# Microscope Design, Operation, and Alignment

## Goal

You will be introduced to the technical construction and the main components of a transmission electron microscope (Philips CM20), the basic operation of this instrument, alignment procedures, image recording, and darkroom procedures. The specimen of this laboratory is a carbon film supporting $MoO_3$ crystallites. The morphology of these crystallites uniquely correlates with the orientation of the crystal lattice. This is useful for calibrating the rotation of the image and the diffraction pattern as a function of magnification.

## Experiment

1. Record pictures of the instrument and specimen holder with a digital camera.
2. Insert a specimen and start up the microscope.
3. Familiarize yourself with the basic operation (apertures, condenser deflection, specimen translation, magnification, focus).
4. Perform a basic alignment (eucentric height, gun tilt, gun shift, condenser aperture).
5. Observe the rotation of the image as a function of magnification.
6. Observe diffraction patterns.
7. Choose a fixed camera length for diffraction patterns and employ double exposures to document the rotation of the image versus the diffraction pattern as a function of image magnification.
8. Develop the negatives and reload the microscope camera.

## Report

- Referring to your digital pictures, summarize what you learned about the construction of a transmission electron microscope.
- Summarize the purpose and the individual steps of the alignment procedure.
- Include a plot of image rotation versus the diffraction pattern as a function of magnification and comment on the underlying physics.