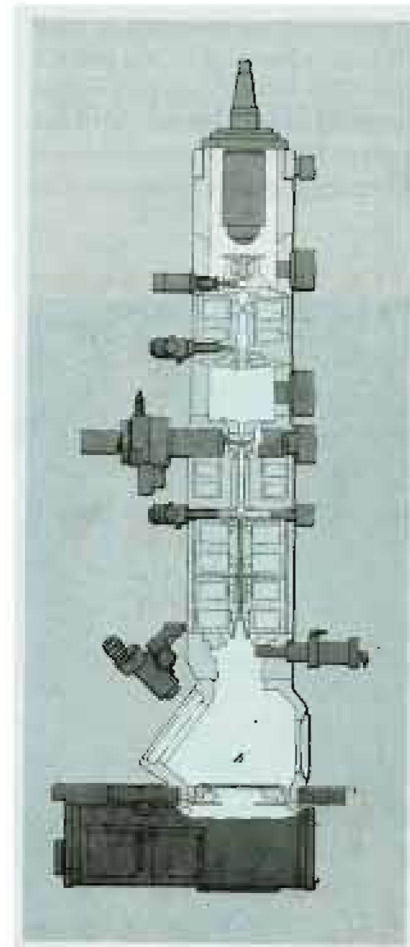
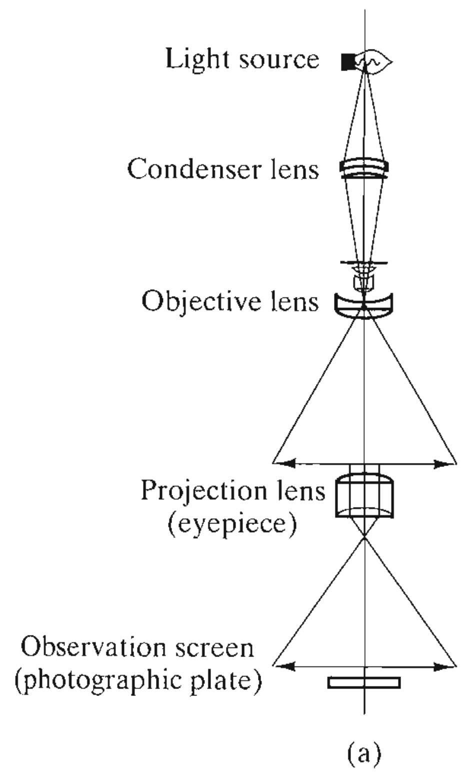
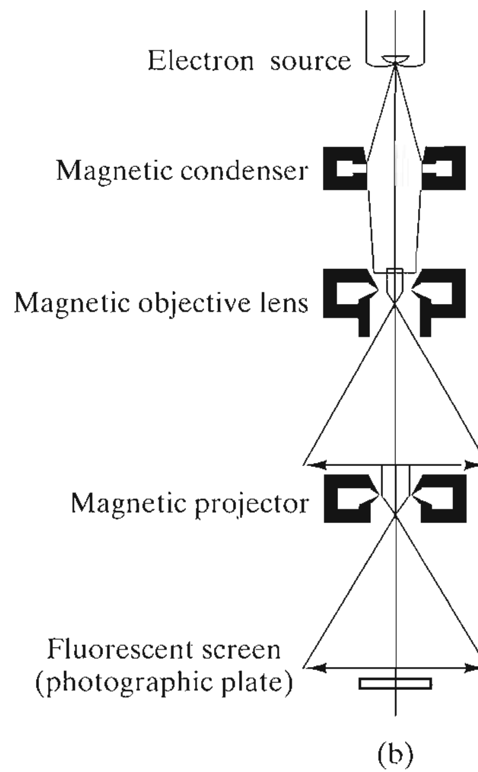
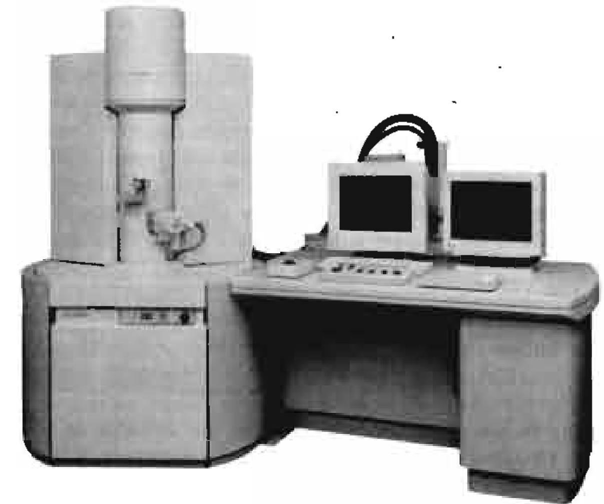
Transmission electron microscope (TEM)

