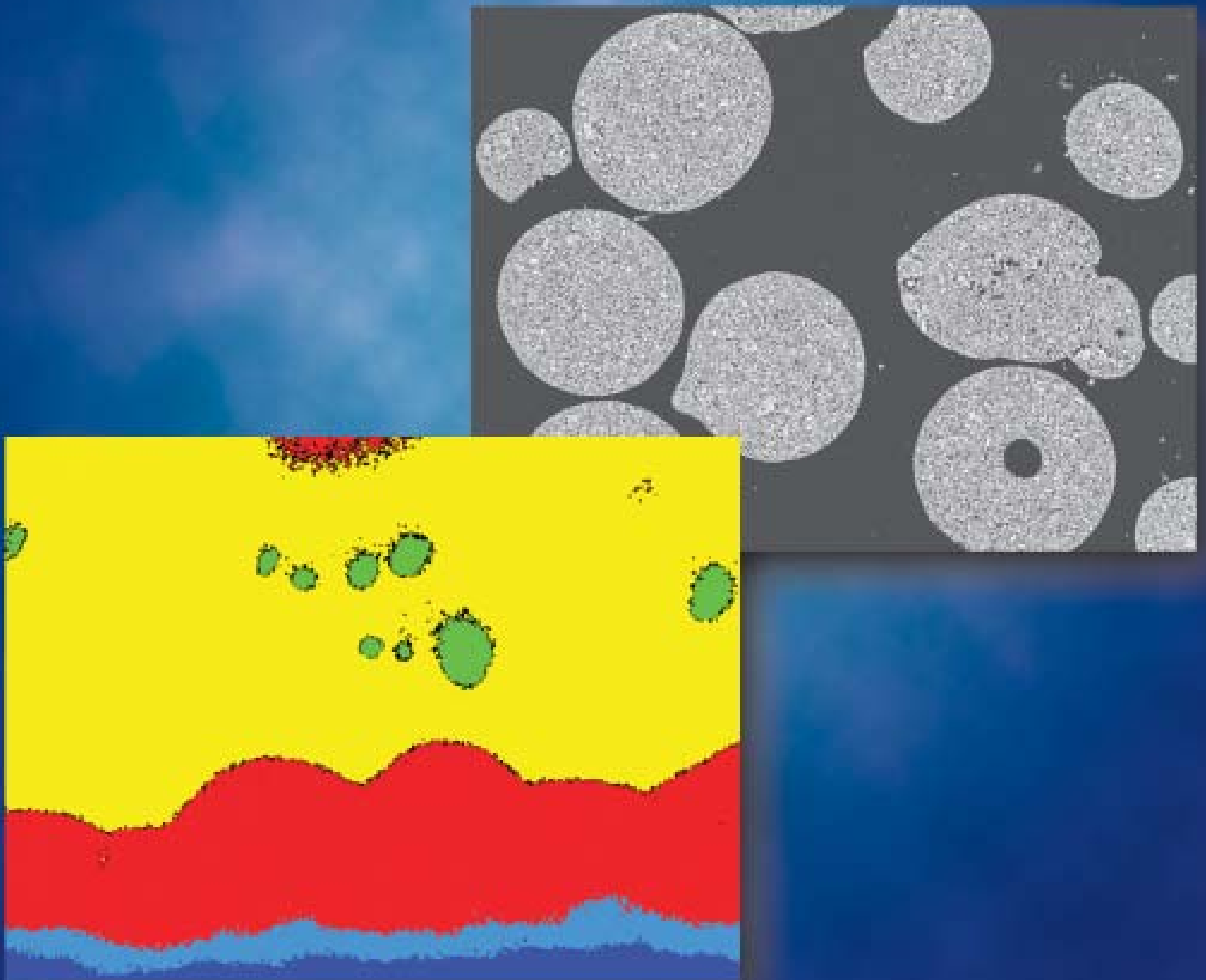
Clean Cross Section Preparation

Cross Section Polisher

SM-09010



JEOL
Serving Advanced Technology

Innovative Tool Filled with Patented Ur
JEOL Application Specialists.
The Cross Section Polisher (CP)

A cross section at 90 degrees to the surface of a specimen (JEOL patent)

The cross section polisher (CP), which is supported by the patented technology developed by JEOL, makes a cross section perpendicular to the surface of a specimen. This is suitable for measurement of multi-layered structures.

