Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

In-situ TEM observations of the nanoscale electrochemistry in a Li-ion cell JIANYU HUANG, Sandia National Laboratories, UNIVERSITY OF PITTSBURGH COLLABORATION — The lithiation-delithiation processes of anode materials in lithium ion batteries were observed by in-situ electron microscopy. The lithiation-delithiation was strongly materials, size, and orientation dependent. Upon charging of SnO_2 nanowires, we observed high density of dislocations in the reaction front, while in charging of ZnO nanowires, we observed discrete cracks in the reaction front. In charging Si nanowires, we found the volume expansion was highly anisotropic, resulting in a dumbbell-shaped cross-section and cracking, eventually splitting the single nanowire into sub-wires. Carbon coating not only increases rate performance but also alters the lithiation-induced strain of SnO_2 nanowires. The radial expansion of the coated nanowires was completely suppressed. The lithiation process of individual Si nanoparticles was strongly size-dependent, i.e., there exists a critical particle size with a diameter of $\sim$ 150 nm, below which the particles neither cracked nor fractured upon lithiation, above which the particles first formed cracks and then fractured.

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Date submitted: 25 Nov 2011 Electronic form version 1.4