

## Electron Energy-Loss Spectroscopy (EELS) and Energy-Filtered Transmission Electron Microscopy (EFTEM)

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### Abstract

EELS (electron energy loss spectrometry) is a technique used in Transmission Electron Microscope (TEM). It analyses the energy \*lost\* by the incoming fast electrons when they travel through the sample. While diffraction effects in the TEM are driven by the interaction of the fast electrons with the nucleus, in EELS, one deals with electro-electron interactions. This is the interaction between the electron of the beam and the electrons in the sample.

Therefore EELS is able to provide information about the electronic structure of the sample. EELS can also be used for chemical analysis, and can provide quantitative information about the composition of the specimen. Since the energy lost is relatively small compared to the energy of the incoming electron (at most 2 to 3000 eV compared to 120 -300 keV in conventional microscopes), the electrons which have lost energy can still be “used” for imaging the specimen. Imaging the specimen with electrons which have lost the energy characteristic for a certain atom will provide a cartographic picture of the repartition of this kind of atom in the sample. This is called chemical mapping.

Looking at the fine structure in the EELS spectrum will give information about the electronic state in the samples, and these results can be compared to theoretical calculations.

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