Clean polished cross section of almost any material in simple steps

The CP can prepare a perfect cross section from almost any material such as;

- Difficult-to-polish soft materials such as copper, aluminum, gold, solder, and polymer,
- Difficult-to-cut hard materials such as ceramic and glass, and
- Composite of these materials.

The cross section prepared by the CP is suitable for EDS, WDS, Auger, and EBSD (Electron Back Scatter Diffraction) analysis, and for observation and measurement of multi-layered structures.

Preservation of internal structures

The CP preserves structures, which the conventional mechanical polish would destroy, such as voids in a bonded interface between gold wire and bonding pad. Adhesion between plated layers, or between solder and metal, can be observed and analyzed accurately. The perfect cross section is suitable for analysis of precipitates as well.

Compared with FIB

Damage to a specimen during polishing is much less compared to FIB preparation due to the use of an argon ion beam. The CP can make a large cross section surface with up to 1mm width.

No skill needed

Making a surface of soft materials by mechanical polish or a microtome requires many years of experience. The CP readily lets you make a perfect cross section after minimal practice.

Front cover image:

Top: Ceramic particles (refer to page 5), Bottom: Reaction layers of tin and copper (refer to page 6).

nique Technology Developed by

Preparation of a cross section -Simple procedure-

1 Cut out and trim a specimen:

The maximum specimen size for the CP is 11mm(W) x 10mm(D) x 2mm (H). A cutter such as ISOMET is a handy tool to cut out a specimen. Etching is done faster when a point of interest is closer to the edge of a specimen. Handy Lap made by JEOL is available to file out an excess portion from the edge.

ISOMET (Cutter) : option

2 Surface treatment

Heat fixing epoxy is applied to the surface of a specimen, if the surface is not flat.

3 Fixing a specimen on the specimen holder:

A specimen is fixed on the specimen holder with wax.

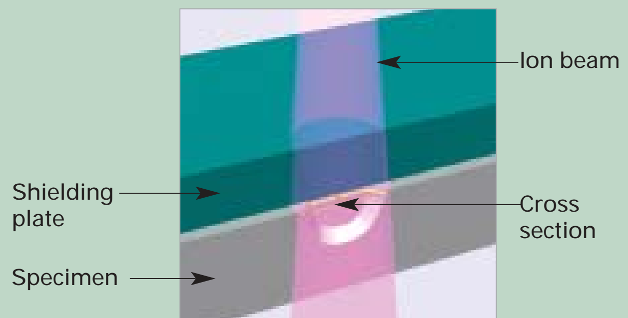
Handy Lap (Polisher) : option

4 Setting the etching condition after mounting the specimen in CP:

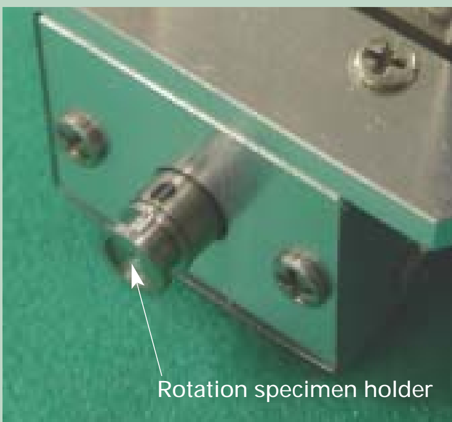
The voltage and current of ion beam, and etching time are set to the CP.

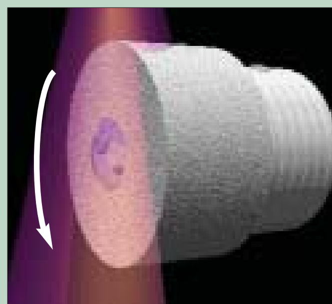
5 Etching:

The ion beam hits perpendicular to the surface of a specimen and makes a cross section perpendicular to the surface of a specimen. The ion beam is parallel to a cross section. The damage to a cross section caused by the ion etching is much less compared to the conventional ion etching method in which the ion beam hits the surface of etched surface.



