School of Physics and Astronomy &
Monash Centre for Electron Microscopy

SEMINAR

Quantitative Characterisation of Catalyst Nanoparticles using STEM

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When: Tuesday 21st February, 2017
Time: 2pm to 3pm
Where: Seminar Room 107, 10 College Walk, Monash University, Clayton

The addition of a second element to platinum-based catalysts, in either a mixed-alloy or core-shell structure, reduces the mass of expensive platinum metal used and can lead to significantly higher catalytic activity for hydrogen fuel-cell applications. Further improvement of these systems requires careful investigations on their atomic-scale structure and composition. Annular dark-field scanning transmission electron microscopy (ADF STEM) can provide structure information. Through careful quantification of the intensity and comparison with careful standards, simulations or statistical methods, it is possible to estimate the 3D structure of single element nanoparticles. However, reliable composition analysis requires spectroscopic analysis.

Aberration correction in STEM, which allows for increased beam currents in smaller probes, and silicon drift detectors (SDDs), which provide a significant improvement in x-ray count rates, have opened up a new era in energy dispersive x-ray (EDX) microanalysis at nanometre and even sub-nanometre scales. In the same way that scattering cross sections can be calculated from ADF STEM images, it is possible to calculate EDX STEM partial ionization cross sections. This approach, which is reminiscent of Watanabe's ζ-factor method, is simple to implement but promises quantitative chemical analysis at the atom scale. I will discuss the advantages of this approach and its application to the study of bimetallic catalyst nanoparticles.

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