

Materials examinations with advanced microscopes



All materials may be examined

FORCE Technology have some of the most advanced microscopes in the market at their disposal and can thus offer a wide range of material analyses.

At our disposal we have a conventional SEM microscope (Scanning Electron Microscope), an ESEM microscope (Environmental Scanning Electron Microscope) and a FIB-SEM microscope (Focused Ion Beam Scanning Electron Microscope), with which we are able to:

- Examine surface structures in magnification from 10 to 800.000 times
- Determine elements' compositions and distribution
- Characterise particles
- Analyse why a fracture may have occurred
- Measure surface coating thickness
- Assess surface contamination.

Analysis of non-conductive materials

With ESEM it is possible to examine non-conductive materials such as e.g. fibres, plastics, paper, building materials and ink/varnish.

It is also possible to examine biological material such as plant fibres, fungi and microbes. Also moist objects/elements such as filters may be examined, which is unique for the ESEM technology.

Analyses at micro- and nano scale with FIB-SEM

The FIB-SEM microscope is the latest addition. The SEM microscope's possibility of generating pictures at very high magnification and depth distinctness is now combined with the ion beam (FIB), which removes, adds and analyses materials at micro- and nano scales, while you look at it.

Areas of application

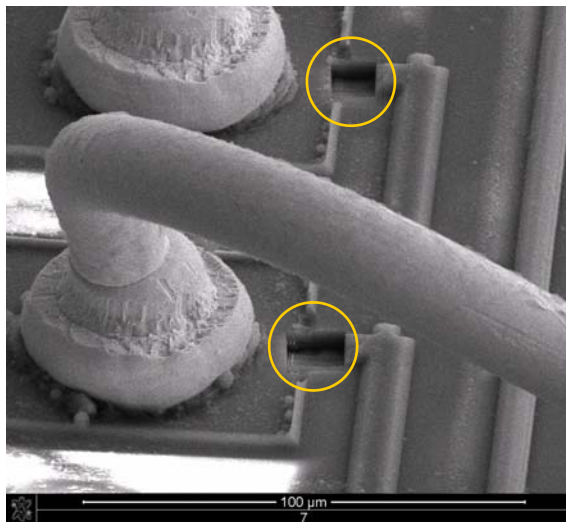
Our FIB-SEM offers quite new possibilities for advanced services for high technology companies in the electronics, medico and telecommunications industries, where the FIB-SEM may be of great help in the design and development phases.

For instance if an electrical circuit is to be modified in a chip or if the three-dimensional micro pore structure in a material is desired examined. We are also able to determine how deep and with which profile an element has penetrated a material surface.

Micro-machining

The FIB-SEM technology may be applied for building up complex micro and nano structures and to perform material modifications with surgical precision.

Developing proto types of e.g. chips may be cost intensive and it may be both faster and cheaper to modify the prototype than making a new one all over. With the FIB-SEM it is possible to remove an electrical connection in a circuit and it is possible to build up a new electrical connection by adding an organo metallic gas, containing e.g. platinum. When the ion beam is applied in combination with the gas, the gas will decompose and the metal will be deposited on the chip, exactly where one desires it to be and it will generate new circuits.



Electrical connection on chip has been removed by the FIB-SEM

Nano lithography

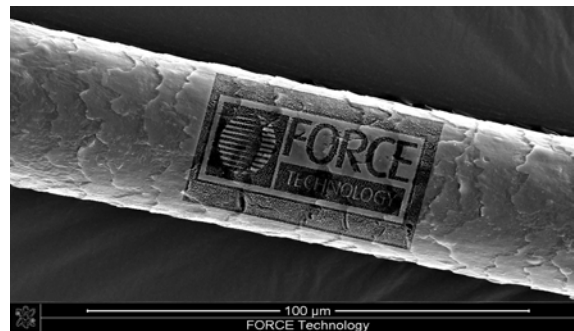
Lithographical tasks represent a specialised application of the FIB-SEM. The equipment can write in almost any kind of solid substance. E.g. the technique is applied for writing on diamonds and thus very clearly and specifically identifying these.

The written text cannot be read by the naked human eye, but it may be applied for marking and identification in case of thefts.



Nano lithography applied on diamonds

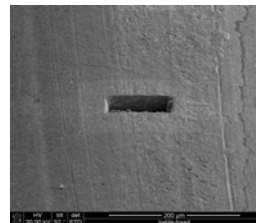
As a funny example of a little lithography task we have cut our logo into a strand of hair by use of the FIB-SEM technology.



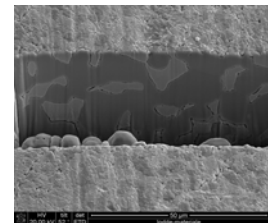
Logo cut into a strand of hair by use of FIB-SEM technology

Examination of structures at and under the surface

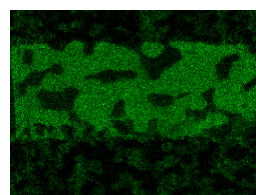
Scanning Electron Microscopy is a surface analysis technique, however, with the FIB it is now also possible to look under the surface. By applying the ion beam for cutting the surface we are able to make a cross section of the upper part of the material, so that the structure, which is desired examined will not be damaged. This is only possible by application of this new technique.



