Supporting information for

Colloidal Tin-Germanium Nanorods and Their Li-ion Storage Properties

Maryna I. Bodnarchuk[*,1,2,§] *Kostiantyn V. Kravchyk,*[1,2,§] *Frank Krumeich,*[1] *Shutao Wang,*[1,2] *and Maksym V. Kovalenko*[*1,2]

[1] Institute of Inorganic Chemistry, Department of Chemistry and Applied Biosciences, ETH Zürich, CH-8093 Zürich, Switzerland

[2] Laboratory for Thin Films and Photovoltaics, Empa – Swiss Federal Laboratories for Materials Science and Technology, CH-8600 Dübendorf, Switzerland

[§]These authors contributed equally to this work

[*]E-mail: bodnarchuk@inorg.chem.ethz.ch; mvkovalenko@ethz.ch

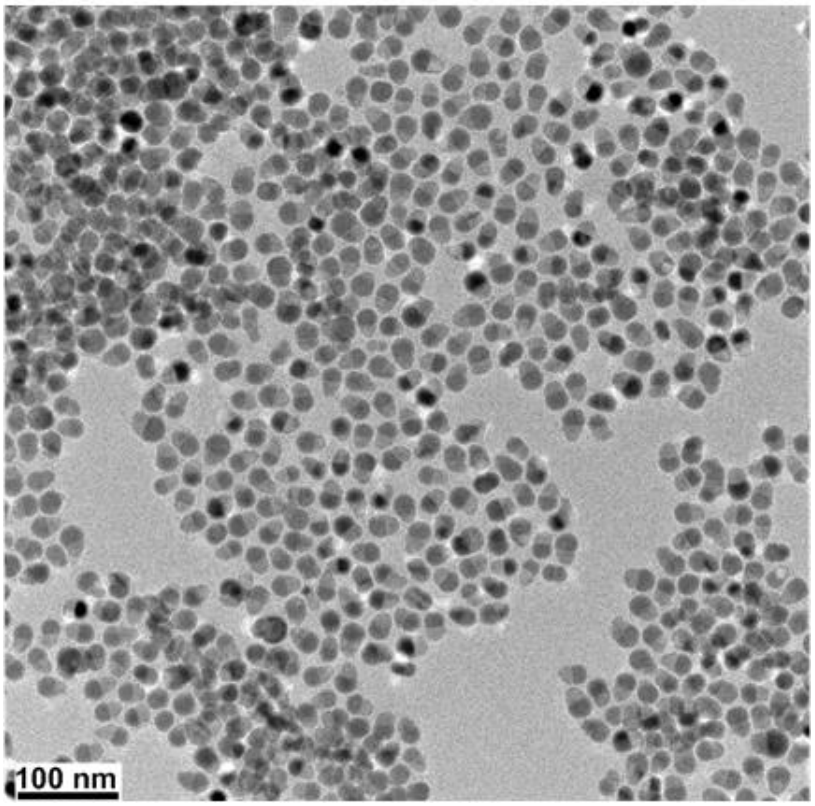

Figure S1. Low-resolution TEM image of Sn-Ge nanorods, corresponding to the sample shown in Figure 1 of the main text.

