New Field Emission Scanning Electron Microscope (FESEM)

The department has recently invested in a new high resolution FESEM (Fig. 1) that is designed to examine the microstructures of a wide range of materials. The microscope is equipped with a variety of imaging, analytical and diffraction detectors (In-lens SE, in-lens BSE, EDS and EBSD), and an in-situ stage which provide detailed surface information of samples at the scale of nanometre level and up to decimetre level.

The EM-laboratory has integrated some of the latest technological innovations and developments related to materials characterisation using EBSD in the FESEM, including:

- **Ultra fast EBSD pattern acquisition**. The new FESEM is equipped with an EBSD detector for ultra fast pattern acquisition. The gains of this technological innovation are increased EBSD scan speed (at present a factor of 20) and increased flexibility and reliability during the subsequent data analysis.
- **Combined EBSD beam and stage scanning.** The combined EBSD beam and stage scanning mode makes it possible to automatically characterize large regions of 150x150 $(mm)^2$ silicon wafers. At present it is possible to analyse regions with the dimensions of about 100x70 mm (Fig. 2).
- **Simultaneous in-situ thermo-mechanical investigations and EBSD examinations**. A separate in-situ deformation unit has been designed that can easily be mounted and operated within the microscope chamber. This equipment design offers in-situ thermo-mechanical testing coupled with ESBD. The in-situ unit provides several deformation modes such as tensile testing, compression and bending. In addition, a special device for heating the sample can be mounted to carry out separate heating experiments or combined thermo-mechanical investigations. Fig. 3a and 3b present high resolution backscatter electron images of one particular $LaCoO_3$ ceramics at zero load and after 250 MPa compression respectively, showing domain reorientation due to the externally applied mechanical field.

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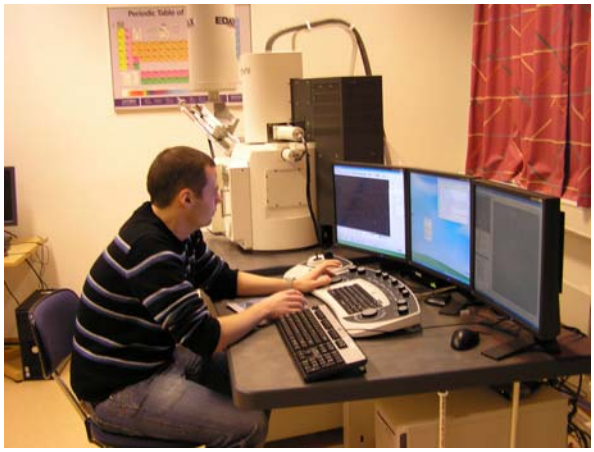


Fig. 1: The new high resolution Zeiss ULTRA 55 FESEM in operation.

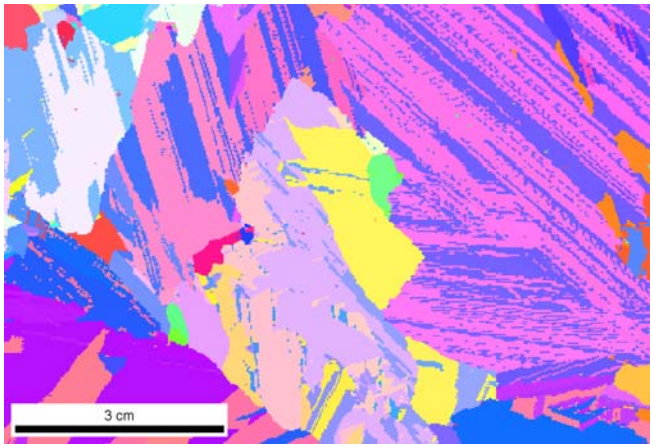
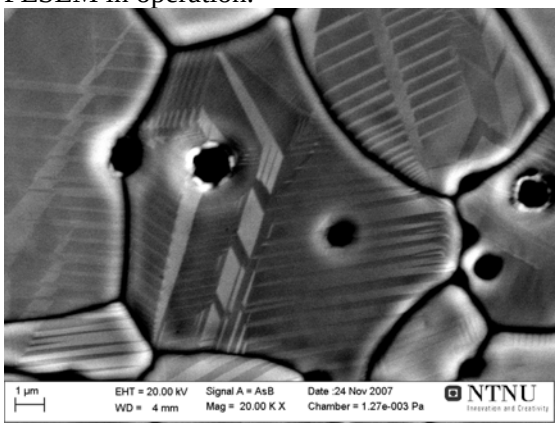
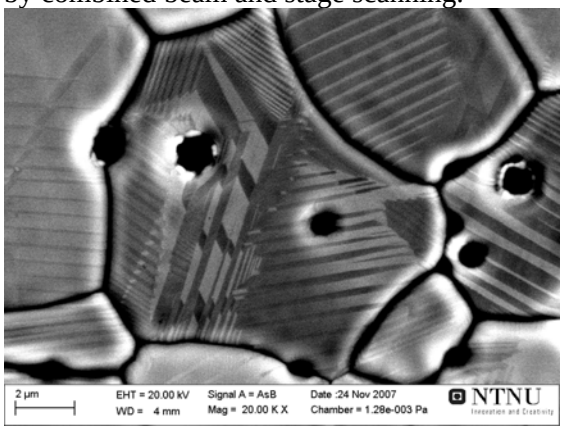


Fig. 2: EBSD orientation map of a silicon wafer obtained by combined beam and stage scanning.



a)



b)

Fig. 3: Domain structures in $LaCoO_3$, (a) before and (b) after compression.

Photos: Morten Karlsen