

## Electron Diffraction I

### Goal

This experiment serves to understand the principles of electron diffraction. For this purpose, you will record and study electron diffraction patterns of two different powder specimens by selected-area diffraction (SAD) as well as convergent-beam electron diffraction (CBED). The specimens are metals with face-centered cubic and body-centered cubic crystal structures.

### Experiment

- Load a specimen, start up the microscope, and align it.
- Record a few images of characteristic areas at an appropriate magnification.
- Switch to diffraction, observe, the diffraction pattern, and record it. Select a convenient camera length. Choose a range of exposure times to make sure that you obtain a negative that is neither over- nor underexposed.
- Load different SAD apertures and study the effect of changing the beam convergence and the diffraction focus. Record diffraction patterns with each SAD aperture.
- Systematically vary the camera length and record SAD patterns with minimum beam convergence at each setting.
- Focus the beam on individual powder particles and observe CBED patterns. Try to find particles whose pattern exhibits a high degree of symmetry.
- Study the effect of changing the condenser aperture and the beam convergence. Record and a few CBED patterns under different conditions.
- Load the second specimens and record SAD patterns and CBED patterns for comparison with the patterns you obtained from the first specimen.
- Record a CBED pattern from the support film without including any powder particles.

### Report

- What is the effect of decreasing the SAD aperture?
- Comment on the effect of changing the beam convergence and diffraction focus on the appearance of the ring pattern.
- From the series of diffraction patterns recorded at different camera lengths, determine the actual camera length for each nominal camera length by inserting the appropriate wavelength  $\lambda$  and lattice parameter into Bragg's law and measuring the ring diameters on the negatives. Do not forget to provide *error limits* for your results!

- Compare the characteristic features of the CBED and SAD patterns you obtained.
- What is the effect of changing the condenser aperture on CBED patterns?
- Explain the difference between the ring patterns of the face-centered and the body-centered cubic material.
- Describe the characteristic appearance of diffraction patterns from amorphous materials (support film).