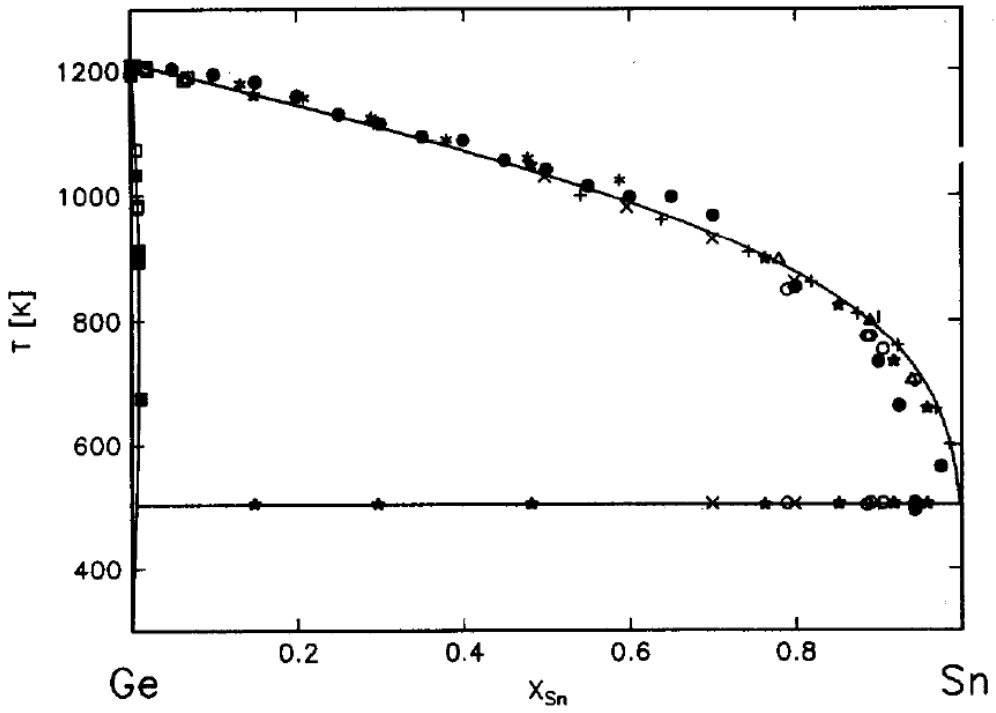

Figure S2. Calculated (lines) and experimental (data points) phase diagrams for Ge-Sn system, taken from Ref.[1] The solubilities of Ge in Sn at the eutectic point of 232 °C are systematically reported to be below 0.5% and the solubility of Sn in Ge doesn't generally exceed 1%.[1-2]

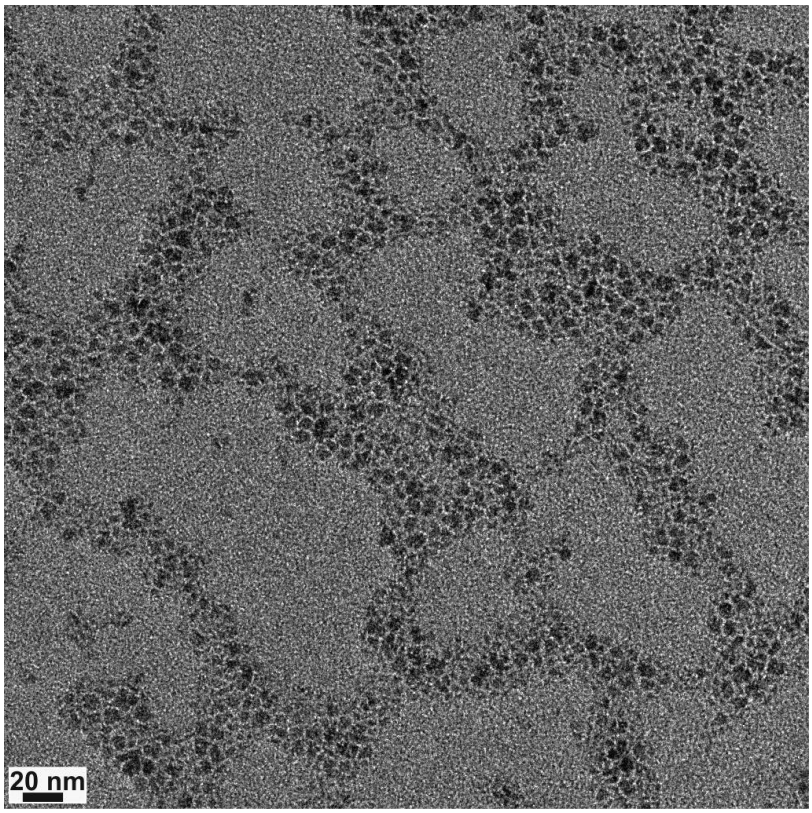

Figure S3. TEM image of poorly crystalline and polydisperse Ge NPs obtained in the absence of Sn NPs as seeds.

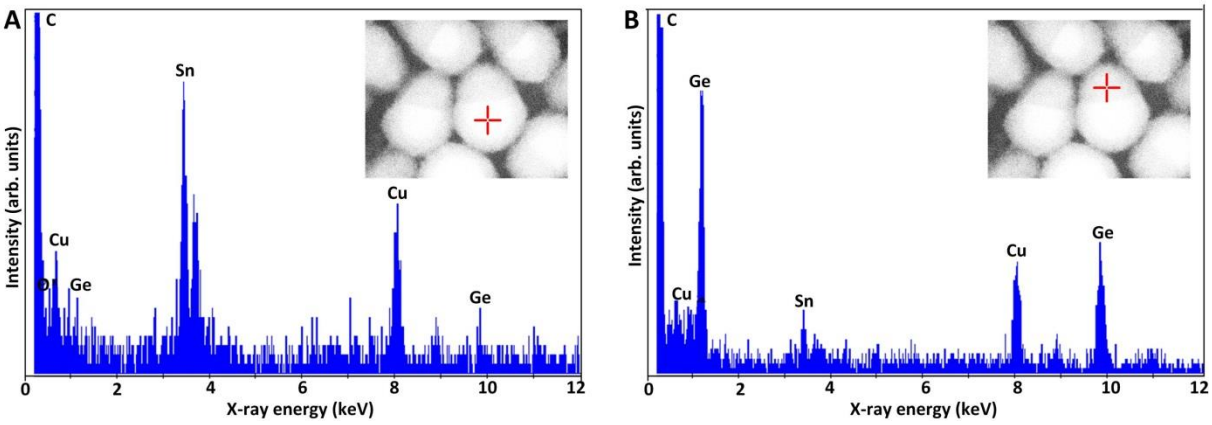

Figure S4. EDX spectra obtained from the Sn (A) and Ge (B) sides of Sn-Ge NRs. The Cu signal is from the copper mesh of the TEM grid.

