CONVERGENT BEAM ELECTRON DIFFRACTION (CBED)

CBED is a microanalytical technique that uses a convergent or focused beam of electrons to obtain diffraction patterns from small specimen regions. CBED patterns consist of discs of intensity (rather than spots) which are rich in detail and can be exploited to reveal various aspects of specimen microstructure.[1,2] Spatial resolution is determined by the focused incident probe size.

Possible Applications

- Measurement of specimen thickness[3]
- Measurement of small (0.1%) changes in lattice parameter (due to composition, strain, etc.)[1,4,5]
- Fingerprinting (i.e. phase identification, complementary to EDX, EELS spectra)[6]
- Symmetry determination (point and space Groups for crystallographic analysis of new phases, analysis of phase transitions)[7]
- Low-order structure factor amplitude and phase determination[8]
- Burger's vector determination[9]

Specimen Requirements

Specimens must be crystalline, relatively beam-insensitive, and generally greater than about 60nm thick for most applications; they may be prepared by chemical thinning, ion-beam milling, lift-off of layers, crushing (microcleavage), and/or extraction replicas.

Limitations

The use of thin specimens (<60nm) limits the precision or feasibility of most applications. Small particles (~10nm) will usually also be thin and thus subject to the same limitations. Very thick specimens cause beam broadening and a degradation of spatial resolution.

Suitable Microscopes

This technique is available on the following instruments:

- FEI Tecnai F20
- JEOL JEM 2000FX
- JEOL 2010F
- Topcon 002B
- Philips CM200-FEG

References

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9. R.W. Carpenter and J.C.H. Spence, Acta Cryst. **A38**, 55 (1982).