

## **The Stability of High Tension Measured by Convergent Beam Electron Diffraction as Base for High Accuracy of Lattice Parameter Determination**

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The structure and position of higher order Laue zone (HOLZ) lines in diffraction pattern obtained by convergent beam electron diffraction (CBED) depend on the lattice parameters and the operating voltage of the microscope.

Instabilities like oscillations or drifts of the high tension are therefore limits of the accuracy of the lattice parameter determinations.

Another source for inaccuracies is the detection of the position of HOLZ line in the diffraction pattern. A background noise (caused by the dark-current of camera and inelastic scattered electron) blurs and broadens lines and reduces the signal to noise ratio (SNR).

In this work we are going to investigate the long-time high tension stability of two different TEMs: Philips CM20 at a nominal operating voltage of 200kV and FEI Titan at nominal operating voltages of 80kV and 300kV.

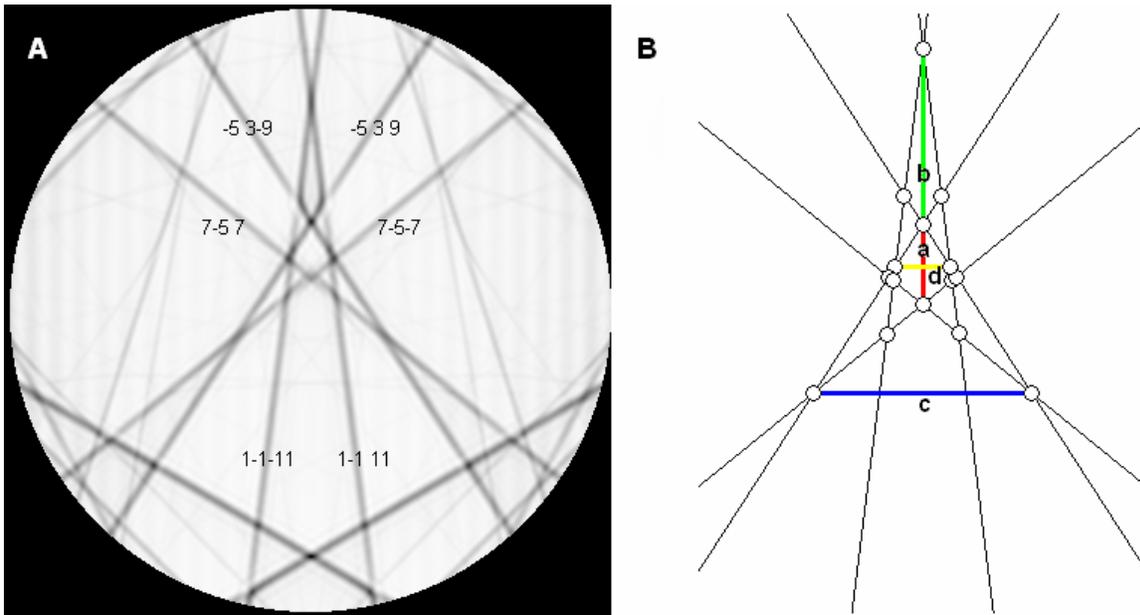
Effects on the stability of the system such as turning on the microscope, changing the accelerating voltage will be discussed as well. In addition the possible obtainable accuracy of lattice parameters determination will be presented depending on the high tension stability of the microscopes.

Fig.1 shows the used HOLZ lines and selected line ratios for determining the high tension and lattice parameters at 200kV (CM20).

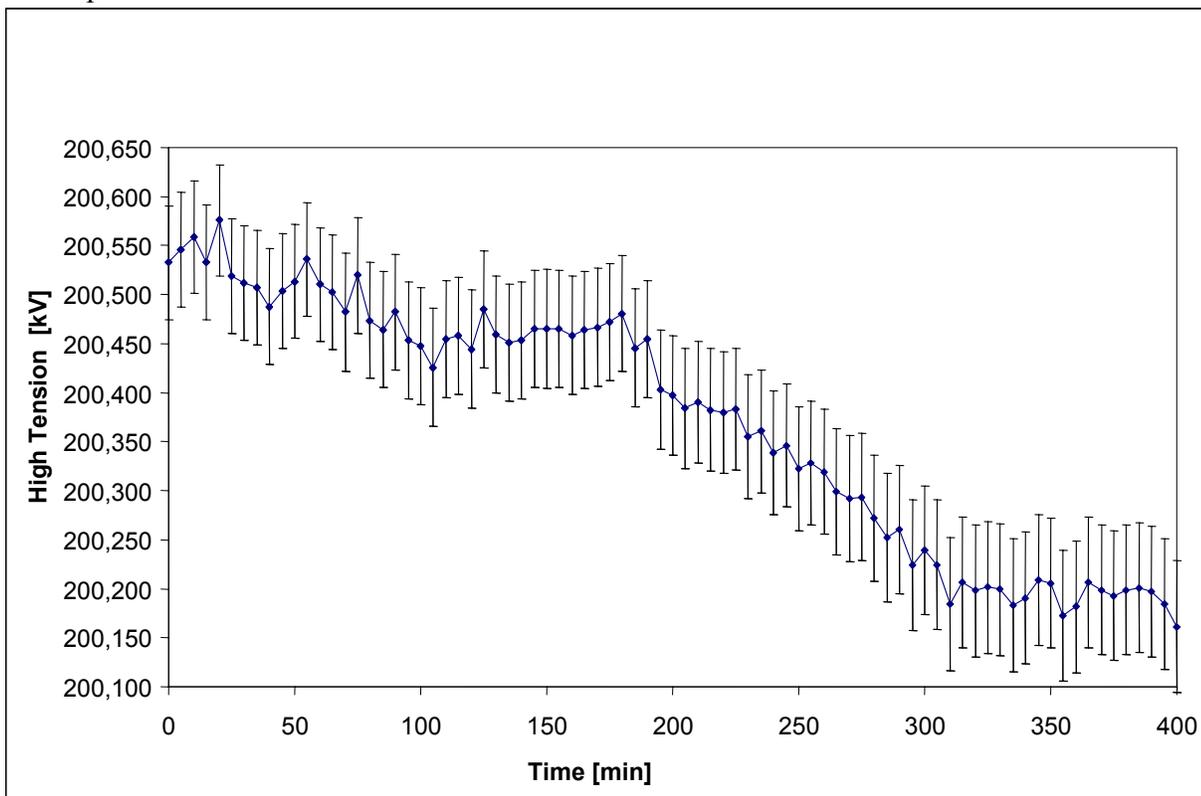
Fig. 2 shows the behaviour of the high tension after turning on a CM20 and working at 200kV. The high tension shows a systematic drift over 6 hours. Continued measurement of the high tension indicate the the CM20 needs about 18 hours to reach stable condition. The stable final voltage is 200,067kV. The error of the measurement of the accelerating voltage is smaller then 26V.

The investigations of the FEI Titan show that system has a mean stable voltage of  $301,133 \pm 0,023$ kV for 300kV nominal voltage, and  $80,200 \pm 0,004$ kV for 80kV nominal voltage.

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**Fig.1.** Calculated CBED-pattern at 200kV and used HOLZ-lines and line ratios for high tension and lattice parameter determination.



**Fig.2** Long-time behaviour of high tension of CM20 (measurements started 20min after turning on the system)