Tentative program

**Electron microscopy block course at the Dalian Institute of Physical Chemistry**

by

Prof. Armin Feldhoff

Leibniz University Hannover

On Monday, instrument check for SEM and TEM will be made together with lab manager to be prepared for practical exercises SEM-1 to SEM-9 and TEM-1 to TEM-6.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Tuesday(3.4) | Wednesday(3.5) | Thursday(3.6) |
| Lectures | 8:30-10:00 | Lecture 1-1 | Lecture 2-1 | Lecture 3-1 |
| 10:00-10:30 | break | break | break |
| 10:30-12:00 | Lecture 1-2 | Lecture 2-2 | Lecture 3-2 |
| 地点 |  | 生物楼学术报告厅 | 生物楼学术报告厅 | 能源楼1号楼1楼会议室 |
|  | 12:00-14:00 | break | Break | Break |
| Exercises | 14:00-15:00 | SEM-1 | SEM-4 | TEM-1 | SEM-7 | TEM-4 |
| 15:00-16:00 | SEM-2 | SEM-5 | TEM-2 | SEM-8 | TEM-5 |
| 16:00-17:00 | SEM-3 | SEM-6 | TEM-3 | SEM-9 | TEM-6 |
| 地点 |  | 能源楼会议中心地下电镜室 |

**Lectures**

**Lecture 1-1, Basics of the scanning electron microscope I (SEM)**

de-Broglie wave length, Lorentz force, electron sources, electron lenses (what does a lens do?), detectors, microscope column, beam-specimen interaction, excitation volume, secondary electrons, backscattered electrons

**Lecture 1-2, Basics of the scanning electron microscope II (SEM)**

high-resolution SEM, specimen charging, depth of focus, energy-dispersive X-ray spectroscopy (EDXS)

**Lecture 2-1, Basics of the transmission electron microscope I (TEM)**

lens in wave optics, resolution limit, Fourier optics

**Lecture 2-2, Basics of the transmission electron microscope II (TEM)**

the 3-stage TEM, absorption contrast, selected area electron diffraction

**Lecture 3-1, The scanning transmission electron microscope (STEM)**

from parallel to convergent illumination, local elemental analysis

**Lecture 3-2, Some practical advice (SEM + TEM)**

sample preparation, avoiding beam damage

**Practical Exercises**

**SEM (9 courses times 4 students = 36 students; courses SEM-1 to SEM-3 given by Prof. Feldhoff; courses SEM-4 to SEM-9 given by lab manager)**

Demonstration of effect of working distance (objective lens focal length) on resolution and depth of focus. secondary electron imaging and energy-dispersive X-ray spectroscopy.

**TEM (6 courses times 3 students = 18 students; all courses given by Prof. Feldhoff)**

Demonstration of absorption contrast (bright-field, dark field) and selected area electron diffraction. how to avoid damage of beam-sensitive materials during observation.