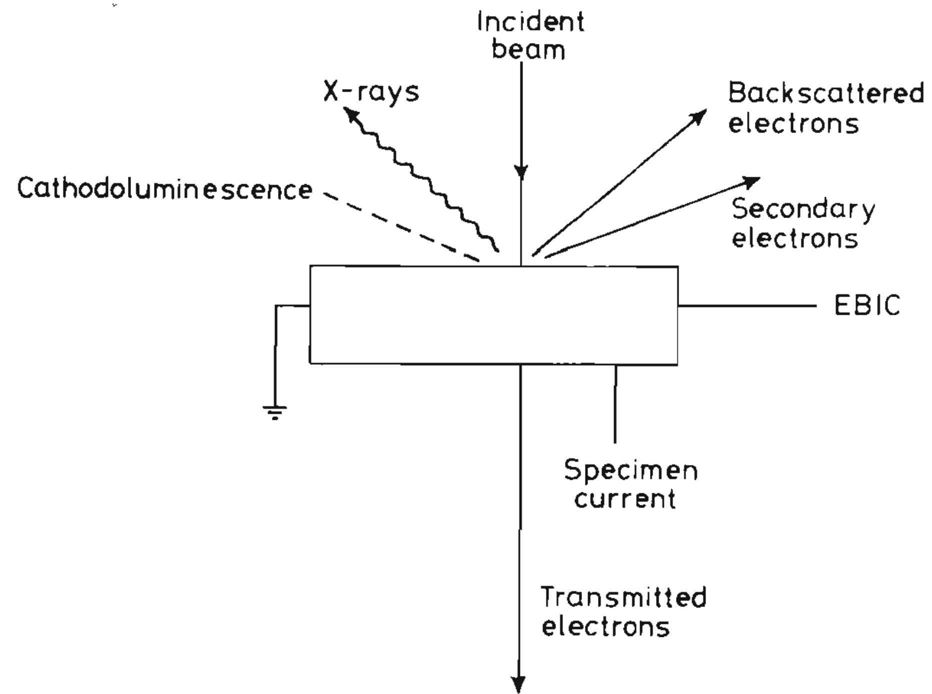




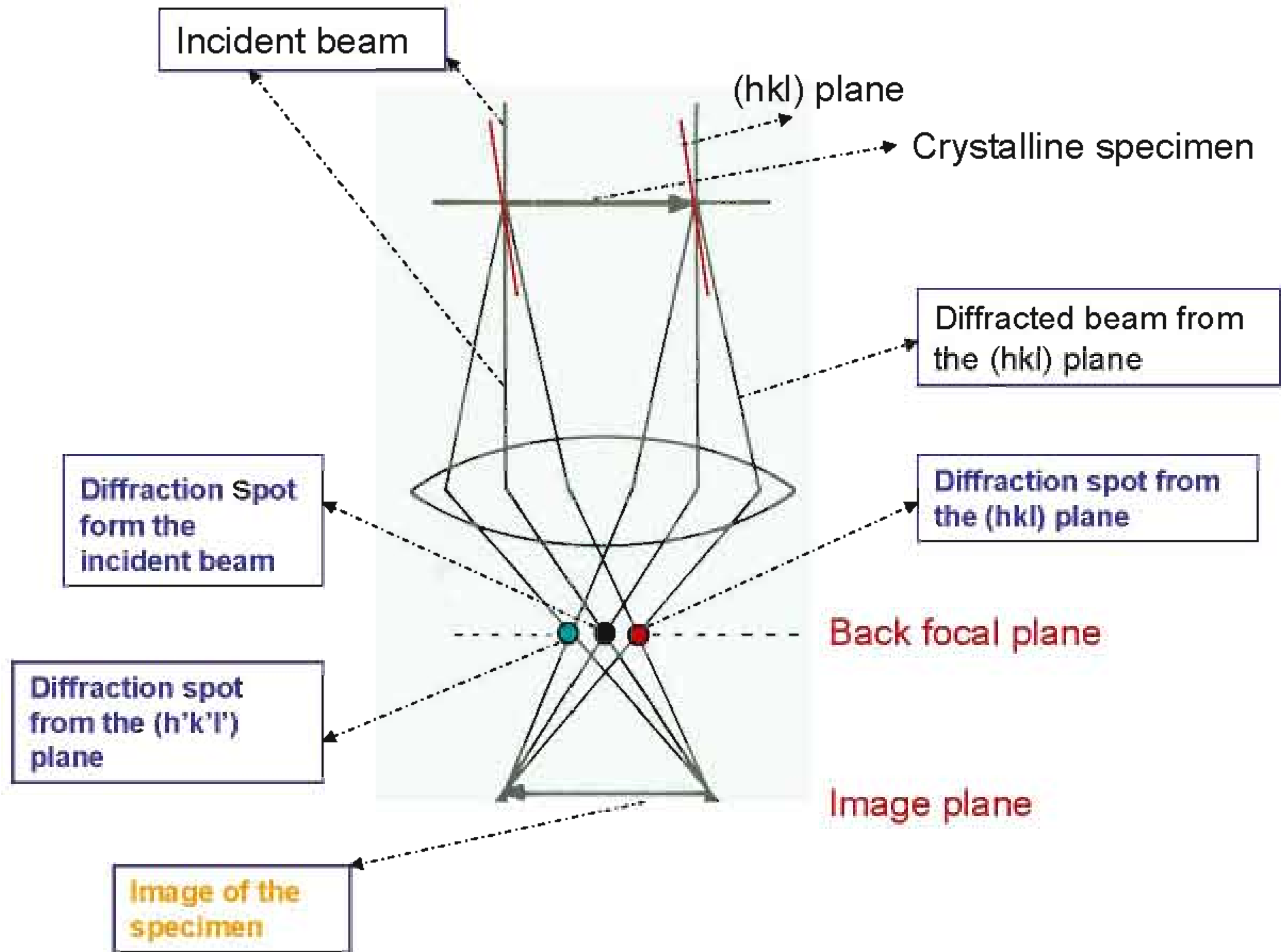




Similarity in design between (a) an optical microscope and (b) a transmission electron microscope.

