Living up to Life

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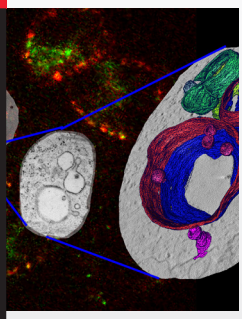
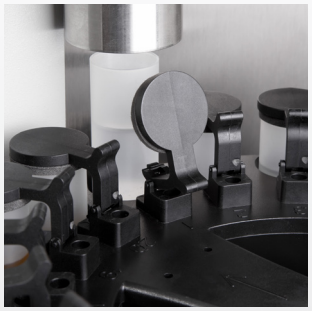
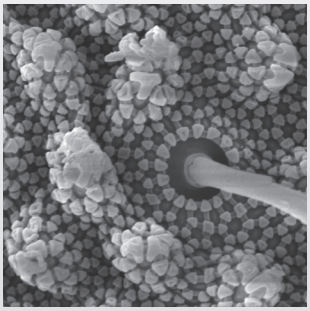
MICROSYSTEMS



Material
Research





Life Science
Research

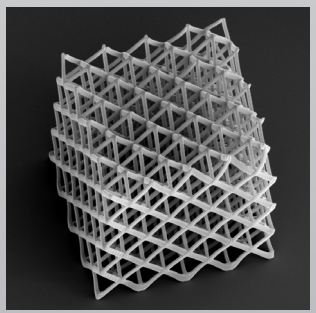
Application Note

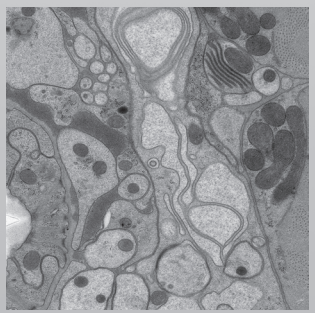
Ion Beam Polishing of sample surfaces

Sample Preparation for SEM

related instrument Leica EM RES102

Medical
Research





Industrial
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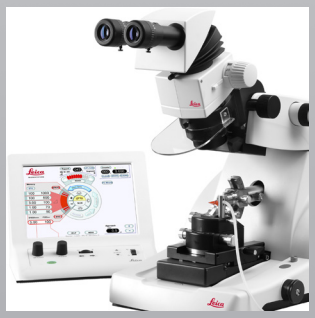


Polishing of sample surfaces

BASIC PRINCIPLE

Ion milling can be used to reduce the roughness of sample surfaces. Small angles less than 6° with respect to the sample surface are necessary. The high voltage depends on the material to be prepared.
The reason for the levelling effect is the different milling angle of flat and rough surface areas. The milling rate is lower for small angles. The rough surface area will be faster milled. The result is a flat surface.

Fig. 42: Polishing effect in case of rough surface areas

Ion polishing is often the final step of sample preparation. The prerequisite is a perfect mechanical pre-preparation as samples with deep surface scratches cannot be ion polished.
Soft materials usually have a smeared sample surface after mechanical polishing. It is necessary to remove this smeared material before ion polishing. Otherwise the above mentioned polishing effect does not work.

