Applications of electron energy-loss spectroscopy (EELS) to elementar mapping in the nanoscale

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The development of modern materials is becoming increasingly reliant on the accurate chemical analysis on the nanoscale. Spectrum Imaging is the collection, visualization and processing of detailed spectroscopic information to create images or line profiles. One special spectrum imaging form is the Electron Energy Loss Spectroscopy (EELS) contrast. In the Energy Filtered Transmission Electron Microscopy (EFTEM), the long aquisition times and image drift of the scanning mode (STEM) can be bypassed and it is possible to map the chemical distribution at high resolution, using only electrons that have suffered an energy loss characteristic of the element of interest, typically an ionisation edge in the 100-3000 eV range. The resultant composite image provides a convenient means to communicate the degree of mixing of the elements, for example the elements that precipitate or segregate at the grain boundary.
Applications in biominerals, rock minerals and alloys will be presented, to show the powerful possibilities of EFTEM imaging. In mineralogical samples the technique is specially important, because the EFTEM is more effective than EDS-STEM for light elements. The possibility to perform filtered imaging mainly of the major (light) elements of the constituting minerals is a prominent step towards better understanding of the complicated reaction pathways that can occur in the nanoscale.