Electron Diffraction Tomography: Camera Systems and Realtime TEM-Control

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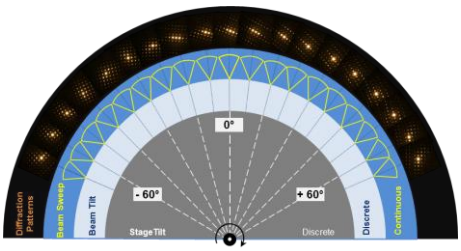
Electron diffraction has some advantages compared to X-ray diffraction. First of all it is possible to get useful diffraction data with very small crystals. The disadvantage of electron diffraction is dynamic scattering. This can be reduced by using precession diffraction technique. A procedure for automated acquisition of tomographic precession diffraction data sets is described by Kolb et al.[1]. The described method is mainly used for less beam sensitive materials. Another approach is described by Zhang et al.[2], using the rotation of the beam perpendicularly to the tilt axis of the goniometer. Since the beam tilt is limited to something like 2°-3° the goniometer tilt is used to fill up the necessary tilt range (± 60°). This method is also not suited for low dose applications because for every beam/goniometer tilt an individual diffraction pattern has to be acquired. Recently, (Shi et al.[3-6]) this method was refined to work under low dose conditions (less than 10 $e^-/Å^2$). The camera system is acquiring continuously diffraction data during a continuous tilt of the goniometer. A problem with this method is the stability of the goniometer tilt speed and the limited flexibility of the tilt acquisition parameters.
We are presenting here a newly developed data acquisition system combining real time direct control of the TEM beam tilt, the goniometer tilt and the acquisition of high resolution diffraction patterns with a synchronized CMOS camera.



As shown in the figure, for a static goniometer tilt, the beam tilt can be incremented by a defined tilt step size and during the exposure time of the camera the beam tilt can sweep up a certain range. This ensures to completely scan the Fourier space.

The beam tilt and deflection systems of the TEM are controlled by our **U**niversal **S**can **G**enerator (USG) and high resolution diffraction patterns are synchronously acquired with our TemCam CMOS camera.

References

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