

# Convergent Beam Electron Diffraction

Purpose of the practicum: acquiring a hands-on experience in experimental acquisition of different CBED patterns (CBED, LACBED, MB-CBED), usage of CBED for orientation of a crystal in a particular crystal zone, understanding of Kikuchi and HOLZ lines, introduction to an information content of CBED pattern.

Results to be achieved: setup for the proper conditions for acquisition of CBED pattern in different modes, getting familiar with reciprocal space and crystal orientation, experimental recording of TEM images and diffractions.

## **Requested theoretical background**

*Basic concepts:*

Reciprocal space and reciprocal lattice of a crystal; Laue zones.

Bragg law and a formalism of Ewald sphere.

Electron diffraction with parallel illumination.

Kinematical theory of convergent beam electron diffraction.

Higher Order Laue Zone lines and Kikuchi lines.

Schematics for obtaining CBED, LACBED and MB-CBED patterns.

## **Content of the practicum and consequent report**

All the steps of practical operation of the instrument will be explained and shown by demonstrator at place. Participants will follow up instructions and obtain their own data for further evaluation. It is advised to have a memory stick for data pick-up.

Si sample oriented roughly in [110] zone will be used.

### 1. Column alignment

<http://www.rodenburg.org/RODENBURG.pdf>

- a. Gun
- b. Condenser
- c. Stigmation

### 2. CBED

Orientation of Si sample exactly into [110] zone using Kikuchi pattern, acquisition of zero order CBED disks at different thicknesses.

*Report should contain a practical consideration of how to obtain a CBED pattern.*

### 3. LACBED

- a. Retuning of TEM in nanoprobe mode. Obtaining and recording of LACBED patterns.

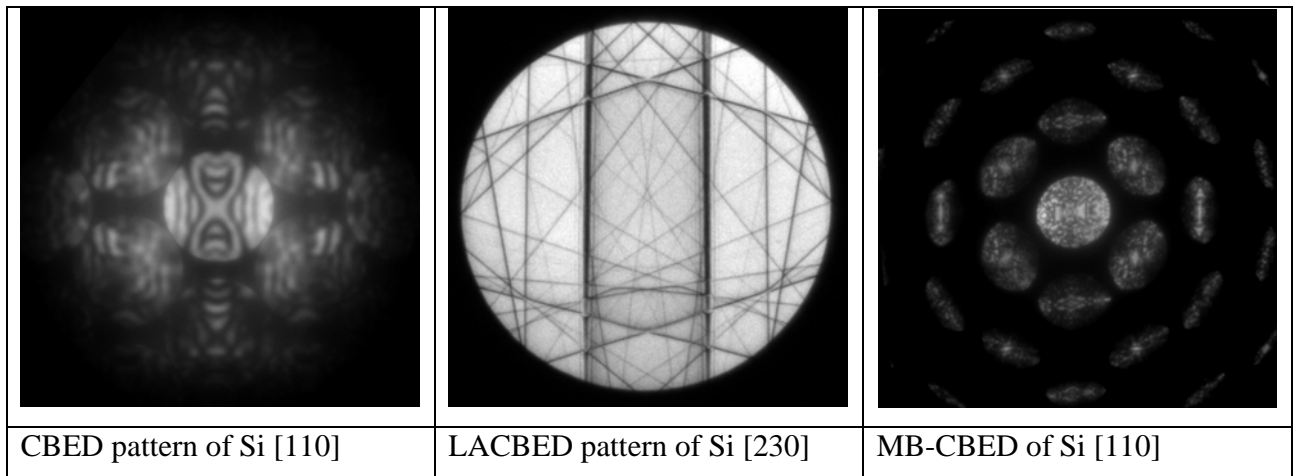
- b. Orientation of the sample in [230] zone using LACBED pattern and Winkiku program. Obtaining of LACBED and CBED patterns in [230] zone.

*Report should contain explanation of differences of operation in TEM and nanoprobe modes. Why the last is necessary to obtain LACBED? Description of the procedure for obtaining LACBED. Explanation of the differences in CBED and LACBED patterns of the same zone.*

#### 4. MB-CBED

- a. Orientation of the crystal in [110] zone.  
b. Setup of experimental conditions and recording of MB-CBED patterns.

*Report should contain a description of setup MB-CBED method. How do different parameters (image height, magnification, convergence angle) influence the pattern obtained?*



*Reference literature (provided as pdfs on the web site):*

[Convergent-Beam Electron Diffraction.pdf](#)

[Large Angle Convergent Beam Electron Diffraction.pdf](#)

[Simultaneous Observation of Bright- and Dark-Field Large-Angle Convergent-Beam Electron Diffraction Patterns.pdf](#)

[Simultaneous Observation of Zone-Axis Pattern and +-G Dark-Field Pattern in Convergent-Beam Electron Diffraction.pdf](#)

[Assessment of the TEM/CBED procedure for strain determination in <130> zone axis.pdf](#)

[Three-Dimensional Strain-Field Information in Convergent-Beam Electron Diffraction Patterns.pdf](#)