Rotation specimen holder (option)





The rotation specimen holder is developed for preparation of a better cross section with fine powder, wire, or a composite of hard and soft materials. The small amount of specimen is mounted on the center of a rotation specimen holder with epoxy. The holder is then mounted on the rotation stage. The rotation specimen holder can also be used for finishing polish of a flat surface by bombarding the ion beam at a very low angle to the surface.

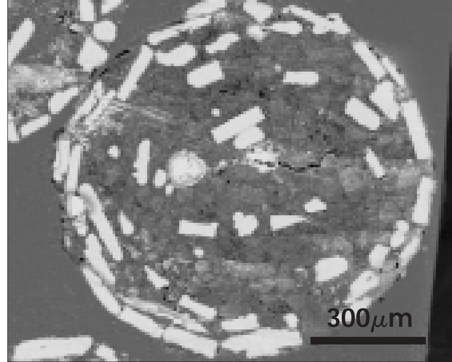
Magically Powerful Tool

– Jobs difficult with the conventional methods are done efficiently–

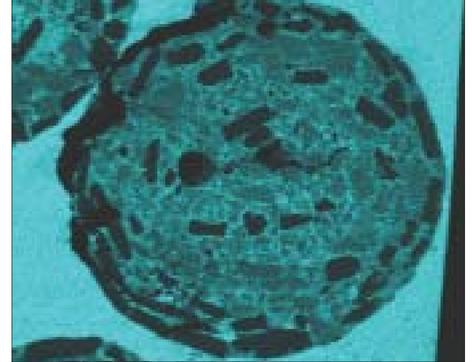
The CP assists SEM, EPMA, and Auger in improving the quality and accuracy of analysis.

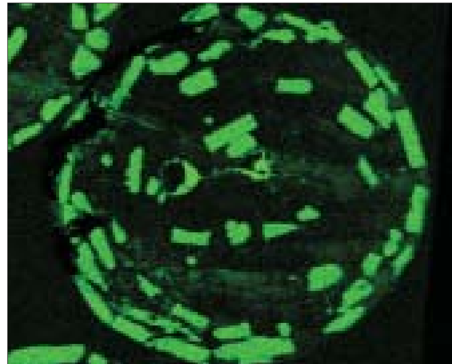
Application to SEM
Granular medicines

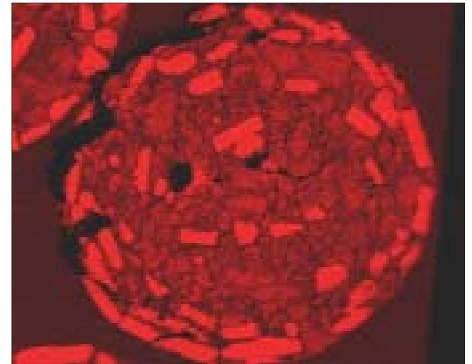
This is a cross section of medical material. It has been extremely difficult to prepare a good cross section since it is sensitive to heat. In this preparation, the distributions of two materials are clearly observed.



Backscattered electron image

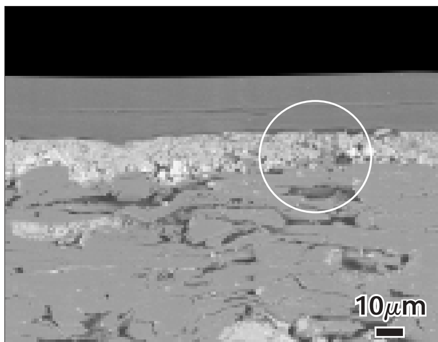

C (EDS)


Na (EDS)

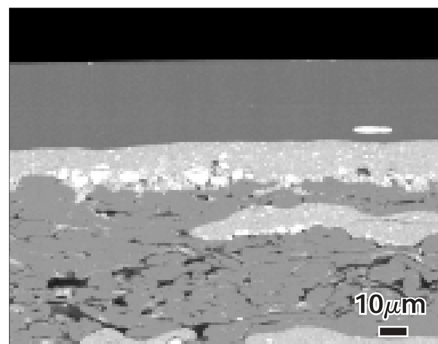

O (EDS)

Application to SEM
Paper

The cross section prepared with the CP shows very little damage as shown in this example (right).

