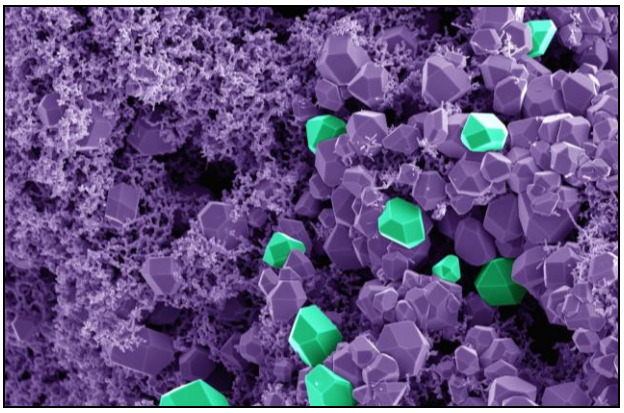
Scanning Electron Microscopy (SEM)

Contents



Electron Microscopy at JU

This electron microscopy (Inspect F50) acquired 2009 at the School of Science / Geology Department instead of the old AMR Leitz 1000A SEM. It is for internal and external stuff and students use; research, industrial, etc.

INSPECT F50

high-brightness, high-current, high-resolution imaging, a SEM equipped with a high resolution Schottky Field Emission source, provides clear, sharp and noise-free imaging. The system's excellent lateral resolution enables easy detection of low-Z elements at low beam energies, adding value and flexibility to the Inspect F50.

Electron Beam resolution

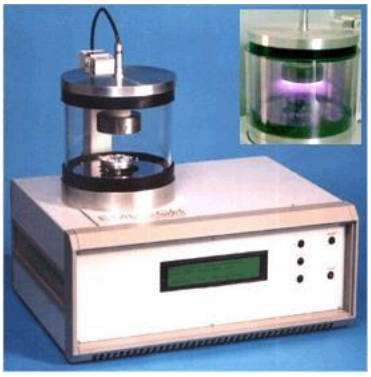
- 1.0 nm at 30 kV (SE)
- 2.5 nm at 30 kV (BSE)
- 3.0 nm at 1 kV (SE)

With a magnification of more than 1,000,000 x

This SEM (**Inspect F50**) has a Schottky Field Emission gun (FEG) for high resolution. This instrument is *high vacuum* (< 6e-4 Pa) and equipped with :

- **Everhardt Thornley SED (secondary electron detector)**
- **Solid–state BSE (backscattered electron detector)**
- **Bruker EDS Microanalysis - X Flash Silicon Drift Detector (SDD)**

SEM equipment



An Emitech K550X sputter-coater with a Magnetron Target Assembly (Platinum), which enhances the efficiency of the process using low voltages, and giving a fine grain; cool sputtering, without the need to cool the target or the

specimen stage. Fully automatic control, low voltage sputtering, high resolution fine coating (order of 2nm Gold Grain), special rotating stage with full tilt facility fitted as standard, even thickness deposition (typically 20nm or 200 Angstroms for SEM work).
The main benefit is primarily to provide conductive metal coatings for non-conductive samples for SEM microscopy.

Applications:

- Industrial (material) Applications
- Life Science Applications
- Natural Resources & Energy
- Scientific Research
- Nano Characterization
- Metals & alloys,
- oxidation/corrosion,
- fractures, welds,
- polished sections,
- magnetic and superconducting materials,
- Ceramics,
- composites,
- plastics,
- Films/coatings,
- Geological sections,
- minerals,
- Soft materials: polymers, pharmaceuticals, filters, gels, tissues, plant material, Particles, porous materials, fibers.

Specifications of SEM samples

Most instruments samples must be stable in a vacuum on the order of 10^{-3} - 10^{-5} Pascal. Samples likely to outgas at low pressures (rocks saturated with hydrocarbons, "wet" samples such as coal, organic materials or swelling clays, and samples likely to decrepitate at low pressure)
For SEM, a specimen is normally required to be small (>5 mm) and completely dry, since the specimen chamber is at high vacuum. Hard, dry materials such as wood, bone, feathers, dried insects or shells can be examined with little further

treatment. Living cells and tissues and whole, soft-bodied organisms usually require chemical fixation to preserve and stabilize their structure

Specimens that pose problems:

- Wool and Cotton tissue
- Cosmetics
- polymers
- Fats and Hydrocarbons
- Emulsions (margarine)
- Biological and Organics (need chemical fixation)
- Contains any Volatiles and water
- Friable samples

Contact person:

for more details and sample analysis using SEM:
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Direction: The University of Jordan, Hamdi Mango Center for Scientific Research building, -1 floor, SEM lab.

