



Contribution ID: 2598 Contribution code: WEODB3

Type: Contributed Oral Presentation

Understanding the beam quality requirement for high energy electron microscopy

Wednesday, 10 May 2023 12:10 (20 minutes)

Commercial electron microscopes with a few hundred keV energies are fundamental tools for understanding the micro- to nano-scale world. One of the frontiers in electron microscopy development is to push the beam energy to MeV range to achieve improved lateral resolution for thick samples. Here we show the theoretical and preliminary experimental analysis of the electron beam quality required in the imaging and diffraction processes with different beam energy. By correlating the diffraction and imaging modalities, we use the focused beam scheme to characterize the beam emittance of a 200 keV TEM and a MeV UED. The quantitative correlation between the measured emittance and the obtained image resolution are established. This work demonstrates a characterization technique for electron microscopy and provides a guidance for designing a MeV electron diffraction and imaging beamline.

Funding Agency

The work was partially supported by the Tsinghua University Initiative Scientific Research Program No. 20197050028.

Footnotes

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Session Classification: MC06.2 - Beam Instrumentation, Controls, Feedback & Operational Aspects (Contributed)

Track Classification: MC6: Beam Instrumentation, Controls, Feedback and Operational Aspects: MC6.T03: Beam Diagnostics and Instrumentation