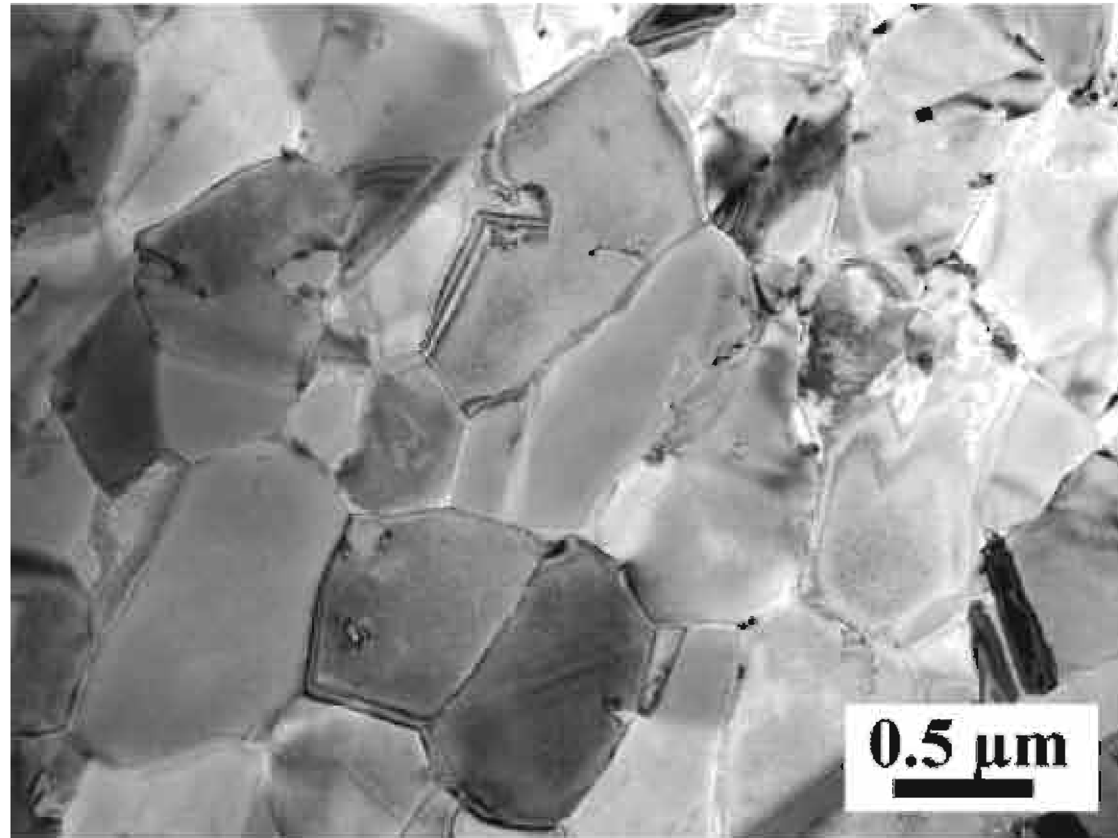


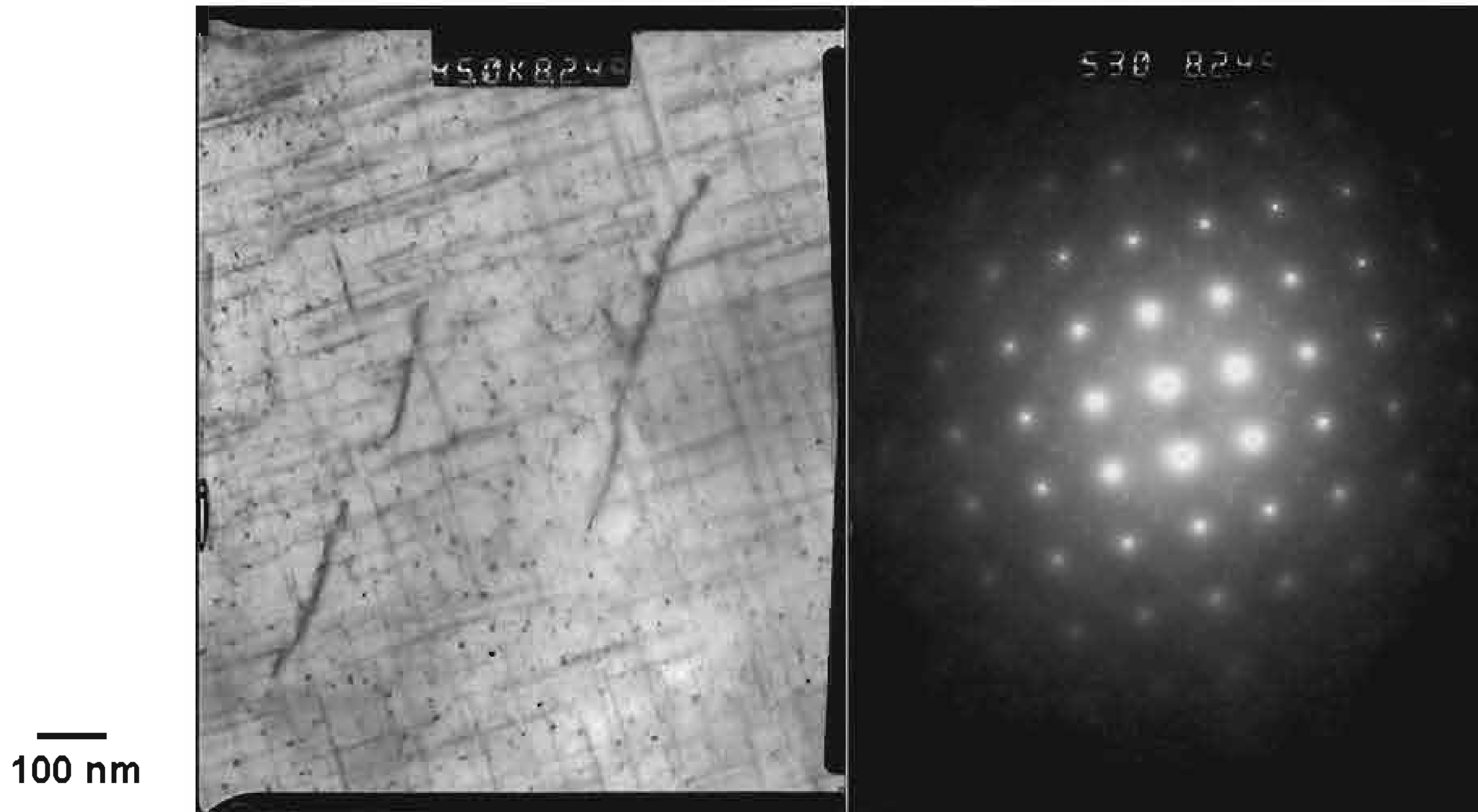
Interaction between the electron beam and the materials



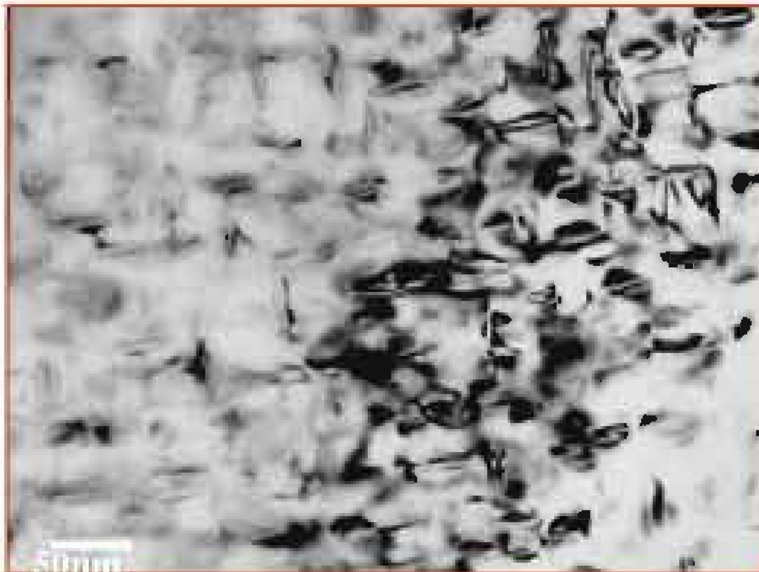
Formation of the diffraction pattern and the image in the TEM