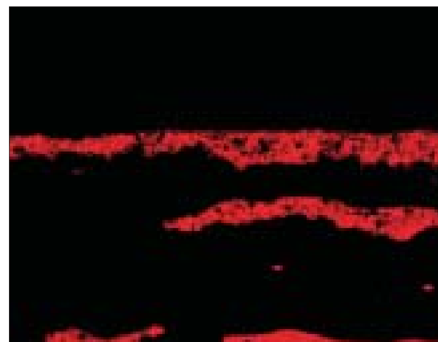


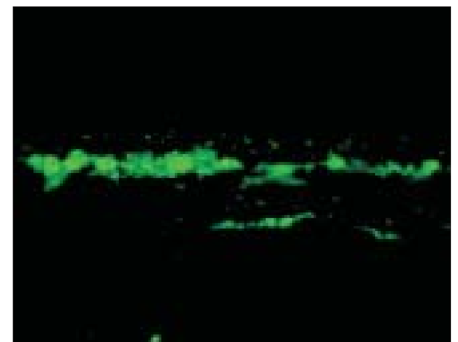
The cross section prepared with a razor edge often shows artifacts such as a loss of inorganic particles (shown in circle), or fibers being compressed.



Cross section by the CP
(Backscattered electron image)

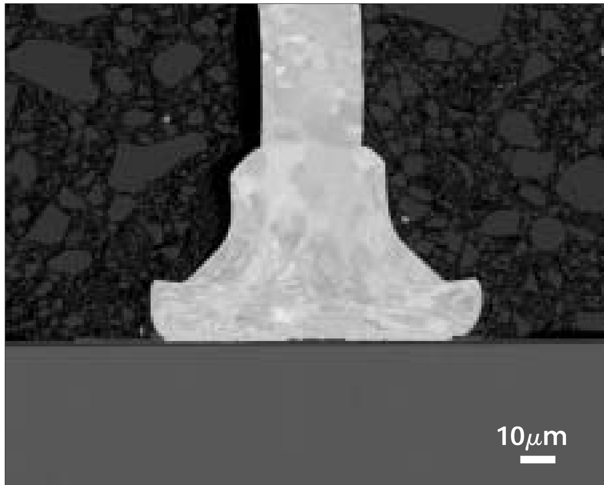
C (EDS)


Si (EDS)

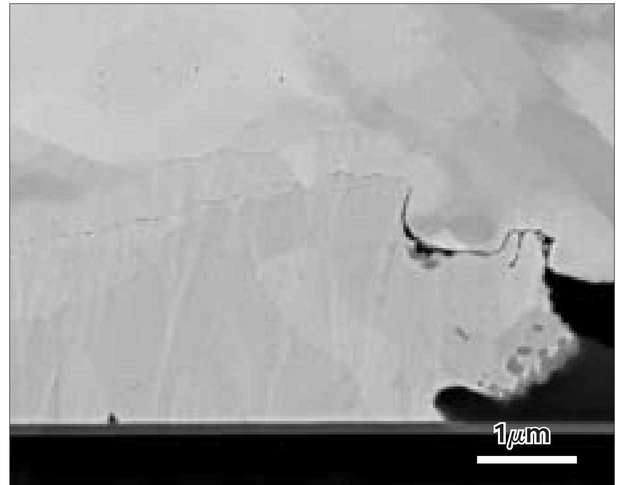

Ca (EDS)

Application to SEM
Gold wire bonding

The CP can prepare a cross section of soft materials such as gold with little damage. The CP is suitable for evaluation of voids in the boundary of bonded metals. The conventional mechanical polishing is known for difficulties such as these fine voids being smeared, polish grains being embedded in soft materials, separation of bonded materials, and residual polishing marks being left. The CP can solve these technical difficulties.