General instructions for researchers:

- The interested researcher must be present at SEM lab during analysis.
- The samples must be very small pieces and completely dry.
- Researches from the Faculty of Science/JU must complete the application for using SEM.

SEM Information card

SEM Brochure

The University of Jordan 2012-1962 50

INSPECT F50

high-brightness,
high-current,
high-resolution imaging,

The INSPECT F50 , a SEM equipped with a high resolution Schottky Field Emission source (3.0 nm at 1kV/1.0 nm at 30kV SE), provides clear, sharp and noise-free imaging. In combination with the optimized analytical chamber geometry and its four-axis, motorized tilt, eucentric specimen stage, the high- and stable beam current makes this tool well suited for (automated) short- and long-time EDS, and EBSD analysis and mapping.
The system's excellent lateral resolution enables easy detection of low-Z elements at low beam energies.

Applications:
- *Industrial Applications*
- *Life Science Applications*
- *Natural Resources & Energy*
- *Scientific Research*
- *Nanotechnology Applications*

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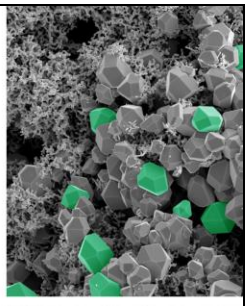
NanoCharacterization
- *Metals & alloys, oxidation/corrosion, fractures, welds, polished sections, magnetic and superconducting materials*
- *Ceramics, composites, plastics*
- *Films/coatings*
- *Geological sections, minerals*
- *Soft materials: polymers, pharmaceuticals, filters, gels, tissues, plant material*
- *Particles, porous materials, fibers*

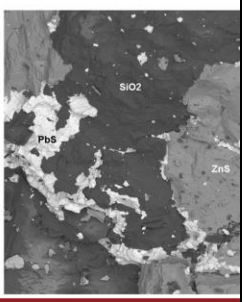
SE
Secondary Electron

Secondary electrons (SE) are the primary imaging signal in SEM where they provide good spatial esolution and high topographic sensitivity. SE are electrons from sample atoms that have been scattered by beam electrons.



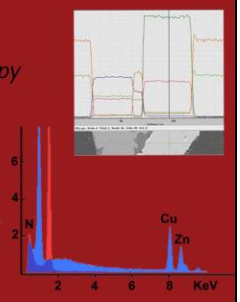
BSE
Backscattered Electron

In BSE , the signal intensity is a function of the average atomic number of the sample volume that interacted with the beam, thus providing atomic number contrast (Z-contrast) in the image



EDS
Energy Despersive X-Ray Spectroscopy

X-ray microanalysis uses an energy dispersive X-ray (EDX) spectrometer to count and sort characteristic X-rays according their energy.
The resulting energy spectrum exhibits distinctive peaks for the elements present, with the peak heights indicating the quantitative elemental composition of the sample within the volume of interaction.



