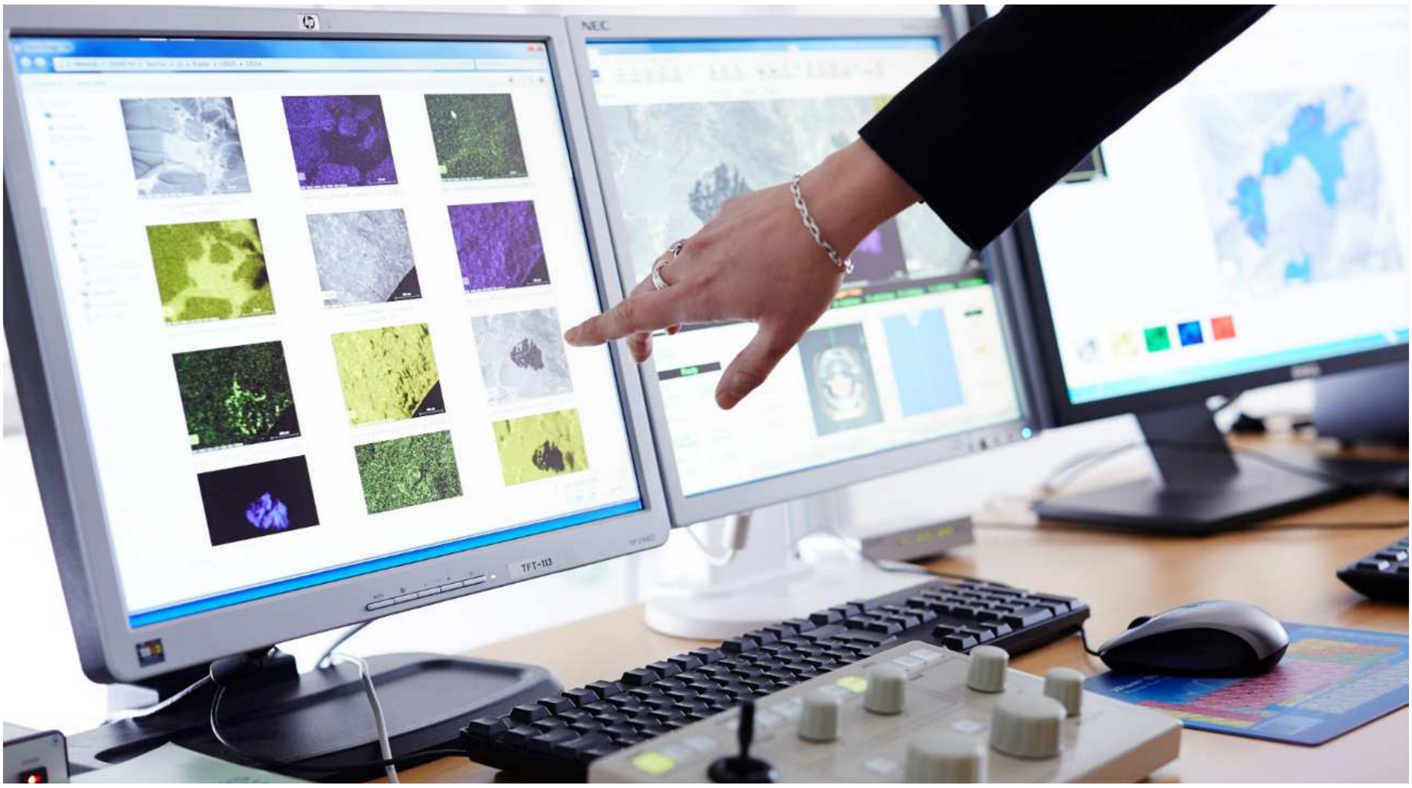

Elemental analysis - EDS

Analysis methods in the Scanning Electron Microscope

Scanning Electron Microscopy (SEM) gives the possibility to image all types of dry surfaces and materials from low up to very high magnifications. With different analysis techniques it is also possible to find out what elements and phases are present, as well as crystal structures and crystal orientations. By combining these techniques, and when needed also with other techniques available at RISE, we can help you to get an overall picture of a specimen/material in order to understand what it has been subjected to or why it behaves in a certain way during service/ load.

