FESEM with EDS, EDSD, CL and STEM

The Central Research Facility (CRF) has installed FE-SEM Supra 55 (Carl Zeiss, Germany) with Air Lock chamber for scientific research. Attachments available with the FE-SEM are STEM, EDS (Oxford Liquid Nitrogen free SDD X MAX 50 EDS), EBSD (Oxford Integrated Advanced Aztec HKL EBSD with forescatter detector system with 4 diodes for Nordlys Analysis) and Mono CL4 (Gatan, UK).

Features of FE-SEM is as follows:

Resolution: 0.8 nm at 15 KV, 1.6nm at 1 KV
Magnification: 12-1000000X
Acceleration voltage: 0.02V TO 30 KV
Gun type: Schottky Field Emission Electron Gun
Maximum Probe Current: 12 pA to 100 nA
Detectors: SE, BSE, In-lens, Retractable STEM with Bright and dark field
Chamber size: 330 mm diameter × 270 mm height

Sample Coating facilities:

Carbon, Gold and Platinum-Palladium are available.

Attachments:

EDS: Single sensor large area (50 mm2) Silicon Drift Detector (SDD) sensor, count rates > 500,000 cps, Throughput > 200,000 cps, Resolution: @ 127eV @ MnKα

Uses of EDS

- Liquid N_2 free SDD detector is used for lighter element analysis
- Elements from Be to Pu can be analyzed
- Qualitative and semi-quantitative elemental analysis
- Point, area & line scanning facility
- Spectral imaging
- Phase mapping
- Both conductive as well as non-conductive samples can be analyzed etc.

EBSD: Integrated Aztec HKL EBSD with forescatter detector system with 4 diodes for Nordlys Analysis, will be operated at low kV and low beam energy for the better spatial resolution. Analyse beam sensitive samples with lower beam energy. Angular resolution is less than 0.1 degrees. Able to discriminate materials with very similar crystallographic lattice parameters. The highest resolution uses the full 1344 x 1024 CCD array to digitize EBSP's. Designed for data collection using low probe currents requiring only 0.5nA to operate.

Uses:

- The crystal structure, orientation and correlative information can be acquired by the technique
- It is used for microstructural characterization (to identify crystal orientation, grain size, global and local texture, recrystallize/deformed fractions, substructure analysis, strain analysis, grain boundary characterization, CSL boundary distribution, slip system activity, phase identification, distribution and transformations, fracture analysis etc.)
- Identification of small grain boundary precipitates
- Observe microstructural change after heat treatment
- Identification of mineral crystal structure with Miller indices
- Phase mapping

Mono CL4: Cathodoluminescence (CL) consisting Mono CL4 (wavelength ranges between 200-850nm), UVMCL (wavelength ranges between 185-200nm) & FIRMCL (wavelength ranges between 1600-2300nm)

Uses:

- Information on the trace elements crystal growth and replacement
- Investigations of cementation and diagenesis processes in sedimentary rocks
- Provenance of clastic materials in sedimentary and metasedimentary rocks
- Details of internal structures of fossils
- Growth/dissolution features in igneous and metamorphic minerals
- Accurate identification of various carbonate phases by CL imaging
- To access the degree of alteration of carbonate minerals
- Highly useful in petroleum reservoir rocks to study degree of diagenesis of reservoir rocks
- Major use in the development of Semiconductor devices
- Optical, electronic and crystal defect properties of semiconductors
- Surface Plasmon (optical) properties of metallic nanostructures (plasmonics)
- Inter- and intra-molecular structure of organic materials etc.

Note: Moisture rich sample (without proper treatment) and use in defence purpose is strictly prohibited. Sample for imaging and analysis should be prepared by user only. The FESEM laboratory is not responsible for preparation of samples for SEM, EDS, EBSD, CL and STEM.