APPLICATION EXAMPLES

- Oil shale
- Nickel based super alloy

POLOSHING OF AN OIL SHALE SAMPLE

Purpose

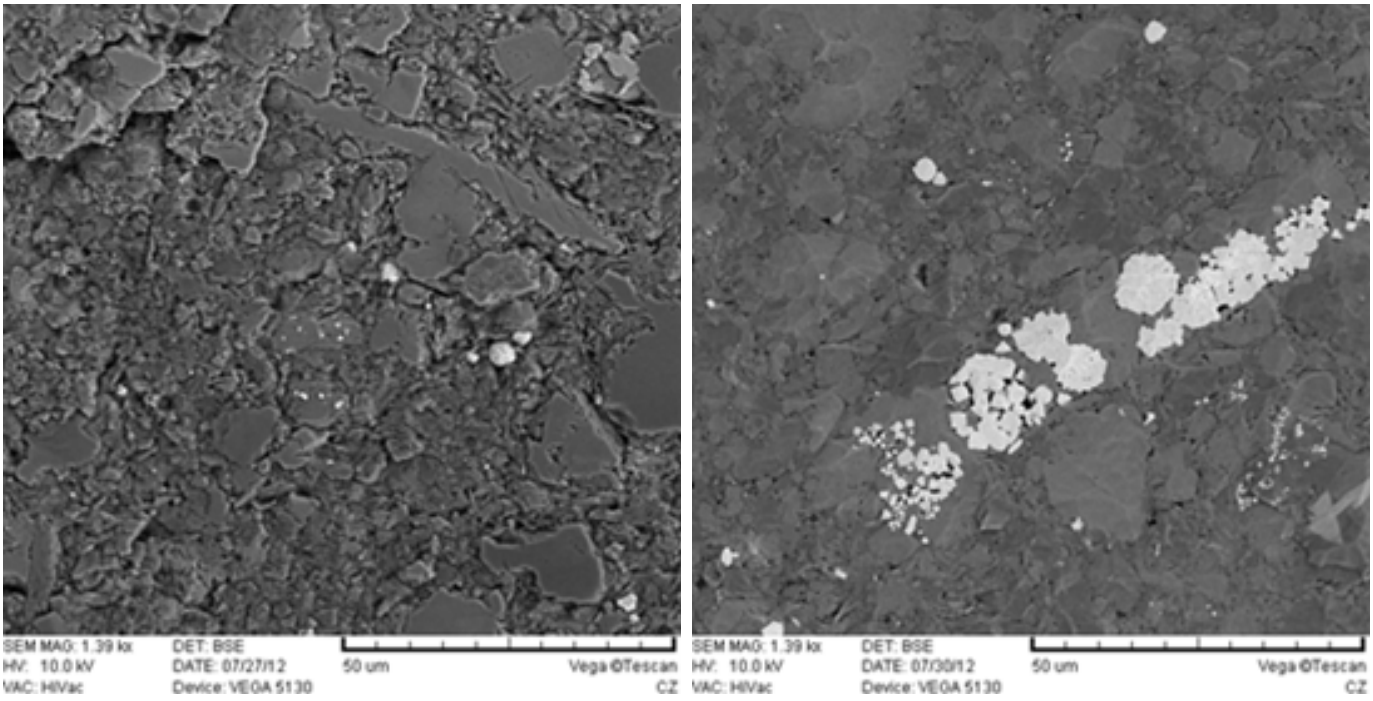
Mechanical polishing of oil shale is difficult because of the different hardness of the organic and inorganic components. The surface is often not completely flat.
A final ion polishing after mechanical polishing can greatly enhance the surface quality. On the other hand, the sample surface should be as good as possible before ion polishing. Thus the combination of both steps should be the right way to achieve a good result.

PREPARATION PARAMETERS

Acceleration voltage:	6 kV
Gun current:	2.2 mA
Sample movement:	Area mode
Milling angle:	3°
Milling time:	6 h

RESULTS

The images show an oil shale sample after mechanical polishing and after additional ion polishing. Due to the different hardness of the components of the oil shale the surface quality is not good enough for imaging. An additional ion polishing of an area of about 20 mm in diameter leads to a much better surface quality. Now it is possible to observe structural details.



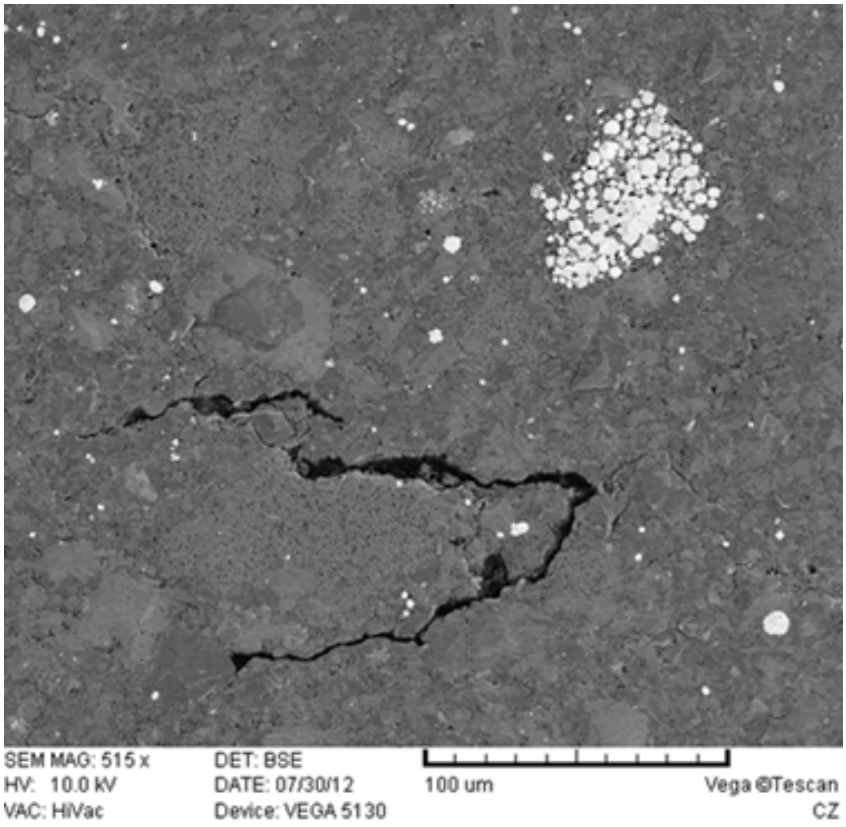


Fig. 1: Oil shale after mechanical polishing (upper left image) and after additional ion polishing (top right and lower image) (6 kV, 3°, 6h, and area mode)

POLISHING OF NICKEL BASED SUPERALLOY

Purpose

Usually sample surface is not completely free of damage after mechanical polishing. The depth of surface damage is three times than the grain size of the lapping foil. Ion polishing is a good tool to remove such damage. It can be used for SEM and TEM samples.

