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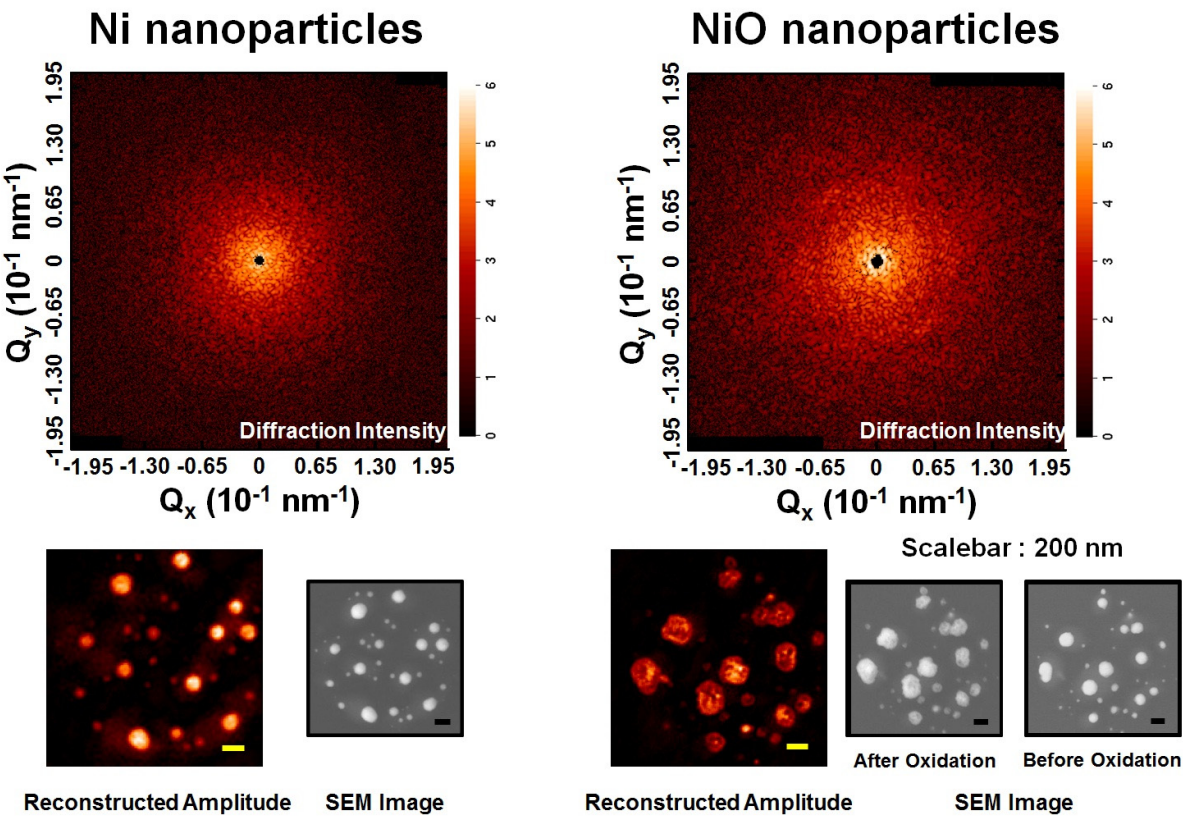
Structure of Ni and NiO Nanoparticles Observed by X-ray Coherent Diffraction Imaging

Chan Kim[1], Yoonhee Kim[1], Sun Young Hamh[2], Jun-Gon Son[2], Krishna Prasad Khakurel[2], Mazhar Iqbal[2], Do Young Noh[1,2]

[1]School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea,
[2]Graduate Program of Photonics and Applied Physics, Gwangju Institute of Science and Technology, Gwangju, Korea

Coherent diffraction imaging (CDI) method using hard x-ray at 5.46 keV was applied to study assembly of Ni and Ni oxide nano structures formed on a Si3N4 membrane. Density distribution of Ni nano-particles was obtained quantitatively with about 15 nm lateral resolution by reconstructing images from the speckle diffraction pattern. In addition, reconstructed images of nickel oxide particles indicated that Ni atoms diffuse out during the oxidation process leaving pores inside the nickel oxide crust. Furthermore, we recognize that really weak phase object, less than 5 nm thickness of Ni residues, can be reconstructed due to the reference particles. We achieved quantitative information of nanometer sized materials and demonstrate the effect of reference particles by using hard x-ray coherent diffractive imaging method.

Keywords: Coherent diffraction imaging, Weak phase object, Nano materials


Ni nanoparticles
NiO nanoparticles
Diffraction Intensity
Diffraction Intensity
Q_y (10^{-1} nm^{-1})
Q_x (10^{-1} nm^{-1})
-1.95 -1.30 -0.65 0 0.65 1.30 1.95
Scalebar : 200 nm
After Oxidation
Before Oxidation
Reconstructed Amplitude
SEM Image
Reconstructed Amplitude
SEM Image