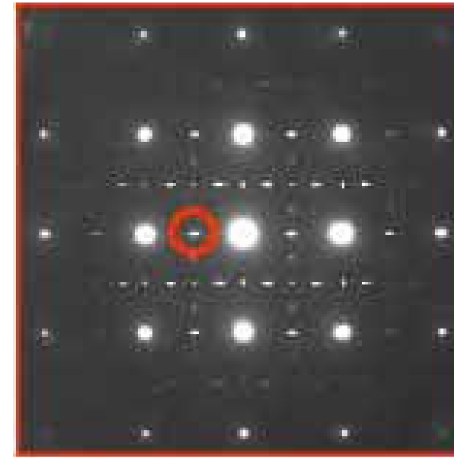
Electron diffraction pattern


0.5 μm

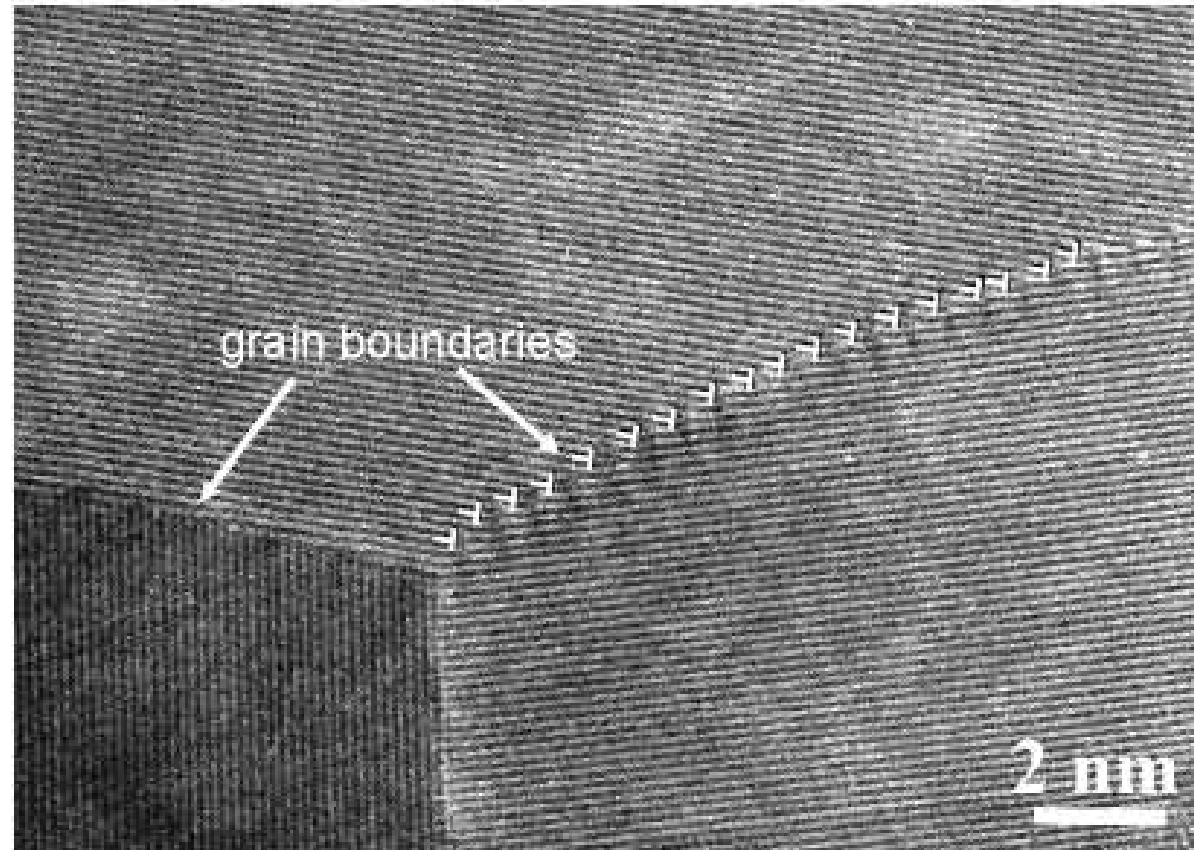


Precipitates formed in an Al alloy (a) bright field image; (b) dirrfaction pattern from the area in (a).





Precipitates formed in a spray-formed IN 718 aged at 750°C for 24h; TEM, (4918)



High resolution images formed in the TEM.

