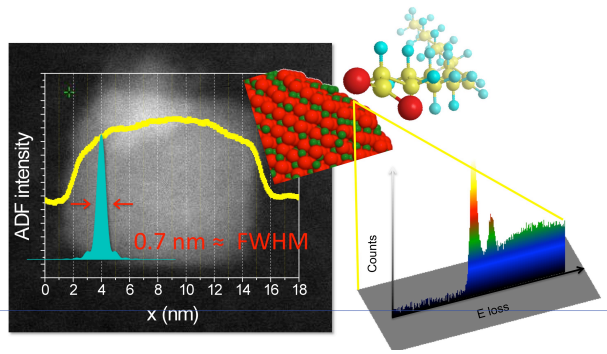
Sub-nanometer electron probes map magnetism at the nanoscale

For the first time, the electron microscope has been used to map the magnetization of nanoparticles in real space with sub-nanometer spatial resolution, along with their structure, chemistry and electronic properties. Research on magnetic materials has been long hampered by the lack of real space probes capable of looking at these systems with true sub-nanometer eyes. Studies, for example, of the magnetic properties of defects in a crystal, or the surface magnetism in interfaces or nanoparticles were as limited as our understanding of the underlying Physics. Electron magnetic chiral dichroism in the aberration corrected electron microscope, combined with density functional calculations, has shown that capping the surfaces with an organic acid restores magnetization on the surface layer[1]. The bonding with the acid's O atoms results in O-Fe atomic configuration and distances close to the bulk values. We conclude that the nature and number of molecules in the capping layer is an essential ingredient in the fabrication of nanoparticles with optimal magnetic properties.



Probing magnetism at the surface of nanoparticles with a sub-nanometer electron beam.

Steve Pennycook 6/7/12 3:40 PM
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[1] *"Surfactant organic molecules restore magnetism in metal-oxide nanoparticle surfaces"*. J. Salafranca, J. Gazquez, N. Perez, A. Labarta, S. T. Pantelides, S. J. Pennycook, X. Batlle, M. Varela. Nanoletters **12**, 2499-2503 (2012).

These are the instructions received from Linda Horton: Highlight must refer to a recent (within weeks!) archival publication. Should be about 175 words. Avoid the use of scientific jargon and discipline-specific terms. The highlight is targeted for an exceptionally diverse audience: non-specialist scientists as well as non-scientists. Choose an appealing title that will compel the readers to read the entire text. State the achievement in the first sentence as a clearly worded statement of the discovery, breakthrough, or advancement – use lay language if possible. Follow this with a statement as to why the achievement is scientifically important and the broader impact (societal, technological, etc.) (this is the second sentence): technology

implications/potential applications, energy, and/or scientific discovery. Do not include future plans and what is now being pursued.

Text right-aligned, 12pt Times New Roman.

Text mentions the actual publication[1] somewhere.