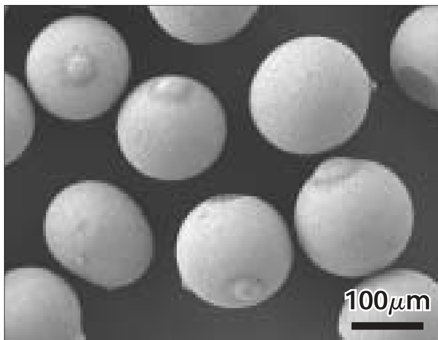
Backscattered electron image



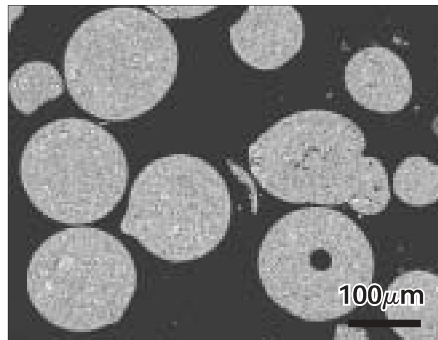
Backscattered electron image

Application to SEM
Ceramic particles

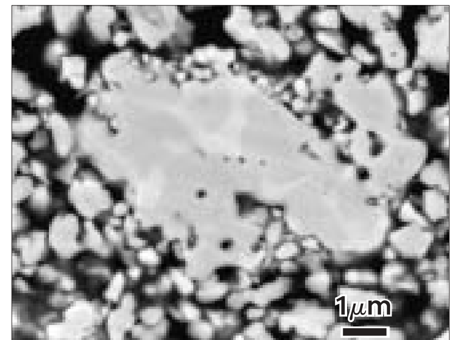
The CP can cut hard materials such as ceramic. The optional rotation specimen holder makes a smooth cross section of powder held with heat setting epoxy.



Surface (Secondary electron image)



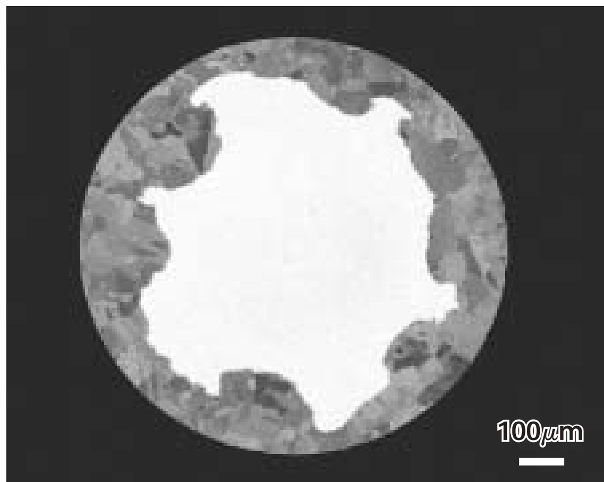
Cross section (Backscattered electron image)



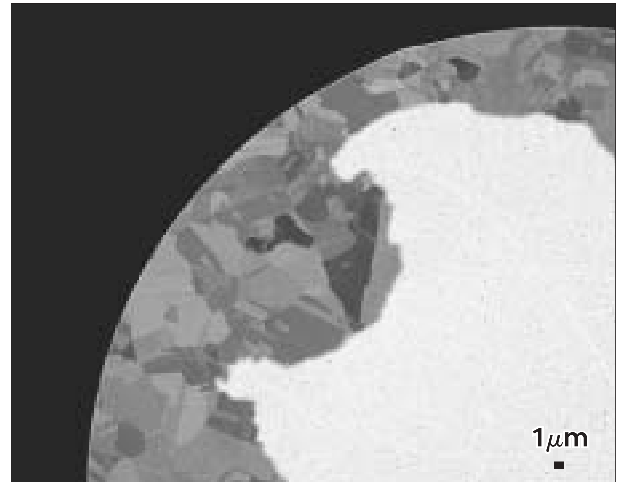
Cross section (Backscattered electron image)

Application to SEM
Super conductive wire

This is a cross section of super conductive wire. The difference between the peripheral and the central regions is clearly observed. The rotation specimen holder makes a smooth cross section of wire.