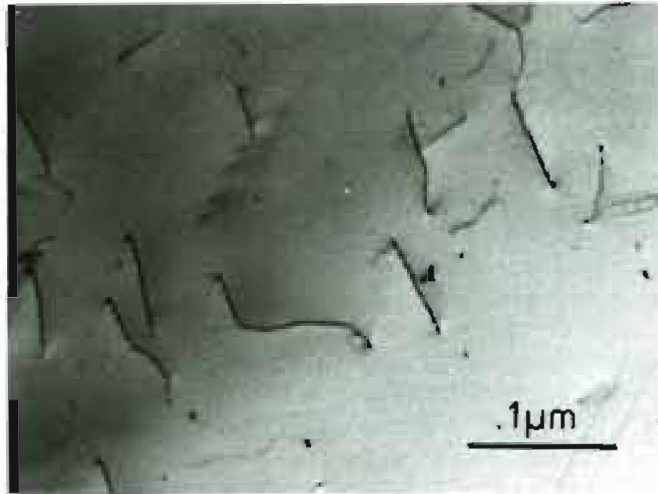
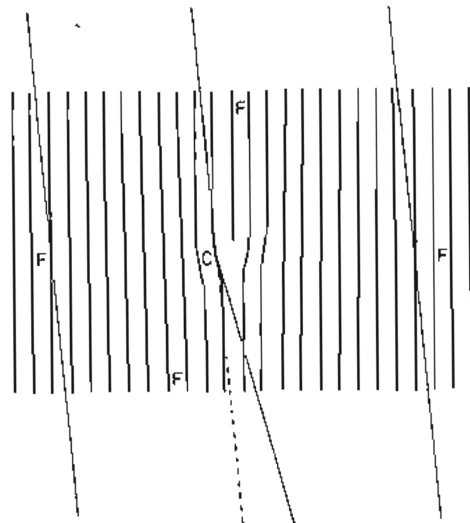
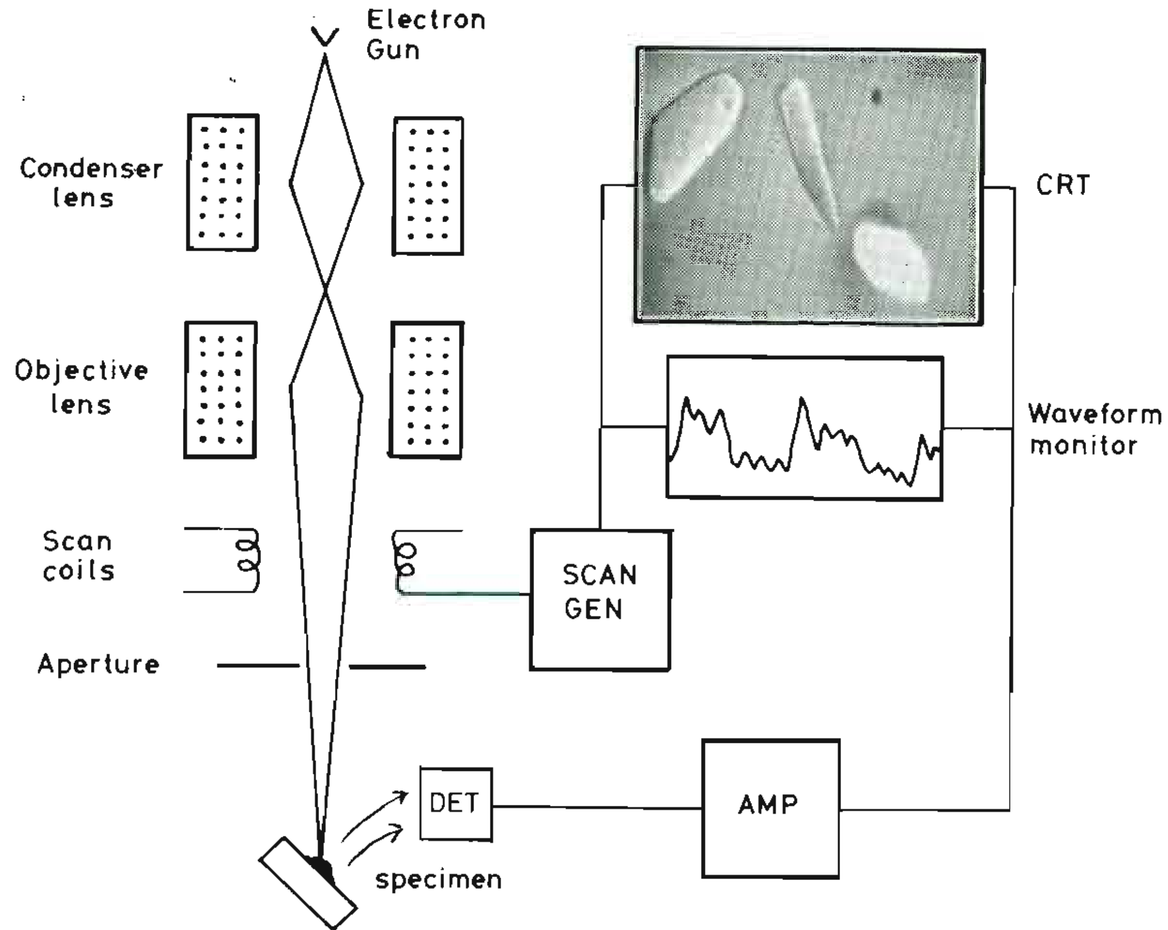


Figure 4.22 Dislocations in strong diffraction contrast in a metal foil.



