**Supplementary Materials**

**Submicro-Sized Si-Ge Solid Solutions with High Capacity and Long Cyclability for Lithium Ion Batteries**

Kuber Mishra,1,\*,† Xiao-Chen Liu,2,† Mark Geppert,1 James J. Wu,4 Jun-Tao Li,3 Ling Huang,3 Shi-Gang Sun,3 Xiao-Dong Zhou3,5,\* and Fu-Sheng Ke,2,\*

*1*Department of Chemical Engineering, University of South Carolina, Columbia SC 29208, USA

*2*College of Chemistry and Molecular Science, Wuhan University, Wuhan 430072, China

*3*State Key Laboratory of Physical Chemistry of Solid Surfaces, Xiamen University, Xiamen, 361005, China.

*4*Electrochemistry Division, NASA Glenn Research Center, Cleveland, OH 44135, USA

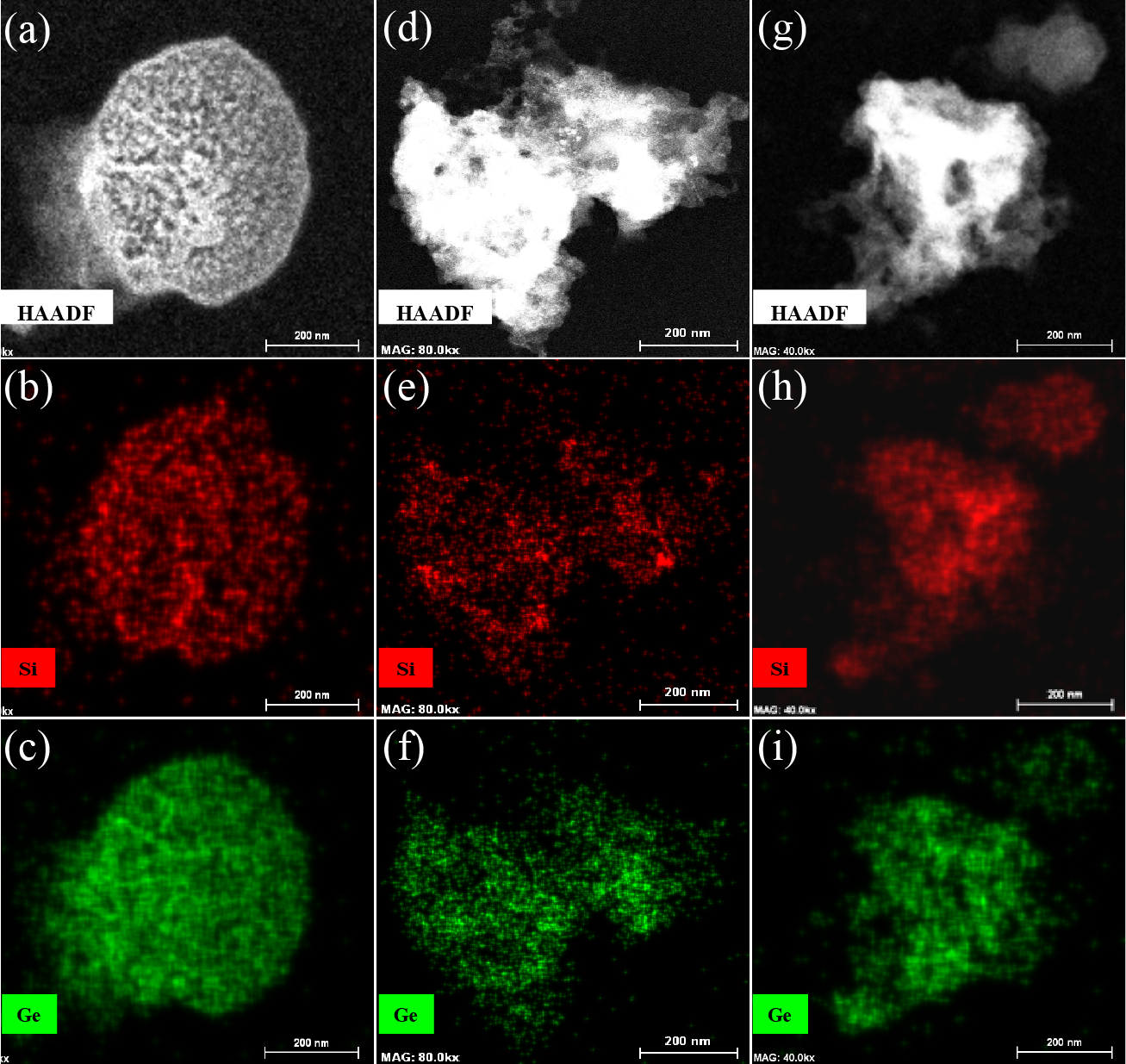
5 Institute for Materials Research and Innovation, University of Louisiana, Lafayette, La, 70503, USA