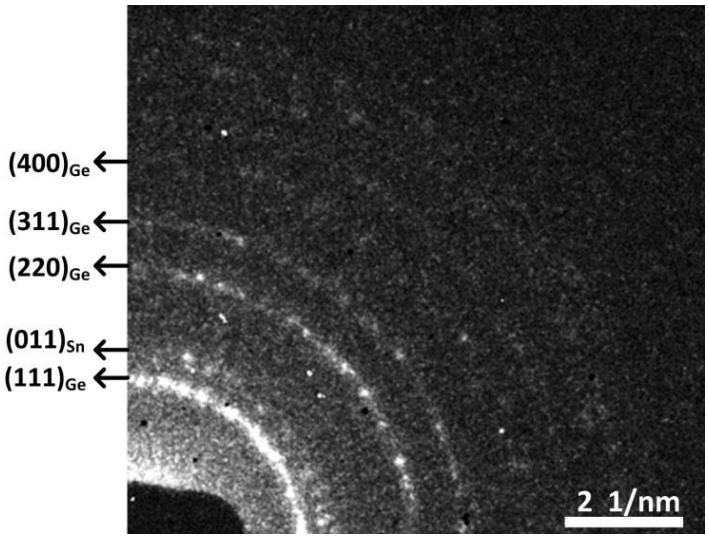

Figure S5. Electron diffraction pattern of 15×25nm Sn-Ge NRs; same sample as shown in Figures 1 and S1.

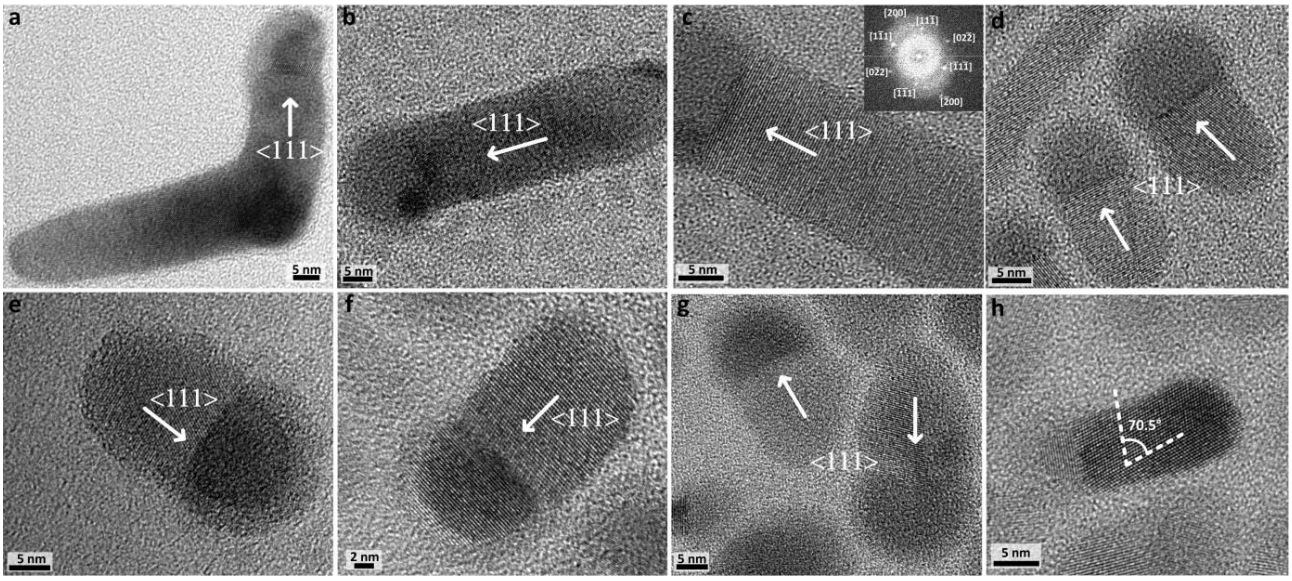

Figure S6. High-resolution TEM images of Sn-Ge NRs.

