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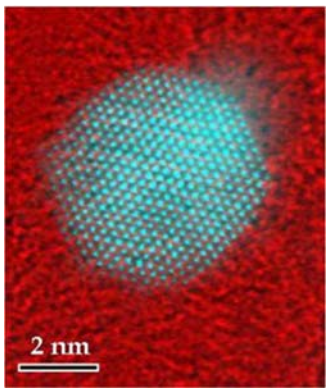
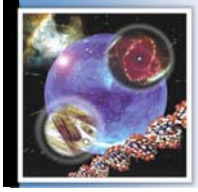
Aberration-corrected Electron Microscopy of Supported Atoms, Clusters and Nanoparticles

The electron microscope has evolved into a highly sophisticated and expensive instrument. Atomic-level information is now routinely accessible by either the scanning- or fixed-beam electron microscopy techniques. Various types of lens aberrations can now be corrected, primarily due to the rapid advancement in computer technology and sophisticated electronics in the last decade. With the aberration-corrected electron microscopes sub-angstrom resolution imaging is becoming routinely accessible by general users, especially those researchers in the field of nanotechnology. The combination of sub-angstrom resolution imaging with atomic level electron energy loss spectroscopy, environmental chamber or novel sample holder makes an advanced TEM/STEM the most powerful nanocharacterization instrument for nanoscience and nanotechnology research. In this presentation, I will briefly discuss the lens aberrations, their limitations on the achievable image resolution, and the different types of aberration-correctors. Applications of the aberration-corrected electron microscopy techniques to the study of supported single-atom, subnano cluster, and nanoparticle catalysts will be emphasized.



Sub-angstrom resolution high-angle annular dark-field and bright-field STEM composite image of an alloy nanoparticle in a fuel cell catalyst, clearly revealing the atomic arrangement of surface atoms of the bimetallic nanoparticle, the graphitic structure of the carbon support and the shape of the nanoparticle.



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