† These authors contributed equally to this work

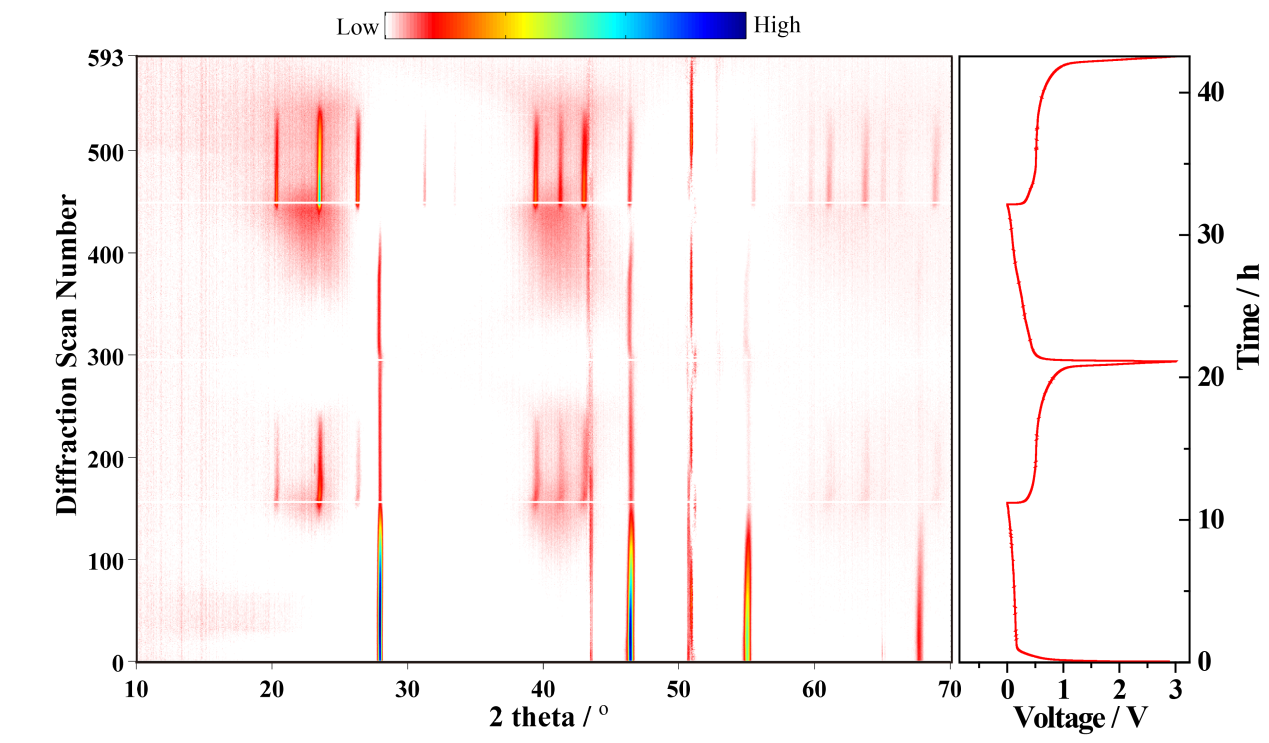
\*Corresponding author: Tel.: 803-777-7540. Email addresses: kefs@whu.edu.cn (F.-S. Ke), zhou@louisiana.edu (X.-D. Zhou) , kmishra@email.sc.edu (K.M.)

****

**FIG. S1.** Plot of βTotal vs 4sinθ/cosθ to calculate the lattice strain for (a) Si0.50Ge0.50 and (b) Si0.75Ge0.25. (c) is the relation used to calculate the lattice strain. The slope of the plot βTotal vs 4sinθ/cosθ provides the lattice strain (Δd/d).



