Imaging at the Nanoscale with Multilayer Laue Lenses

Scientific Achievement

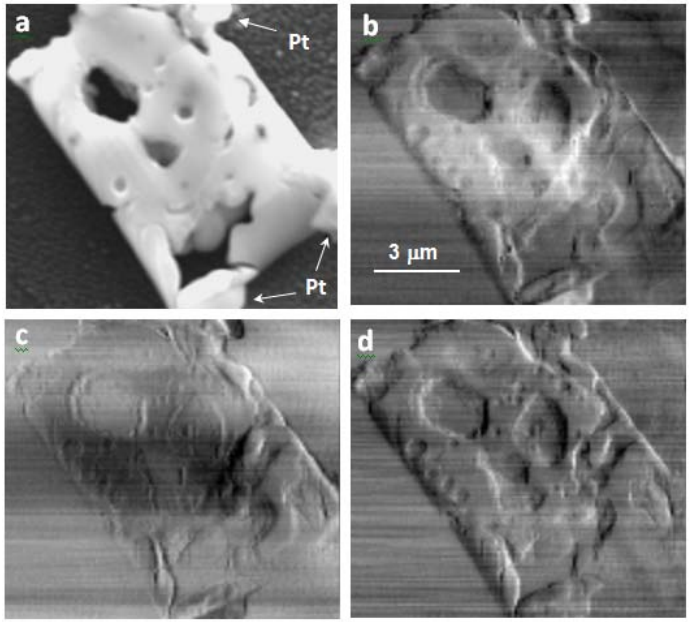
Developed a novel algorithm that enhances the quantitative phase imaging capability of scanning x-ray microscopes for imaging of nanostructures

Significance and Impact

A novel result because it allows examination of the structural, compositional, and possibly chemical state change of a specimen for which conventional contrast imaging mechanisms (absorption, fluorescence) may not work

Research Details

- Developed a novel Fourier-shift "fitting" algorithm that clarifies optical patterns emerging from scanning x-ray microscopes, producing a quantitative phase image with fewer artifacts and less blurring than existing methods.
- Successfully used technique to visualize the nanostructures invisible to absorption and fluorescence contrast in a solid-oxide-fuel cell by quantitative phase imaging.



(a) Scanning electron microscope (SEM) image of the solid oxide fuel cell (SOFC) specimen adhered on a Si_3Ni_4 window with Pt welding. (b-d) are horizontal phase-gradient scanning x-ray microscope images obtained by differential intensity, moment analysis and Fourier-shift fitting algorithms, respectively. Artifacts and blurring effects can be seen in (b) and (c), as compared to (d).

H Yan, YS Chu, J Maser, E Nazaretski, J Kim, HC Kang, J Lombardo, WKS Chiu
Nature's Scientific Reports **3**: 1307 (2013) 10.1038

Work was performed at Argonne National Laboratory