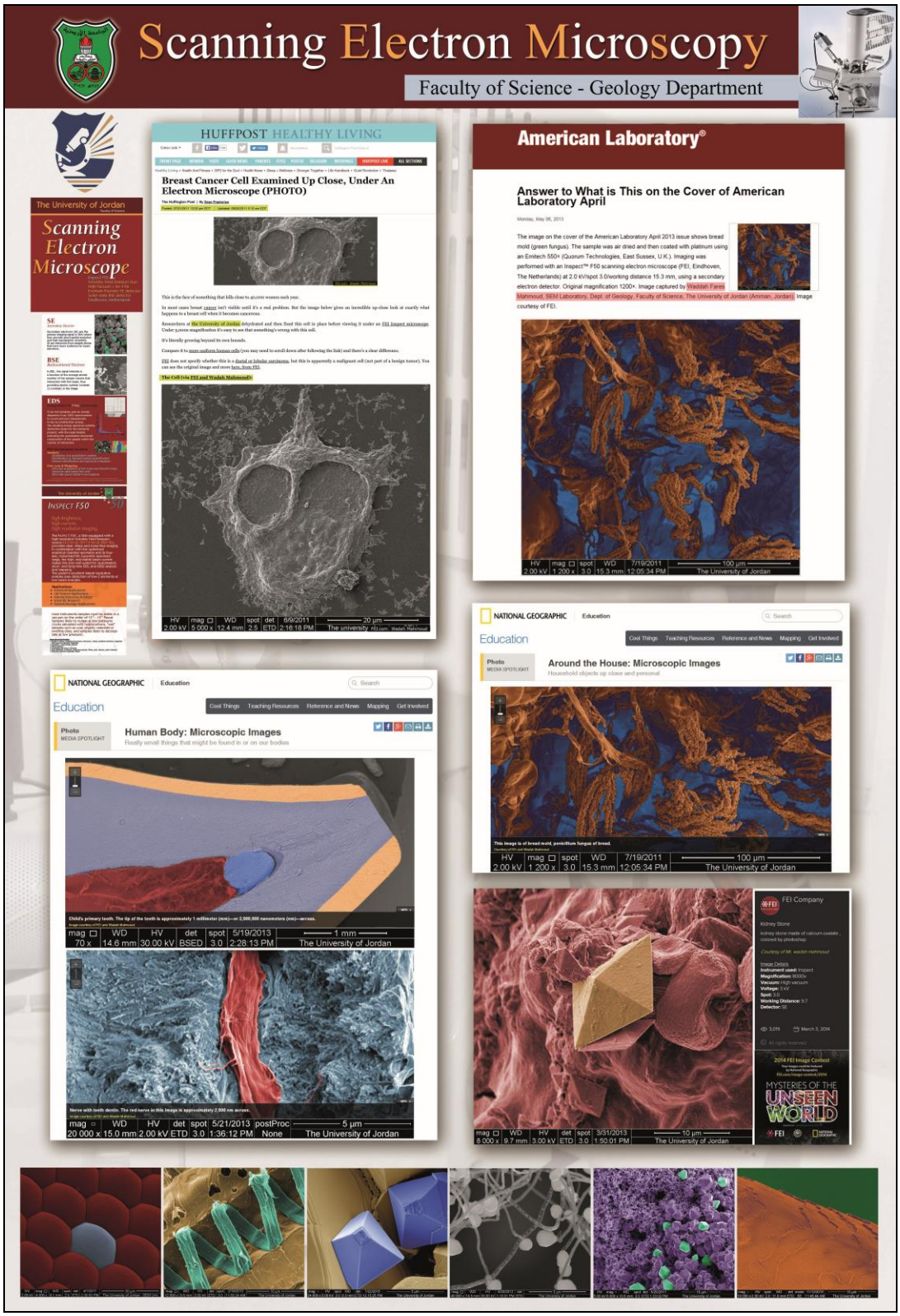
EDX Microanalysis Solutions

Analysis
- Qualitative and quantitative analysis
- Standardless or standard-based quantification
- Element identification and spectrum evaluation

Line scan & Mapping
- Ultra-fast acquisition of line scans and element maps
- Spectrum data based line scan
- Ultra high speed digital X-ray mapping

EDS Microanalysis - X Flash Silicon Drift Detector (SDD) - Bruker AXS Microanalysis GmbH

Some SEM Gallery / Published in different sites and Journals (HUFFPOST, American Laboratory, National Geographic and FEI (*now Thermo Fisher Scientific*)



ACHIEVED WORK

Works done by this Inspect F50 microscope as follows:
It is first installed at the end of 2009 and operating to the present time.

Statistical Data	
Number of samples examined from 2010 until now	**> 4200** sample
Number of SEM photo images taken	**~ 33896** photos
Number of spot chemical analysis (EDS)	**> 11242** acquisition

Clients used the SEM to date of 13/2024	percent
The University of Jordan researchers and students	~ 81 %
Other Jordanian Universities & Companies / Outside Jordan (other countries)	~ 19 %

Complete list of clients and researchers

Jordan

1. The University of Jordan
2. University of Science and Technology - JUST
3. Yarmouk University
4. Hashemite University
5. Balqa University
6. Applied Science University
7. Al Husain University
8. German Jordanian University
9. Mutah University
10. Tafeleh University
11. Al Israa University
12. Amman Ahlyyia University
13. Royal Scientific Society
14. Jordan Atomic Energy Commission
15. Carbonate Company
16. Ferasah Engineering Company
17. Austrail Jordanian Chemical
18. JPM Jordan Pharmacuticals Company
19. Yobeel School
20. Al Raed School
21. Nabil Foods Company
22. AL Hasaad AL Tarbawi schools
23. Al-Zaytoonah University

24. Manaseer Carbonate Company
25. Middle East University (MEU)
26. Mayar International Schools
27. Hikma Pharmaceuticals Company
28. Public Security Directorate(The Hashemite Kingdom of Jordan)

Iraq

29. University of Baghdad
30. Al-Mustansiriyah University
31. University of Mosul
32. Salahaddin University-Erbil
33. University of Sulaimani
34. Tikrit University

Syria

35. Tishreen University

Palestine

36. Najah University

Algeria

37. University of Batna 2 (Mostefa Ben Boulaïd)
38. Université Frères Mentouri - Constantine 1

Saudi Arabia

39. Taif University
40. University of Al-Kharj (Prince Sattam Bin Abdulaziz University)
41. Jouf University

Wadah Fares
14 Aug 2024