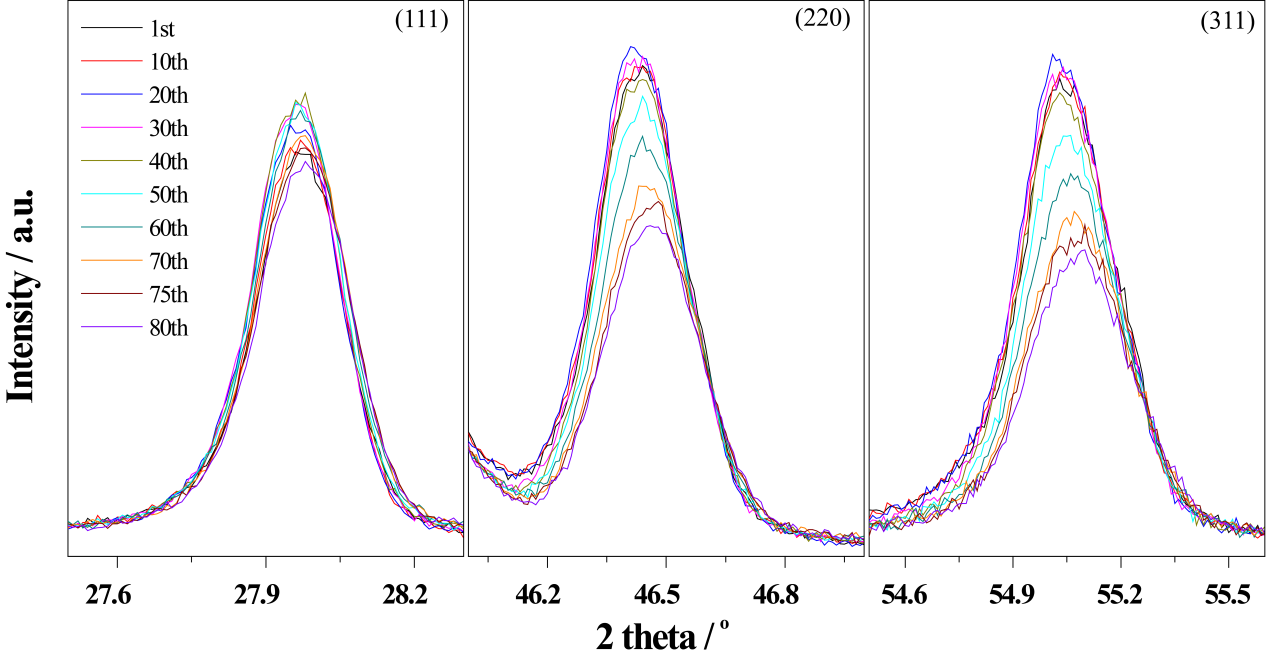
**FIG. S2.** Post cycling TEM and elemental mapping images of (a,b,c) Si0.25Ge0.75, (d,e,f) Si0.5Ge0.5 and (g,h,i) Si0.75Ge0.25.