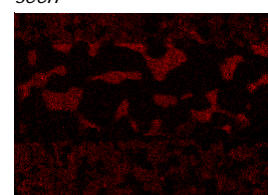
Cut in a soldering thread



Further magnification of the cut, where two different phases are clearly seen



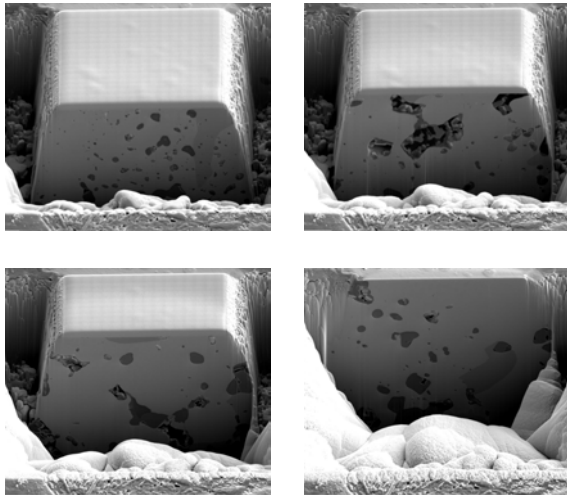
Tin distribution in the soldering thread



Lead distribution in the soldering thread

2-D and 3-D characterisation

For a long time it has been possible to produce photos with fantastic depth distinctness of the the surface structure with a traditional Scanning Electron Microscope. In combination with the FIB it is possible to "cut and photograph" through a sample in very small steps. Thus the 3-dimensional range of e.g. pores in a material are traceable. In the photos are seen a cut in metallic materials with various compositions.



Cuts in metallic materials

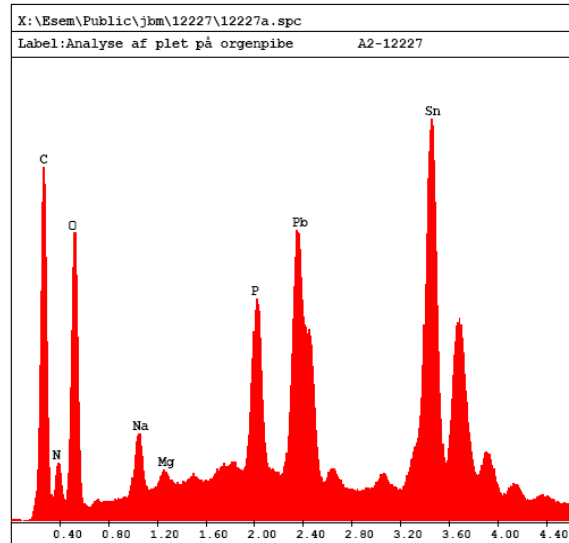
Detective work

FORCE Technology often get assignments where the customer is totally blank as to why the problem arose. An example could be when we examined spots in organ pipes in a village church.



The organ pipes with discoloration marks

We performed an elements' analysis which showed that the spots contained large concentrations of nitrogen and phosphor. These elements are typically seen in cleaning detergent and urine.



Element	Wt %	At %
C K	16.98	39.20
N K	5.07	10.03
O K	19.73	34.19
NaK	1.91	2.30
MgK	0.44	0.50
P K	3.67	3.29
PbM	17.05	2.28
SnL	35.14	8.21
Total	100.00	100.00

Result of an elements' analysis

FORCE Technology visited the church to check the circumstances further, and it turned out that the church held bats who urinated in the air. The guilty party was found and the organ builder was acquitted.

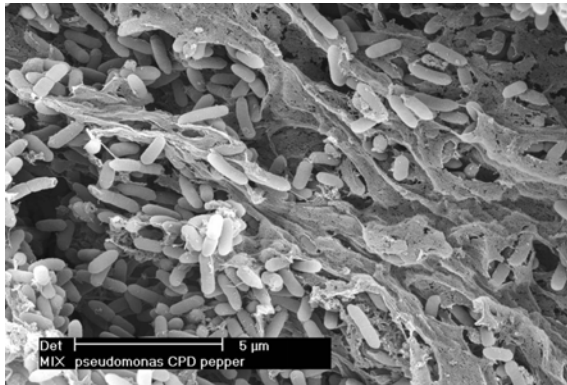


The guilty party was found

Trace your examination on-line

As a customer, when you submit samples for analysis with us, it is possible to track the analysis on-line from your own place of employment via our web-site.

Together with our SEM-operators you will be able to actively participate in the problem solving rapidly and smoothly, without having to spend either time or money visiting FORCE Technology.



Clear rod-shaped bacteria in a green pepper. By use of ESEM it has become possible to trace such water-saturated structures.

Rapid case handling

We are very aware of our customers' need for rapid answers to their problems and we strive to be able to deliver them as soon as possible - often in only a couple of days.

Unique services

FORCE Technology's services are unique. We combine high-technology microscope services with our wide experience and know-how within materials technology.

Related services

Our many materials specialists in steel and other metals, plastics and composites and cement and concrete all partake in ensuring relevant and competent conclusions to the many different types of analysis tasks we solve daily.

Furthermore, we offer consultancy on choice of materials for a given product or structure and we are very experienced at preparing their adhering requirement specifications.

We also conduct condition assessments, testing, inspection and on-site examinations world-wide, which can be initiated at very short notice.

Corrosion protection and surface treatment is also one of our key competences and our many activities may also be included as part of e.g. product development, quality assurance and preventive maintenance.

When you are out of luck and a damage or failure occurs many immediate questions arise. FORCE Technology holds many years' experience in the field, and we know how to help you in the situation providing a fast, competent and impartial approach to damage and failure analyses.



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