MSE672–Lab 2: Basic Diffraction

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1 OBJECTIVES

•   Becoming more proficient in alignment of TEM

•   Acquisition of diffraction patterns

•   Use and position of apertures

2 HANDS ON EXERCISE

The sample is a polycrystalline aluminum film on an amorphous lacey carbon film on a copper grid.

2.1 ALIGN TEM AT 31.5 K

• Do a standard alignment at 31.5k and brightness index 11

2.2 APERTURES

This part is done with the screen down.

•   In imaging mode, insert and center the 20um condenser aperture.

•   Switch from "Image" to "Diff"

•   Use "Ill Stig" to stigmata the beam. Make the beam as symmetric as possible

•   Use "Focus" control to make the beam as small as possible

•   Insert the Beam Stop. If the beam is not centered under the Stop use "Image Shift" to position the beam under the Stop

2.3 ACQUISITION OF DIFFRACTION PATTERN

Please note that the central beam in the diffraction pattern of a thin sample contains about 90% of the electron beam current and can easily destroy the CCD camera. Therefore, please **think before you lift the large screen**.
    Generally speaking and MANDATORY in this class, is that

•   the large screen is DOWN and the

•   beam stop is in

EXCEPT for acquisition of the diffraction pattern.
    Another note, there is no use for a diffraction pattern in a TEM if you do not take an image with it. On a simple sample like the one in this class taking an image is not very helpful, but at least we can see the area of the sample per diffraction pattern.

Here is how we do this experiment:

1. Go to standard imaging conditions (31.5 k and illumination index 11)

2. Find an area you want to take the diffraction pattern from

3. Insert the Cond Ap (or SAD) aperture

4. Go in diffraction mode

5. Chose camera length

6. Focus and stigmate (with ILL STIG) the central beam to make it as small and round as possible.

7. Insert beam stop (do NOT move beam stop position at this point. It is already aligned it to the center of the CCD camera)

8. Center diffraction pattern on the beam stop with Image Shift

9. On Camera View set the speed to 0.1 sec

10. Raise the large viewing screen

11. If the diffraction rings are not round use the Objective Stigmator to correct.

12. Acquire diffraction pattern. On Camera Acquire set collection to Focus, set the time to 0.1 – 0.5 sec. (Focus is set to sum 10 images)

13. **LOWER LARGE SCREEN, NOW.**

14. Repeat with a smaller aperture

15. **LOWER LARGE SCREEN, NOW.**

16. Repeat with another camera length but large aperture. **NEVER CHANGE THE CAMER LENGTH WITH THE SCREEN UP**

17. **LOWER LARGE SCREEN, NOW.**

18. Take image of illuminated area.

3 HOMEWORK Make one ppt slide of the following tasks:

1.   Use your diffraction patterns and index the rings.

2.   Use all diffraction patterns from your section and calibrate them.

3.   Plot a calibration curve for the diffraction mode of our TEM.

4 CENTERING OF A CIRCLE IN DIGITAL MICROGRAPH

1. Choose the circle, click approximately in the center of the diffraction pattern and open the circle while you press the *Shift* key.

2. Right click the diffraction pattern and chose *Image Display*, select *Calibration* and set the origin to 512 in X and Y.

3. Check the center of the schematic in the *Control* palette and move the circle to zero in the x and y directions.