**(a)**



**(b)**



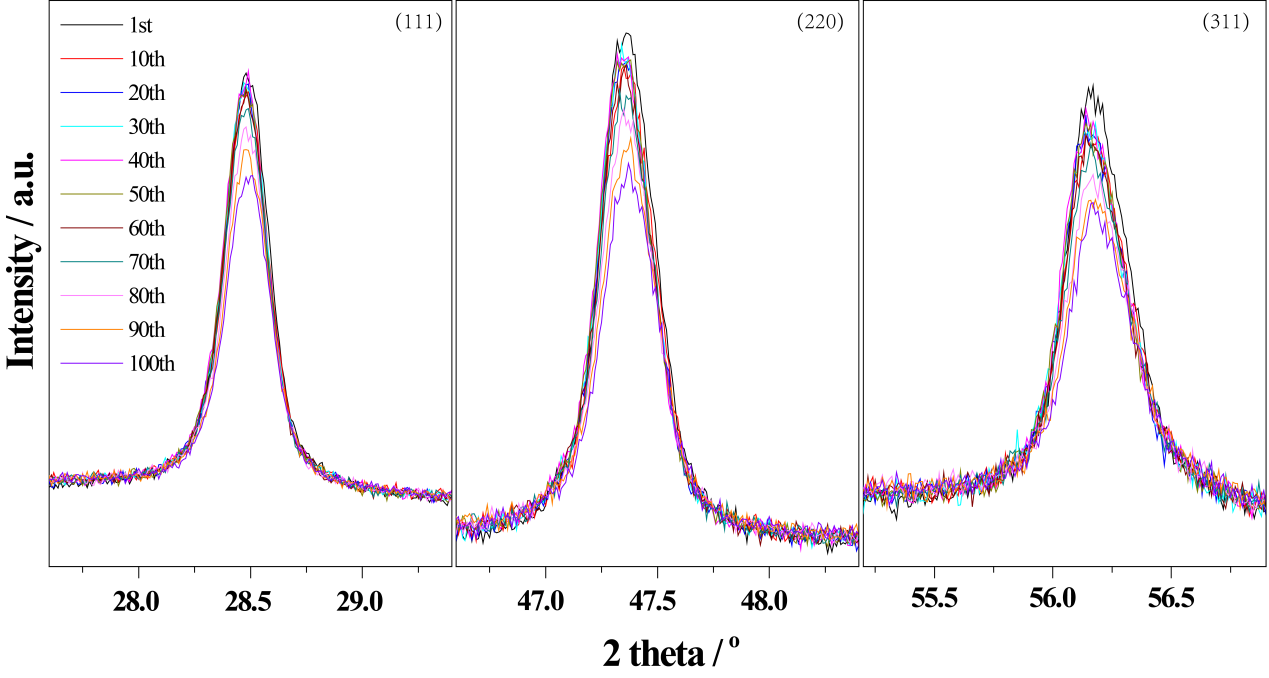
**(c)**

**FIG. S3.** (a) First two-cycle discharge-charge curves and the corresponding in situ XRD patterns corrected between 0.01 and 3.0 V at 0.15 A g-1 of the Si0.5Ge0.5 solid solution anode. Last diffraction scan as background. (b) Discrete XRD, prior to background subtraction, selected from (a). (c) Selected XRD patterns during the 1st discharge process of the Si0.5Ge0.5 solid solution anode, prior to background subtraction.



