The application of novel TEM techniques to the study of Pt catalysts

L Cervera Gontard
Department of Materials Science and Metallurgy, University of Cambridge, Pembroke Street, Cambridge CB2 3QZ, UK
e-mail*: lc358@cam.ac.uk*

R E Dunin-Borkowski
Department of Materials Science and Metallurgy, University of Cambridge, Pembroke Street, Cambridge CB2 3QZ, UK

L-Y Chang
Department of Materials, Oxford University, Parks Road, Oxford OX1 3PH, UK

A I Kirkland
Department of Materials, Oxford University, Parks Road, Oxford OX1 3PH, UK

C J D Hetherington
Department of Materials, Oxford University, Parks Road, Oxford OX1 3PH, UK

D Ozkaya
Johnson Matthey Technology Centre, Blount's Court, Sonning Common, Reading RG4 9NH, UK

Industrial catalysts usually comprise crystalline particles of high atomic number that have sizes of between 1 and 20 nm and are supported or embedded in a lower atomic number matrix. Electron microscopy is an important tool for the physical characterisation of their shapes, sizes and crystalline structures, which are, in turn, important for understanding their catalytic properties. Here, developments in transmission electron microscopy (TEM) such as spherical aberration (C_s) correctors and in scanning transmission electron microscopy (STEM) such as high-angle annular dark field (HAADF) electron tomography are applied to the study of 5-10 nm platinum nanoparticles supported on carbon. Indirect methods are used to remove lens aberrations using through-focal series exit-wavefunction restoration (TF-EWR). The aim of the work is to assess the degree to which an appropriate choice of spherical aberration coefficient provides an improvement to image quality and interpretability for such particles, both with and without the use of TF-EWR , and at the same time to combine these measurements with three dimensional information obtained about the particle morphologies using HAADF electron tomography.