PREPARATION PARAMETERS

Acceleration voltage:	7 kV
Gun current:	2.6 mA
Sample movement:	Rotation
Milling angle:	5°
Milling time:	3 h

RESULTS

Fig. 2 shows a Nickel based superalloy after mechanical polishing and after additional ion polishing. The sample surface has a lot of fine scratches after mechanical polishing. It was possible to remove all these scratches and to achieve a nice surface after an additional 3 hours ion polishing.

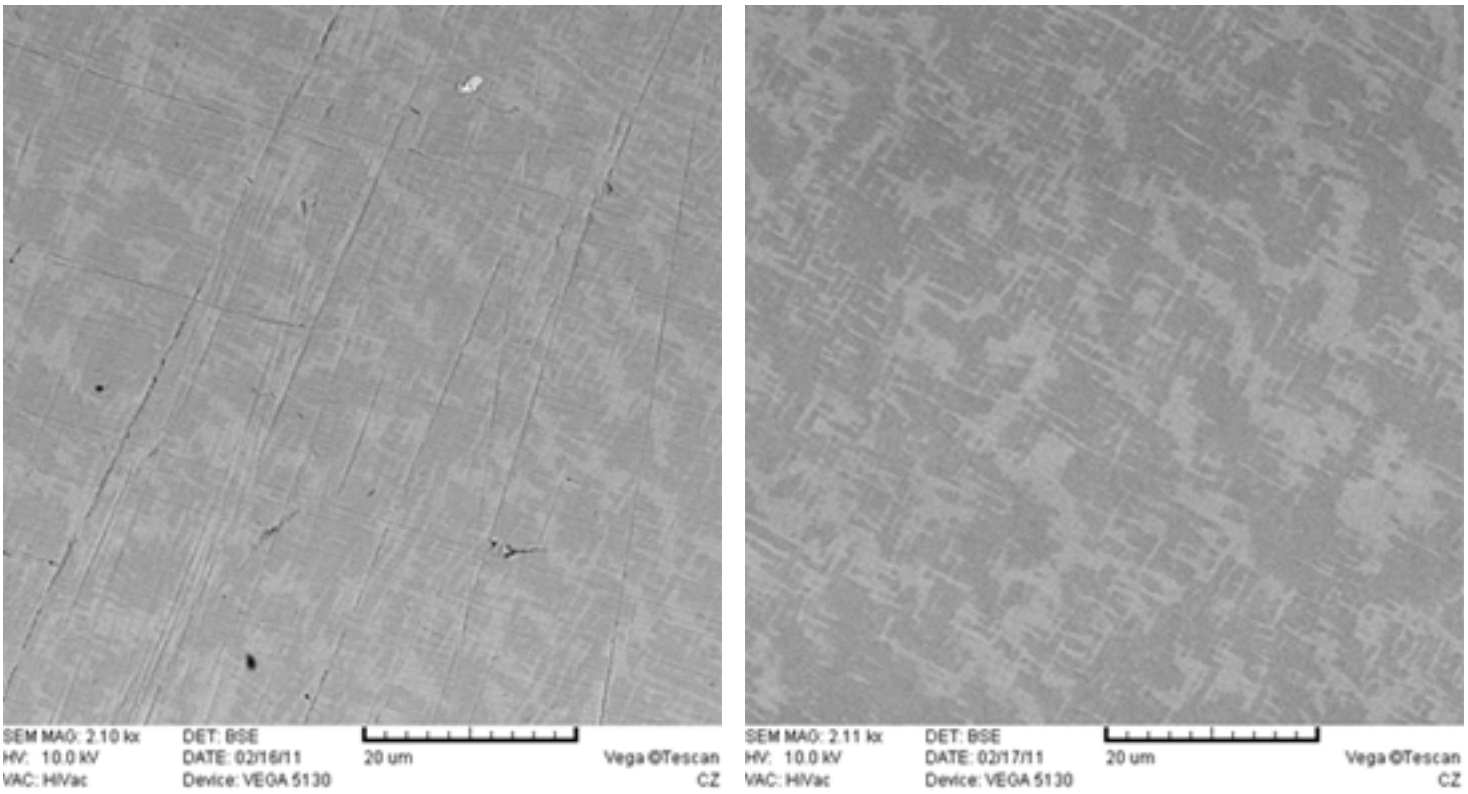


Fig. 2: Nickel based super alloy (CSMX-4) after mechanical polishing (left) and after additional ion milling (7 kV, 5°, 3h, and rotation) (right)

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RELATED PRODUCTS

Leica EM RES102

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