Artifacts, Contrast mechanisms and Strategies for recording EELS Spectroscopic Images for Different Energy Regimes with Applications for Heterogeneous Catalysis

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When recording electron energy loss spectroscopic images, there are many degrees of freedom. For instance, trade-offs must be made between signal-to-noise, spatial resolution, and energy resolution: opening the EELS collection angle increases signal collection efficiency and image interpretability; however, it also reduces the jump ratio of core-loss edges. In many spectrometers, there is also a reduction in energy resolution. Optimizing spectral collection requires forethought and consideration of the specimen, the microscope, and the spectrometer. Different strategies are required to extract the chemical and bonding information at different energy losses. Nanoscale fingerprinting is possible from various statistical fits in the low-loss region. At moderate energies, great care needs to be paid to background subtraction. At high energies, the spatial resolution is better and the interpretation is simple, however the signal-to-noise ratio is poor. In this talk I will present practical details on recording and processing EELS spectroscopic images for both chemical and electronic information. I will discuss the underlying contrast mechanisms and artifacts in EELS spectroscopic maps, various processing techniques for different energy regimes, and applications for in-situ and ex-situ study of catalyst nanoparticles.