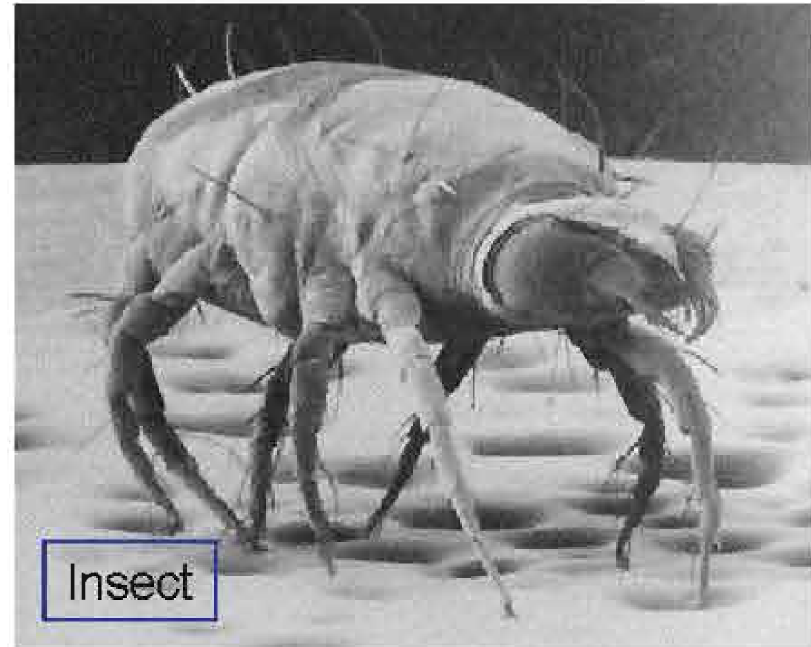
Scanning electron microscope

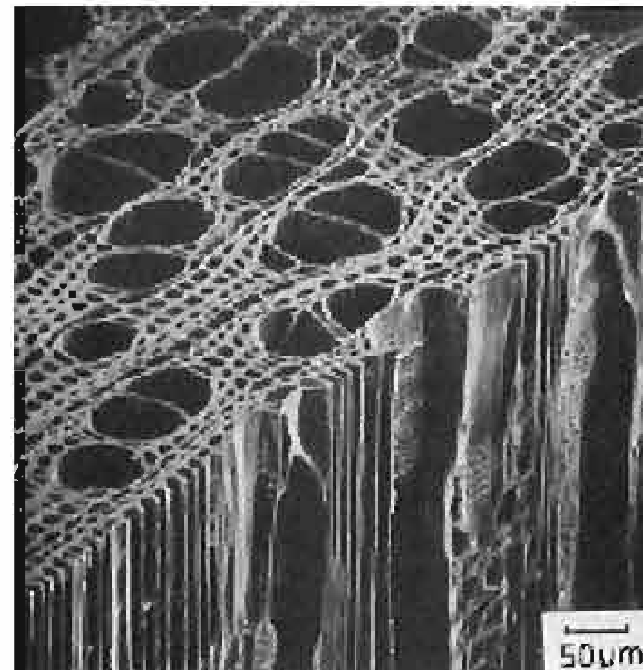


Schematic diagram showing the main component of a scanning electron microscope

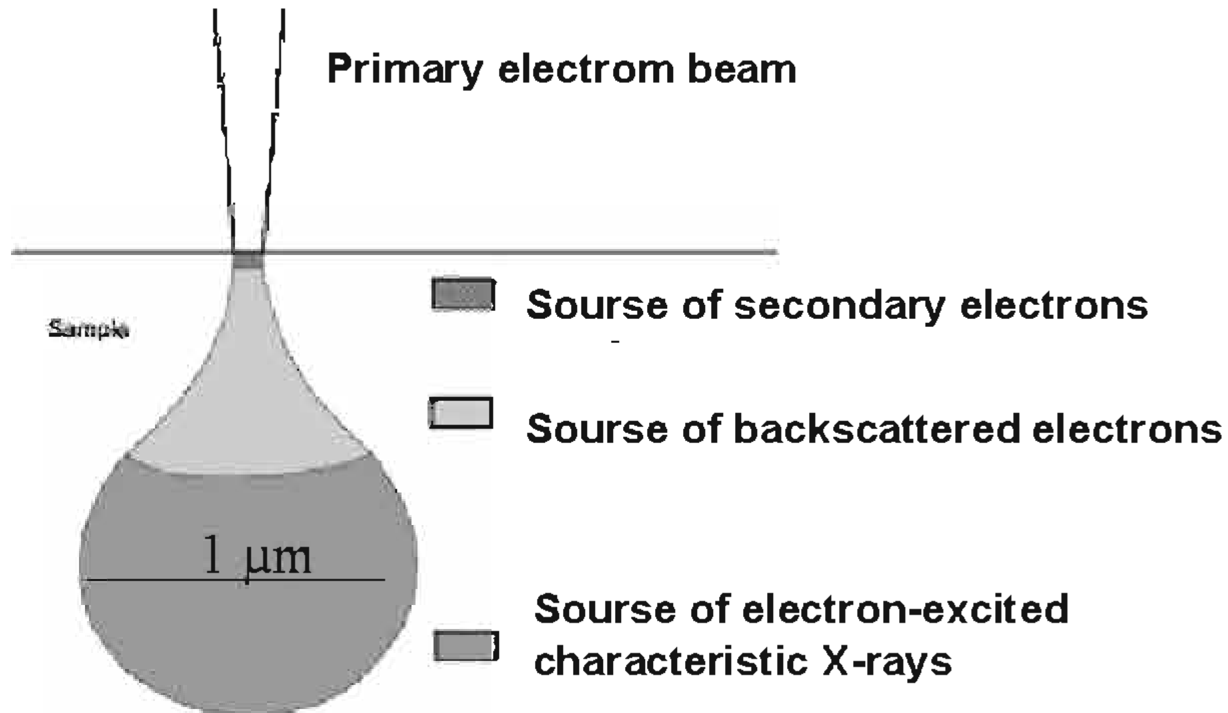
SEM advantages

1. Resolution
2. Depth of focus
3. Chemical analysis



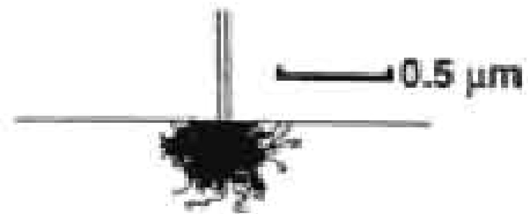


Beam – specimen interaction 20kV

