ELECTRON HOLOGRAPHY

Electron holography permits the retrieval of both amplitude and phase of an electron wave, whereas the phase information is normally lost when recording electron images. From the amplitude and phase images, the exit-surface wave can be reconstructed. The phase image can also give high spatial resolution information about any electric and magnetic fields in the specimen.

Possible Applications

- Resolution enhancement for atomic resolution imaging[1]
- Imaging of electric[2] and magnetic[3] fields at high spatial resolution
- Accurate (about 1%) measurement of mean inner potential and quantitative imaging of variations in mean inner potential[4]
- Imaging of surface steps[5] and dislocations at surfaces[6]

Specimen Requirements

Specimens must be thin enough (<50nm) so that there is insignificant inelastic scattering; region of interest must be no more than 50nm from specimen edge; specimen should be non-charging; specimen can be prepared by any technique suitable for high resolution imaging although cleaved wedges are particularly suitable.

Limitations

Atomic resolution with limited field of view (<50nm) or low resolution (>10nm) with a larger field of view (>1µm); region of interest must be within 50nm (high resolution) to 1µm (low resolution) of specimen edge; results can be difficult to interpret due to objective lens transfer function and dynamical diffraction.

Suitable Microscopes

This technique is available on the following instruments:

- Philips CM200-FEG

References

1. H. Lichte, Advances in Optical and Electron Microscopy **12**, 25 (1991).
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3. N. Osakabe, et al, Appl. Phys. Lett. **42**, 746 (1983).
4. M. Gajdardziska et al, Ultramicroscopy **50**, (1993) p. 285.

5. A. Tonomura, et al, Phys. Rev. Lett. **54**, 60 (1985).
6. N. Osakabe, et al, Phys. Rev. Lett. **62**, 2969 (1989)