Energy Dispersive X-ray Spectroscopy, EDS

Energy Dispersive X-ray Spectroscopy (EDS) is an efficient way of performing elemental analysis.

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By analysing the X-rays emitted at each point or area in the material, information is obtained about which elements are present and at what concentrations. The method is simple, fast, and non-destructive.

In only a few seconds it is possible to get at spectrum of the characteristic X-ray peaks from the main elements in the specimen. By analysing longer times, the accuracy of the measurement is improved, which can be of interest for calculation of the relative material composition.

Elemental analysis can be performed in chosen points, as line profiles or by elemental mapping over an area.

Point analysis

Figure 1a shows an example of point analysis with EDS. Two particles are analysed by point analysis in one point at the time, acquiring a spectrum over the elements present. Particle 1 in the example consists of zink (Zn) and particle 2 consists of iron (Fe).

Line profile

Figure 1b shows a line profile in a cross-section specimen after laser treatment of titanium (Ti) in a nitrogen (N)-rich environment. The analysis is performed at 800 times magnification and shows an enrichment of N in the surface, down to a depth of approximately 10 µm. No oxygen (O) is detected in the surface.

Elemental mapping

Elemental analysis can also be performed by elemental mapping where intensity maps show the relative concentration of each element in the analysed area (figure 2d-f).

In addition, figure 2 shows how elemental mapping can be combined with analysis of phases and crystal orientations (by Electron Backscattered Diffraction = EBSD) in an elegant way.

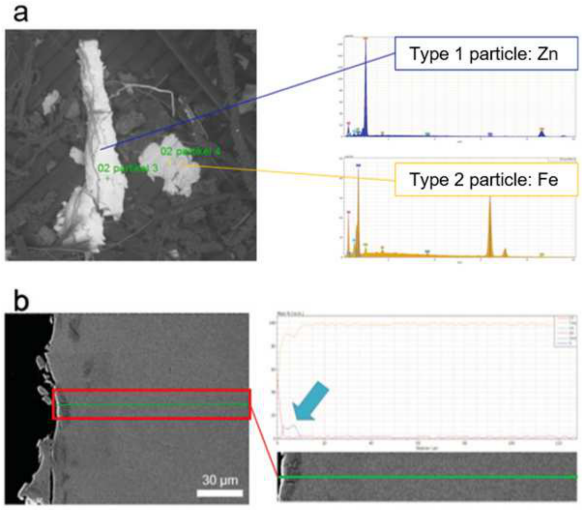

Figure 1. Elemental analysis
a) example of point analysis with EDS
b) line profile in a cross-section specimen after laser treatment of Ti in a N-rich environment

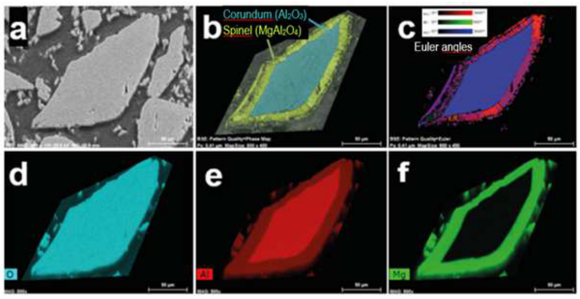

Figure 2. Analysis of steel furnace lining, combination of EDS and EBSD
a) SEM image taken at x500
b) EBSD, phase map
c) EBSD, crystal orientation map (Euler angles)
d) EDS, elemental map of oxygen (O)
e) EDS, elemental map of aluminium (Al)
f) EDS, elemental map of magnesium (Mg)