

Setting up a streak camera for time resolved measurements in the TEM

Ali, H.¹, Eriksson, J.², Li, H.³, Jafri, S.H.M.¹, Ögren, J.³, Ziemann, V.³ and Leifer, K.³

¹ Applied Materials Science, Department of Engineering Sciences, Uppsala University, Sweden, ² Department of Physics and Astronomy, Uppsala University, Sweden, ³ Uppsala University, Sweden

We build a new experimental setup[1] for getting time resolved measurements in the transmission electron microscope (TEM). The setup is based on a streak camera built inside the electron energy loss (EEL) spectrometer which sweeps the electron beam across the CCD camera to obtain time-resolved measurements similar to an optical streak camera[2]. This experimental set up can be installed on any available TEM equipped with an EEL spectrometer.

The streak camera is composed of two parallel conductor plates separated by a dielectric which are mounted inside the EEL spectrometer through TV camera port as shown in Fig. 1. A high voltage is applied to the plates and its polarity is switched periodically across the conductor plates. The application of HV causes the conductor plates to charge up which in turn causes the electron beam to deflect towards positively charged plate as shown in Fig.2. This deflection of the electron beam produces a beam sweep across the CCD camera which effectively converts the sweep axis into a time axis where we get pixel-to-pixel time resolved data. The electron beam is blanked in the reverse charging direction to avoid overriding the data. This beam sweeping and beam blanking process can be repeated several times to get adequate intensity on the CCD.

This set up is capable of recording time-resolved images, diffraction patterns and EEL spectra with a streaking time in the range of 100ns to 10us. Depending on the number of pixels in one beam sweep, the pixel to pixel time resolution can be much higher as compared to the total streaking time.

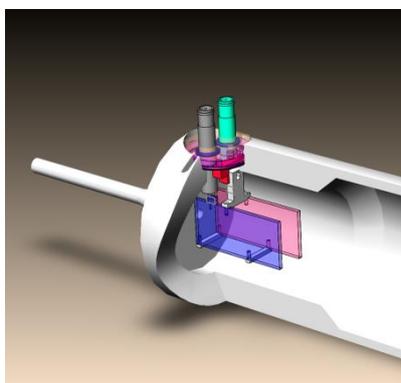


Fig. 1. A drawing of beam sweeper plates in EEL spectrometer

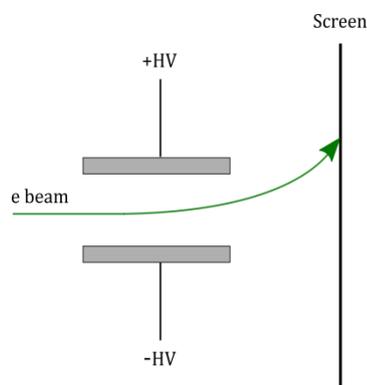


Fig. 2. A schematic of electron beam sweeping action

- [1] H. Ali *et al.*, "An electron energy loss spectrometer based streak camera for time resolved TEM measurements," *Ultramicroscopy*, vol. 176, pp. 5 - 10, 2017.
- [2] D. J. Bradley, K. W. J. Ones, and W. Sibbett, "Picosecond and femtosecond streak cameras: present and future designs," *Phil. Trans. R. Soc. Lond. A*, vol. 298, pp. 281 - 285, 1980.