Backscattered electron image



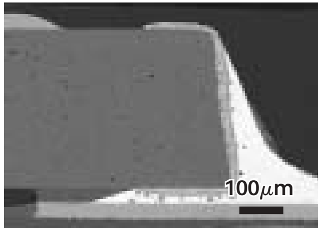
Backscattered electron image

The CP Makes Difference in Analysis

Application to SEM

Chip resistor

A chip resistor is soldered on a base plate with lead free solder. The reaction layers in solder are clearly observed. This example shows that soft materials can be cut with little artifact.



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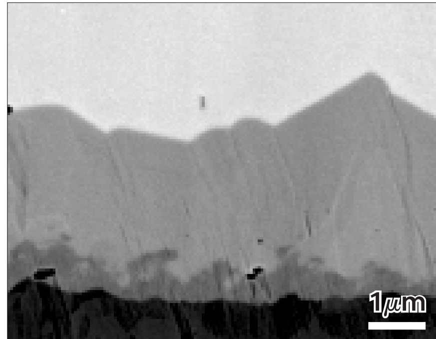

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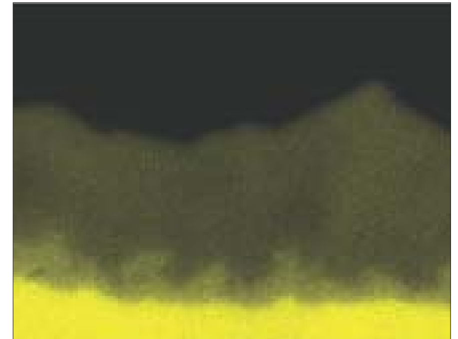
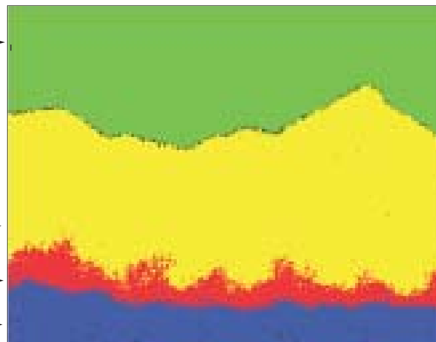
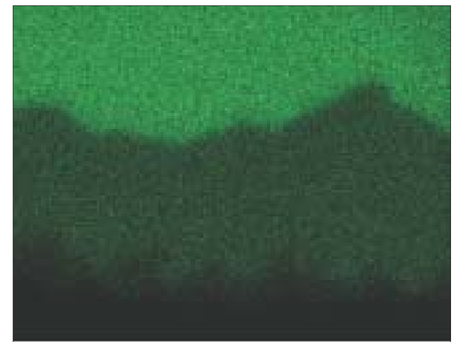

Cu (EDS)



Phase analysis

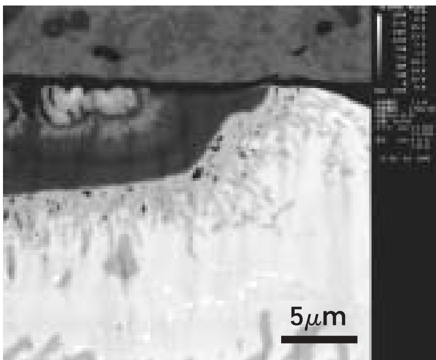

Sn (EDS)

Specimen courtesy of ESPEC CORP.

