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Analytical electron microscopy in an aberration-free environment

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A fully aberration-corrected electron microscope such as the proposed National Transmission Electron Achromatic Microscope (NTEAM) presents outstanding opportunities for improved analytical electron microscopy in materials science. This presentation will explore some possibilities in the areas of (i) elemental mapping and electron diffraction by energy-filtered transmission electron microscopy (EFTEM), and (ii) electron energy-loss spectrometry (EELS) and X-ray energy-dispersive spectroscopy (EDS) with small probes in the scanning transmission electron microscopy (STEM) mode. Bolometer (or microcalorimeter) X-ray detectors currently under commercial development could lead to dramatic improvements in sensitivity at high spatial resolution for applications such as intergranular segregation, where it should be possible to measure 1% of a monolayer coverage. The combination of a monochromator, aberration corrector, and high-resolution electron spectrometer could lead to "synchrotron spectral resolution at atomic spatial resolution," for EELS studies of chemisry and bonding at defects.

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