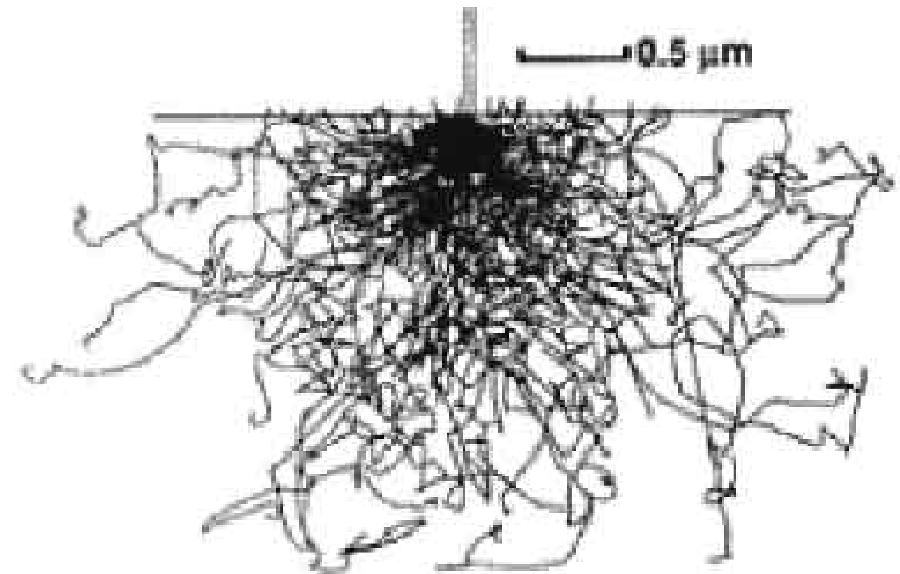


Accelerating voltage

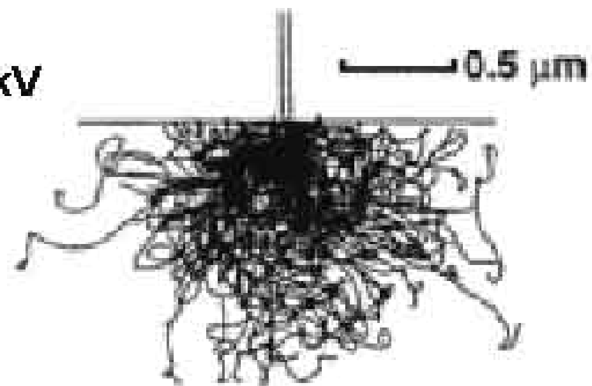
10 kV



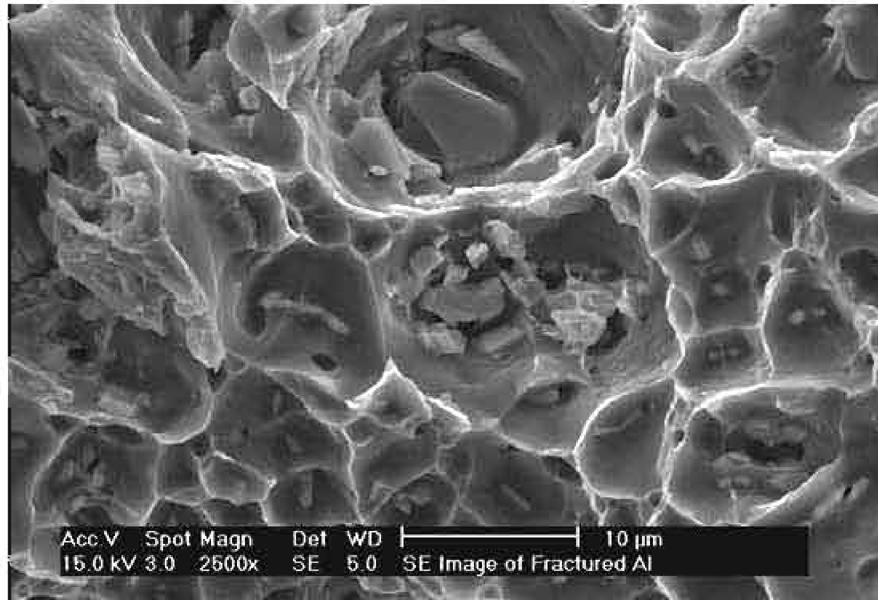
20 kV

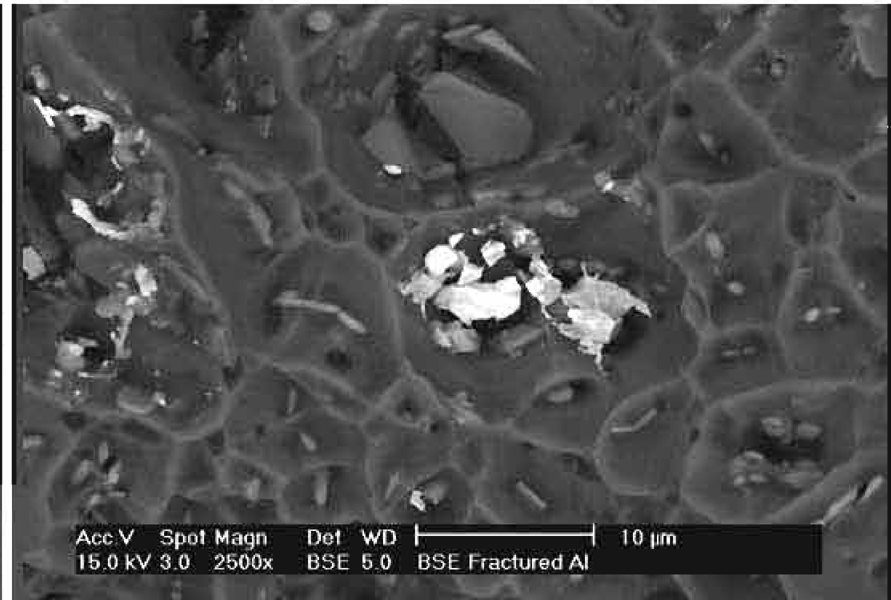


30kV



Monto Carlo simulation of electron trajectories in iron as a function of accelrating voltage.



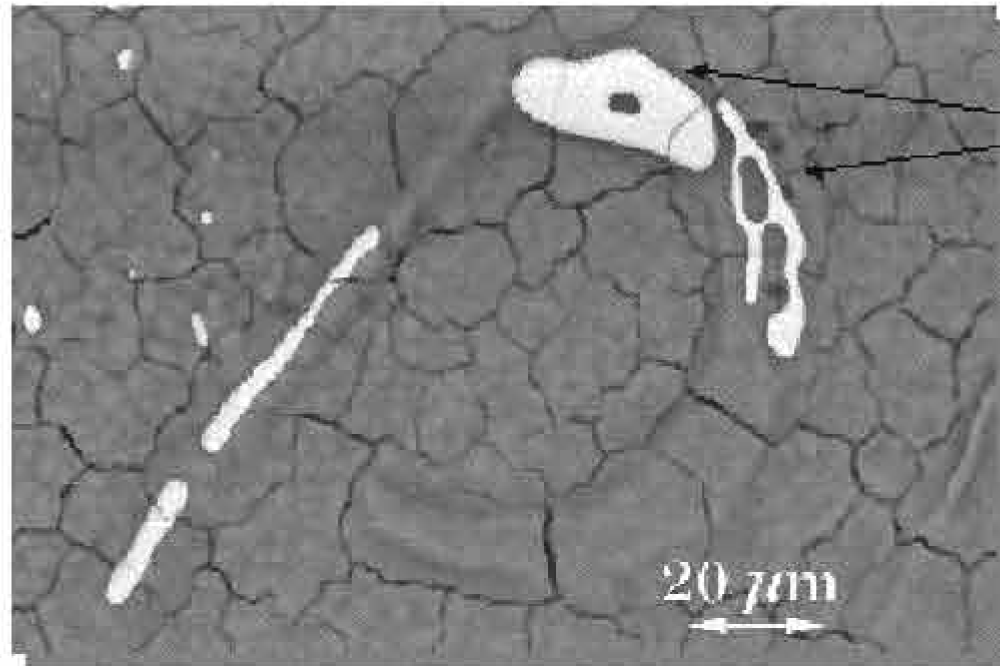


Secondary electron image (topographic image)