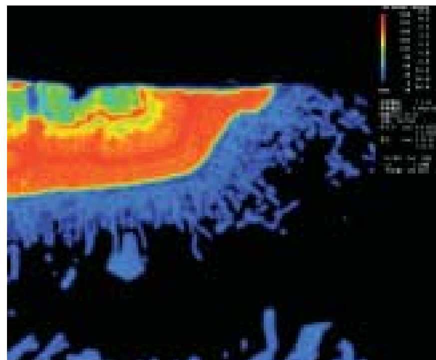
Application to EPMA

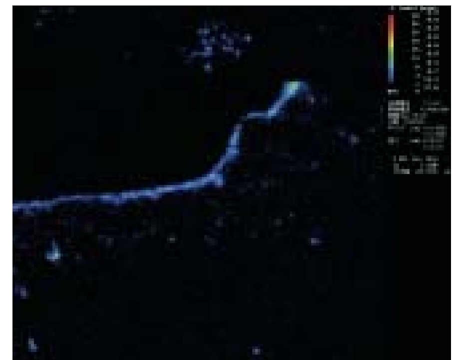
Lead-free solder

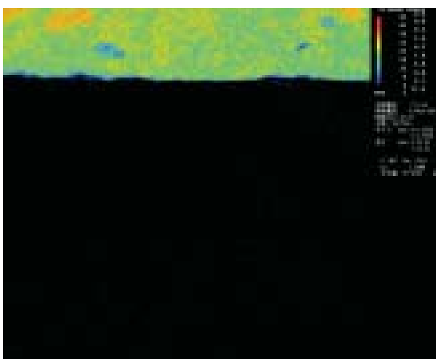
In this example, the distribution of phosphor and copper is well preserved and clearly observed in the boundary between the nickel and the solder layers.

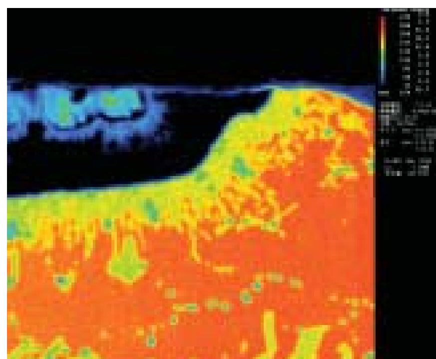


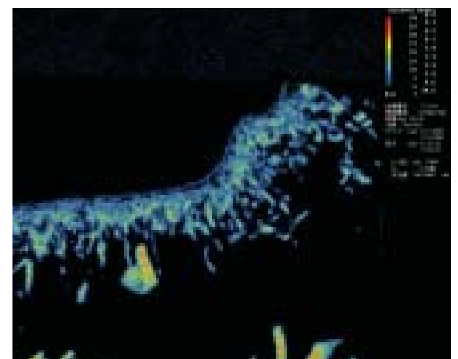
Backscattered electron image


Ni (WDS)


P (WDS)


Ti (WDS)

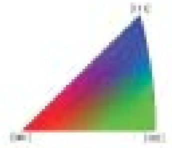

Sn (WDS)

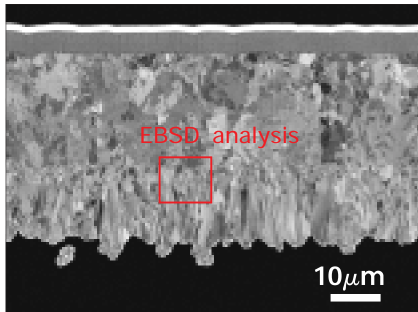

Cu (WDS)

Application to EBSD

Card edge connector

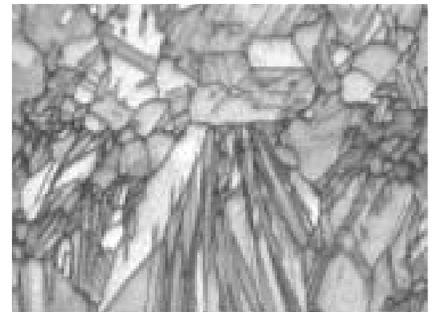
This is a cross section of a card edge connector on a printed circuit board. A cross section made by the CP can be used for evaluation and measurement of layers such as the gold (top) and nickel (second) layers in this example. The contrast in the copper (third) layer is generated by the variation of crystal orientation of the copper grains and indicates that the surface is made with little damage in the crystal structures.



