.

Intermittent milling results (Sample: tire rubber)



No intermittent milling



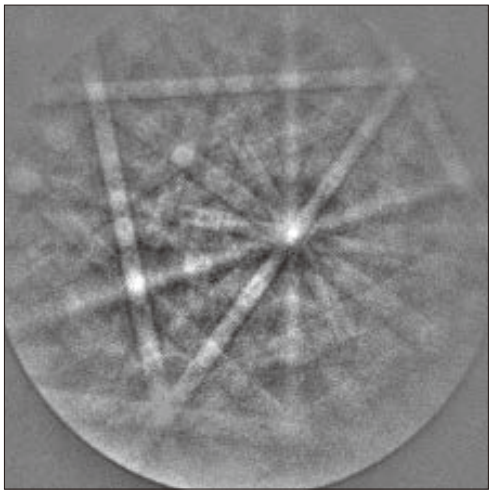
With intermittent milling

Finishing Mode

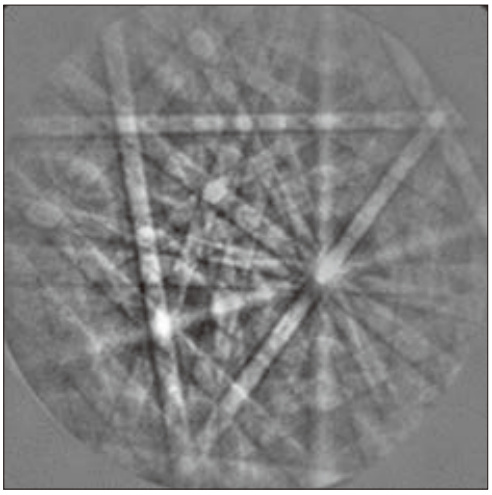
It is known that when a crystalline specimen is processed with an ion beam, there is decrystallization of the surface layers on the sample cross section. The thickness of the decrystallized layer becomes thicker as the acceleration voltage becomes higher.
Finishing mode is a method for obtaining high-quality cross sections with very thin decrystallized layers in a short period of time, by combining high-speed milling at high acceleration voltage with the a finishing milling at a low acceleration voltage.

The finishing mode makes it possible to obtain vivid channeling contrast, with minimal damage to the layers at the surface.

Finishing milling results (Sample: Polysilicon)



No finishing



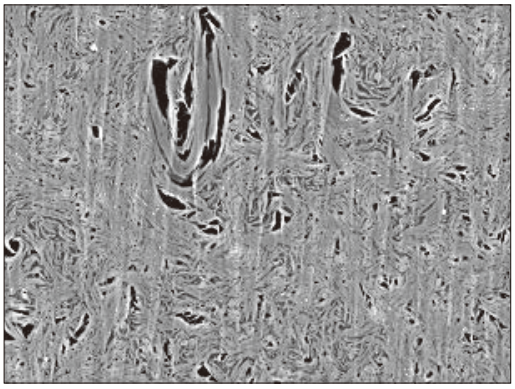
With finishing

OPTIONS

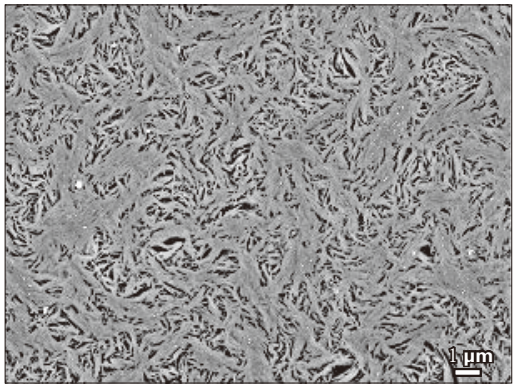
Specimen rotating holder (IB-09520SRH)

The specimen rotating holder further enhances the effect of the specimen swing function.
Performing the milling while rotating a cylindrical sample stage to match the motion of the shield plate, is a way to reduce the milling marks that depend on the processing direction to produce smooth cross-sections.

Comparison of specimens with many voids (Sample: Lead for a mechanical pencil)



Cross section processed with the shield plate method



Cross section processed with the rotating holder

Large specimen holder (IB-09530LSH)

The large specimen holder can hold a specimen of up to 20 mm (width)×12 mm (length) × 5 mm (thickness).

High-precision positioning CCD camera (IB-09540CCD)

The camera enables you to observe the position of the sample and the shield plate at high magnification.
You can check the positions of the sample and the shield plate at magnifications from × 100 to ×1,000.

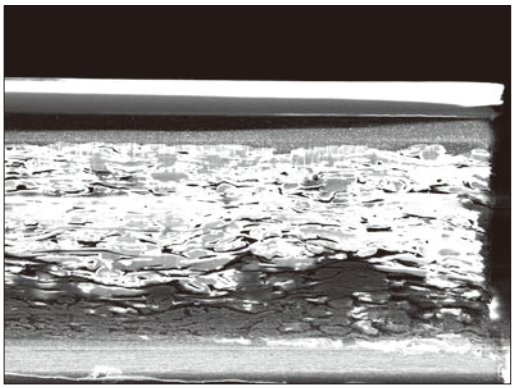
Carbon coating cassette (IB-12520CC)

Setting the carbon coating cassette into the CP makes it possible to create carbon coatings. Ion beam coating under a hard vacuum allows the observation and analysis of non-conductive samples. In addition, this device features a very low consumption of carbon.

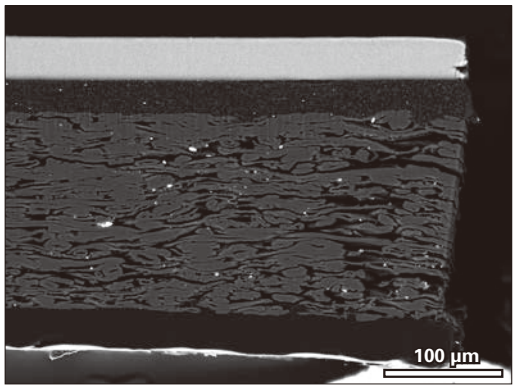
Main specifications

Ion beam sputtering, maximum coating range: 20 mm × 5 mm
Target: Carbon 25 mm diameter × 5 mm thickness
Cannot be mounted at the same time the shield plate is set

Carbon coating effect (Sample: coated paper)



Before coating



After coating