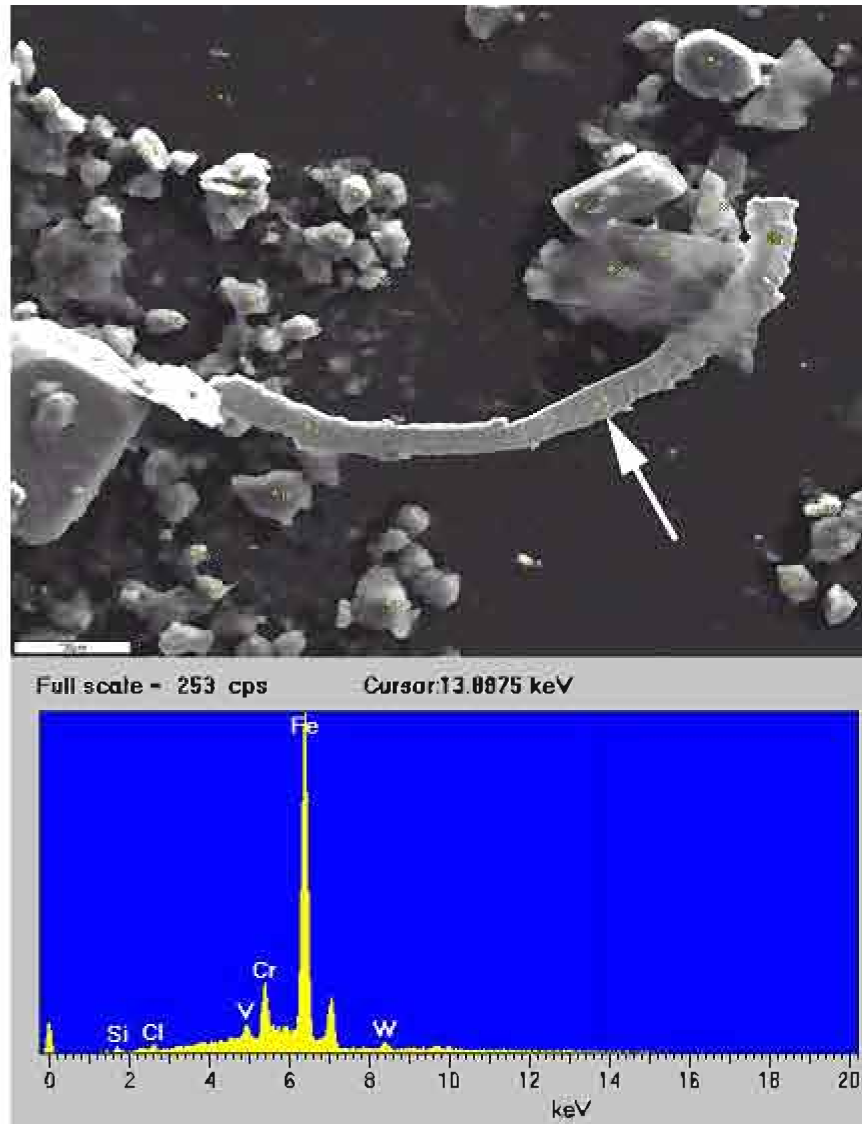
Backscattered electron image (compositional image)

BSE – atomic number contrast

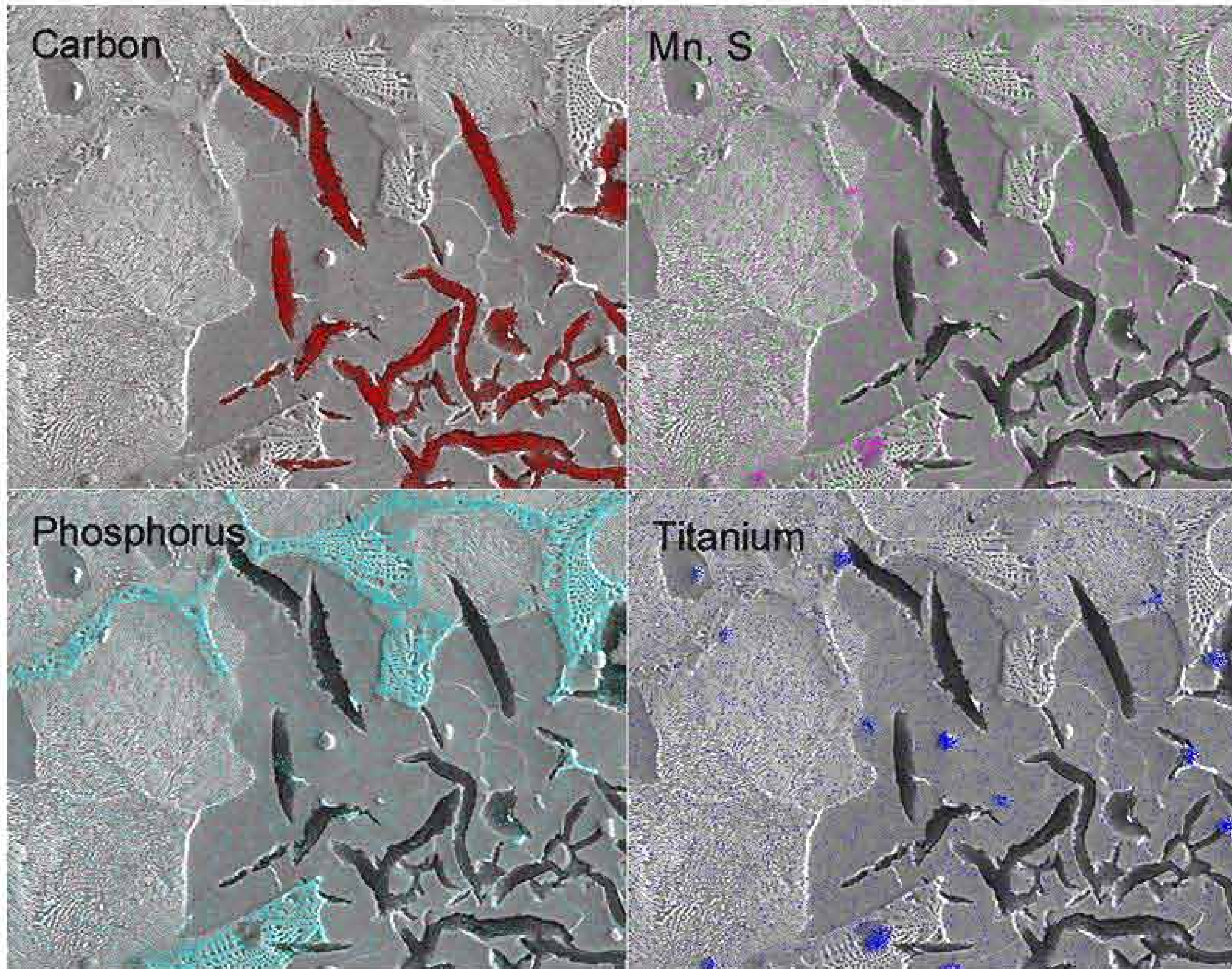
Oxidised
silicon nitride



Y rich



Secondary electron image (SEI) and the X-ray energy dispersive spectrum (XEDS) obtained from the arrowed particle.



Compositional maps (or X-ray images)