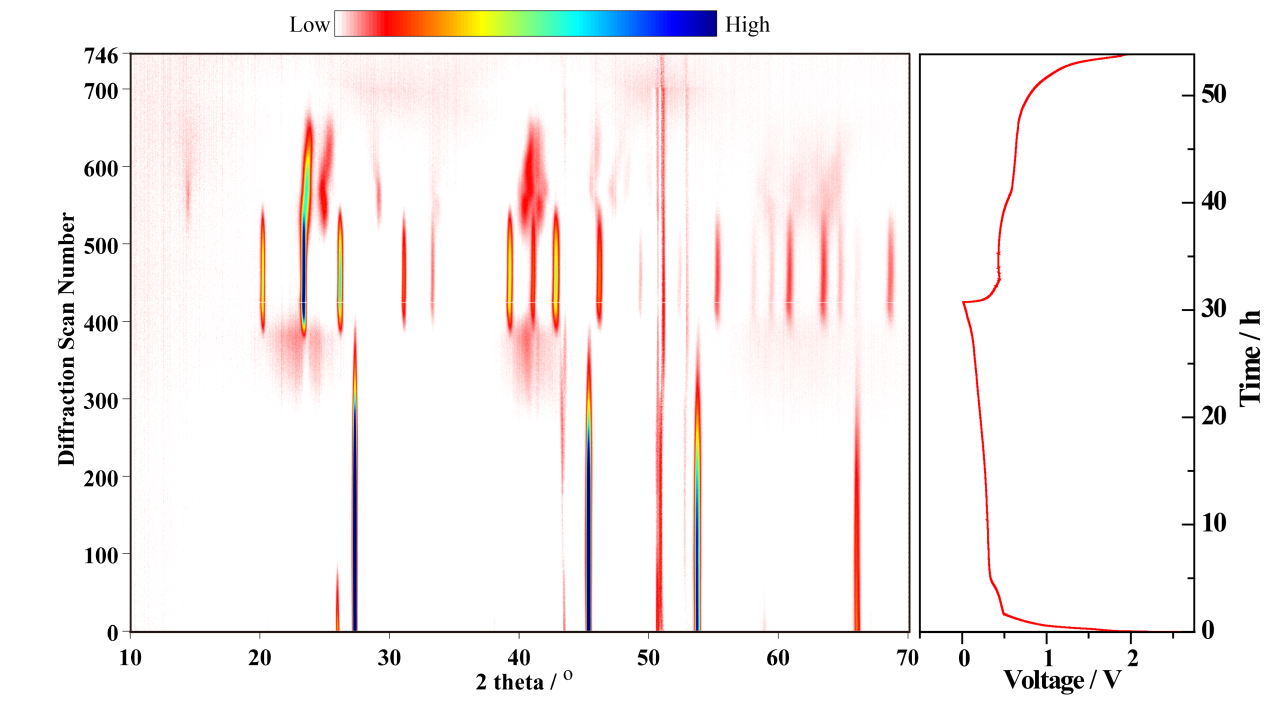
**(a)**

**(b)**

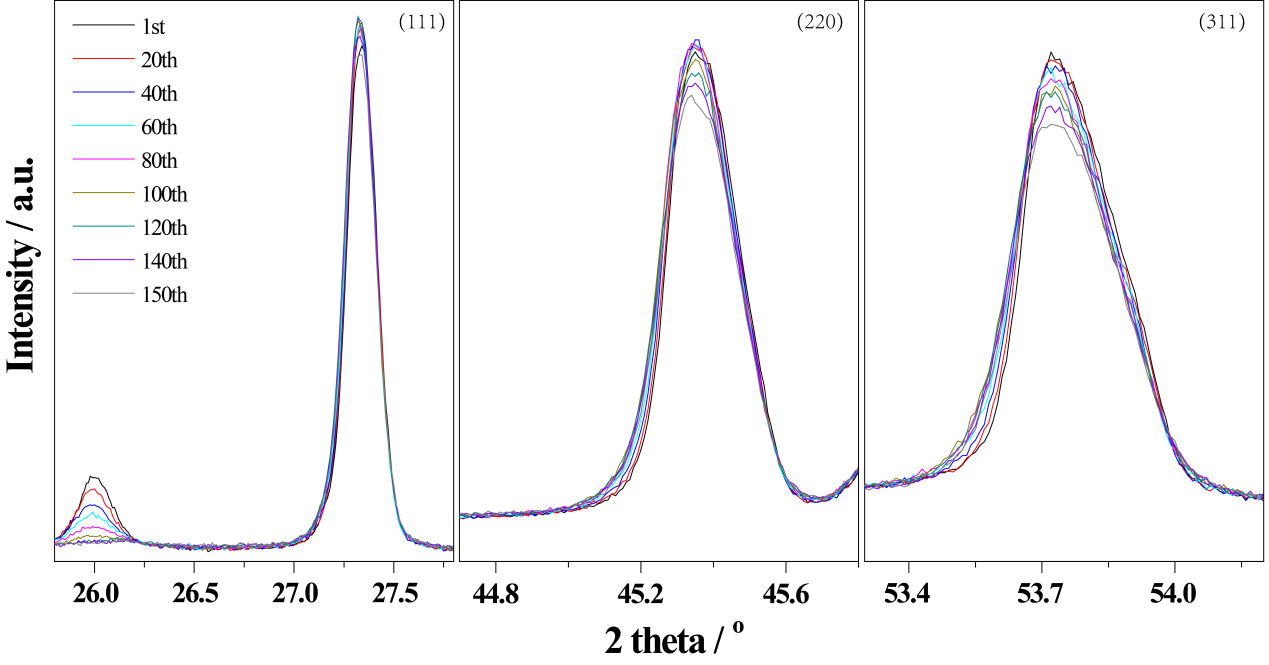


**FIG. S4**. (a) First cycle discharge-charge curves and the corresponding in situ XRD patterns corrected between 0.01 and 3.0 V at 0.2 A g-1 of the Si anode. Last diffraction scan as background. (b) Selected XRD patterns during the 1st discharge process of the Si anode, prior to background subtraction.

**(a)**



**(b)**



**FIG. S5**. (a) First cycle discharge-charge curves and the corresponding in situ XRD patterns corrected between 0.01 and 2.0 V at 0.05 A g-1 of the Ge anode. Last diffraction scan as background. (b) Selected XRD patterns during the 1st discharge process of the Ge anode, prior to background subtraction.