SCANNING ELECTRON MICROSCOPY (SEM)

In scanning electron microscopy (SEM), an electron probe of typically 2-50 nm in diameter is focused onto the specimen. A scan generator simultaneously rasters this focused beam across the sample and drives the x- and y-scan coils of an image monitor. Multiple specimen signals can be detected, including secondary electrons (SE), backscattered electrons (BSE), X-rays (EDS), electron-beam-induced current (EBIC) and cathodoluminescence (CL). These signals can then be used to modulate the monitor intensity and thereby build up a two-dimensional map of the near-surface topography, composition and possibly electronic nature. Spatial resolution is limited both by the size of the focussed probe and also by the information volume (penetration depth) of the specimen excitation.

Possible Applications

- surface topography (SE, BSE)
- elemental mapping (EDS)
- inspection of semiconductor devices (EBIC, CL)

Limitations

Higher voltage operation results in smaller probe size and possibly better resolution depending on the detected signal, but specimen charging, increased heat generation, and radiation damage can compromise specimen and signal integrity. Carbon coating is usually required for biological, organic and insulating specimens.

Suitable Microscopes

This technique is available on the following instruments:

- Nova 200 NanoLab
- XL30 ESEM

References

1. J. Goldstein et al. Scanning Electron Microscopy and X-ray Microanalysis (Plenum, New York, 1981).
2. L. Reimer, Scanning Electron Microscopy, Physics of Image Formation and Microanalysis (Springer Series in Optical Sciences, Vol. 45, Springer, Berlin, 1985)