

PHYS-E0526 - Microscopy of Nanomaterials

SEM Independent Laboratory Exercise

(in Groups)

Learning Outcome:

The goals of the Lab. Exercise are to demonstrate:

- Basic understanding of using the SEM, which includes sample preparation, loading the sample, operate the microscope, image acquisition, etc.
- What are the factors and parameters that influence the SEM micrograph quality?
- What are the main differences between imaging with back scattered electron detector (BSE) and secondary electron detector (SE)?
- Hands-on training about the standard basic SEM alignment (astigmatism and beam wobbling)
- What is the influence of working distance (WD), accelerating voltage (AV) and tilting on the image quality?
- How to discuss and describe SEM micrograph in an article or thesis?

Independent Exercise

Each group has 2 hours to characterize independently one sample of material (metal, metal oxide) using Jeol SEM (JSM-7500F)

Tasks

- Sample preparation, based on the type of the sample. Operating and adjusting all the parameters (astigmatism, wobbler, focus, brightness and contrast) to achieve high quality images.
- Record images at the same location using SE detector at two different WD (15 and 6 mm) with the same AV (10 kV) and magnification (10000).
- Record images at the same location at different AV (5, 10 and 15 KV) maintaining the other conditions (8 mm WD and 30000 magnification).
- Record images using the SE and BSE detector, respectively at the same magnification 500 and the same WD = 8 mm.
- Record high resolution images at different magnifications; 1000 X, 25000 X, 100 KX and 250 KX. The following parameters should be used; AV = 8 KV and WD = 6 mm

Report:

- Write as a group a few pages (3-5 pages) description of this exercise. Remember to name, who are the members of your group and what was the contribution of each group member.
- Compare and discuss clearly the recorded images for each task to demonstrate scientifically the effect of WD, HV, detectors and magnifications.
- Attach the SEM images in suitable size, describe the shape and size of the structures, name those as Fig. 1, 2, 3 and attach figure caption too - and refer to the images in the body text. Exactly, if you would be writing a scientific report.
- Based on the theoretical knowledge, practical background and the machine status, what is the ideal HV and WD to characterize the sample with SE detector (best resolution and clear surface structure) and why?

Send the final report as PDF format to my email (ramzy.abdelaziz@aalto.fi)
The deadline to submit your report is May 15th.