Supplementary Information for

Stable Li-ion Battery Anodes by In-situ Polymerization of Conducting Hydrogel to Conformally Coat Silicon Nanoparticles

Hui Wu\textsuperscript{1,2*}, Guihua Yu\textsuperscript{3,*}, Lijia Pan\textsuperscript{4,5}, Nian Liu\textsuperscript{1}, Matthew T. McDowell\textsuperscript{1}, Zhenan Bao\textsuperscript{4} & Yi Cui\textsuperscript{1,6}

\textsuperscript{1} Department of Materials Science and Engineering, Stanford University, California 94305, USA. \textsuperscript{2} State Key Lab of New Ceramics and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China. \textsuperscript{3} Materials Science and Engineering Program and Department of Mechanical Engineering, The University of Texas at Austin, Texas 78712, USA. \textsuperscript{4} Department of Chemical Engineering, Stanford University, California 94305, USA. \textsuperscript{5} National Laboratory of Microstructures (Nanjing), School of Electronic Science and Engineering, Nanjing University, Nanjing 210093, China. \textsuperscript{6} Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, California 94025, USA.

*These authors contributed equally to this work.

Correspondence and requests for materials should be addressed to Z.B. (email: zbao@stanford.edu) and Y.C. (email: yicui@stanford.edu)
Supplementary Figure S1. Voltage profile of the first charge/discharge galvanostatic cycle of a SiNP/PANi composite electrode at a slow rate of 0.3 A/g. The lithiation potential shows a sloping profile between 0.1 and 0.01 V, consistent with the behavior of crystalline Si.
**Supplementary Figure S2.** TEM images of SiNP/PANi composite electrode after 2,000 electrochemical cycles with (a) low; (b) medium and (c) high magnifications. The inset in (a) shows the selected area electron diffraction (SAED) pattern of the sample.
Supplementary Figure S3. Cell impedance test of the SiNP-PANi composite electrode after 9th, 100th, and 200th deep cycles.
Supplementary Figure S4. SEM image of a Si nanoparticle electrode with PVDF binder after 200 cycles.
Supplementary Figure S5. Photographs of solution A (left), which contains ~100 mM aniline monomer and ~30 mM phytic acid, and solution B, which contains ~125 mM ammonium persulfate.