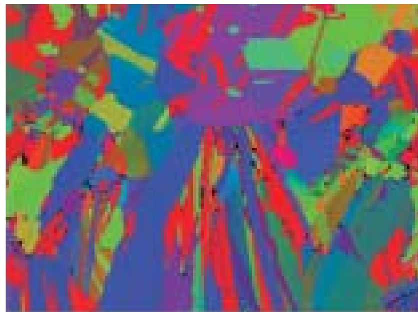


Backscattered electron image

Backscattered electron image



Pattern quality image



Normal direction

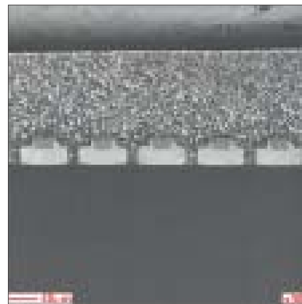
Rolling direction

Transverse direction

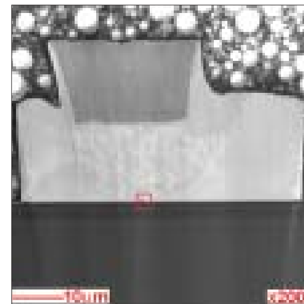
Application to Auger

IC

Internal defects can be studied by preparing a cross section and exposing the internal defects. In this example, a 200nm tungsten layer is formed on the aluminum layer. In the cross section made by the CP shows a grain containing tungsten and titanium. Impurity carbon is detected along the boundary to the gold layer. Auger analysis at a magnification above x50,000 can be done on a specimen prepared with the CP.



Secondary electron image



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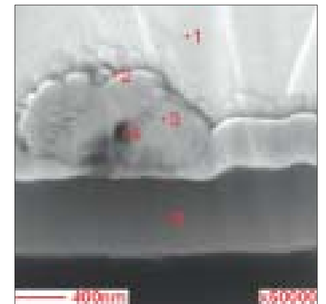

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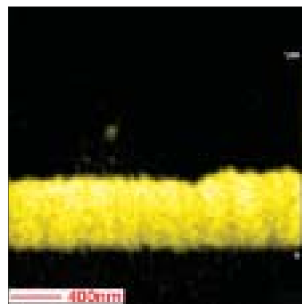
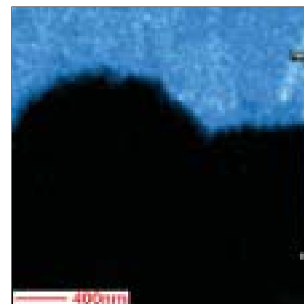
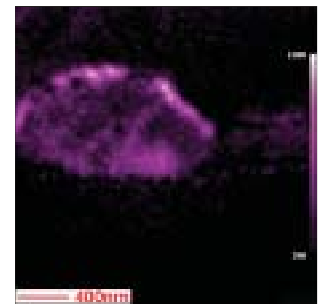


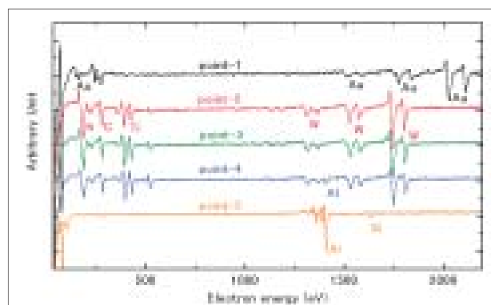
Al



Au

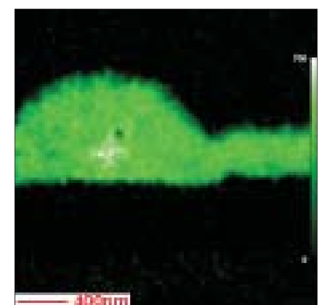


C



Spectra from the analysis points

Ti



W

Specifications

● Accelerating voltage	2 to 6 kV
● Ion beam diameter	500 μm (FWHM)
● Milling rate	1.3μm/min (6kV, silicon, 100μm from edge)
● Maximum specimen size	11mm(W) ×10mm(D) × 2mm(H)
● Specimen stage movement	X : ± 3mm, Y : ± 3mm
● Specimen alignment	± 5 °
● Gas	Argon
● Pressure measurement	Penning gauge
● Pumping system	TMP, RP
● Dimension and weight	Basic unit 380mm(W) ×570mm(D) ×520mm(H), 41kg Rotary pump 120mm(W) ×280mm(D) ×170mm(H), 10kg

Installation requirements

● Power	Single phase AC 100V, 50 or 60Hz, 0.4kVA
● Grounding	100Ω or less
● Argon gas	Pressure:0.15MPa (1.5kg/cm^2) Dry argon, 99.9999% or more purity (Argon gas, gas cylinder and regulator would be provided by customer.)
● Room temperature	20 ± 5 °C
● Humidity	60% or less

Specifications subject to change without notice.

High technology for quality assurance and the environment.

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