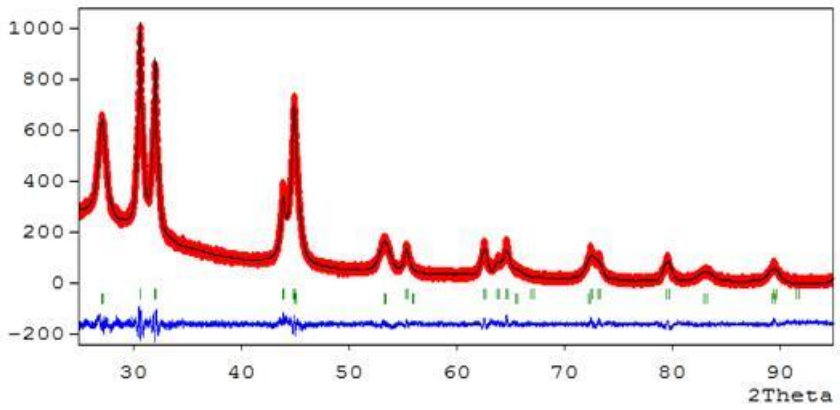

Figure S7. Rietveld refinement of the XRD pattern collected from Sn-Ge nanorods (see also same pattern in Figure 2B of the Main Text). The weighted pattern and profile R-factors, Rwp and Rp, were 3.74 and 2.91, respectively. The goodness-of-fit indicator (S) was 1.29.

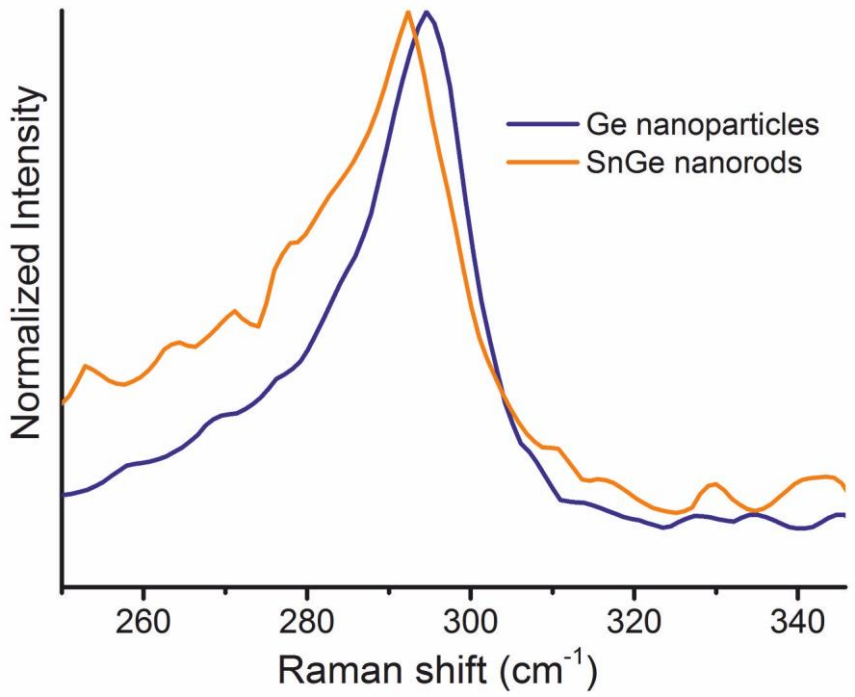

Figure S8. Raman spectra of Ge NPs and SnGe NRs.

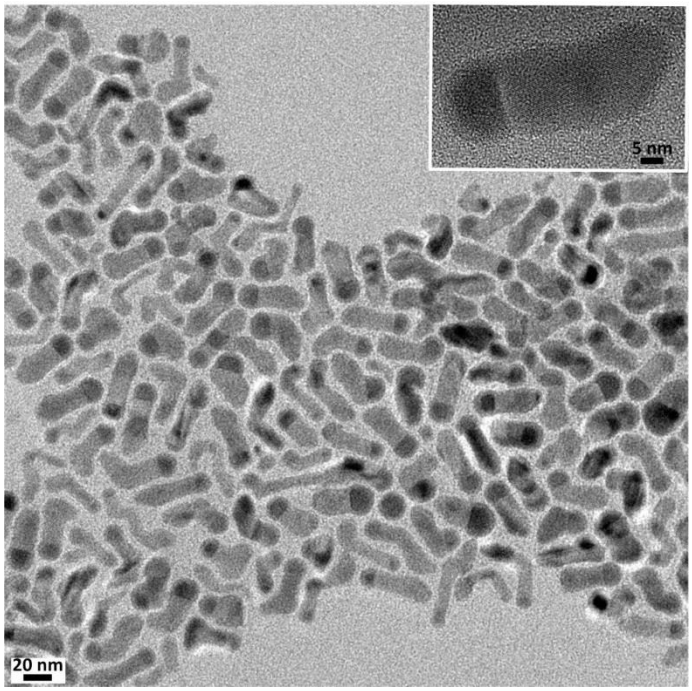

Figure S9. Low- and high-resolution TEM images of Sn-Ge NRs synthesized at Ge:Sn molar ratio of 25 using 15nm Sn NPs as seeds.

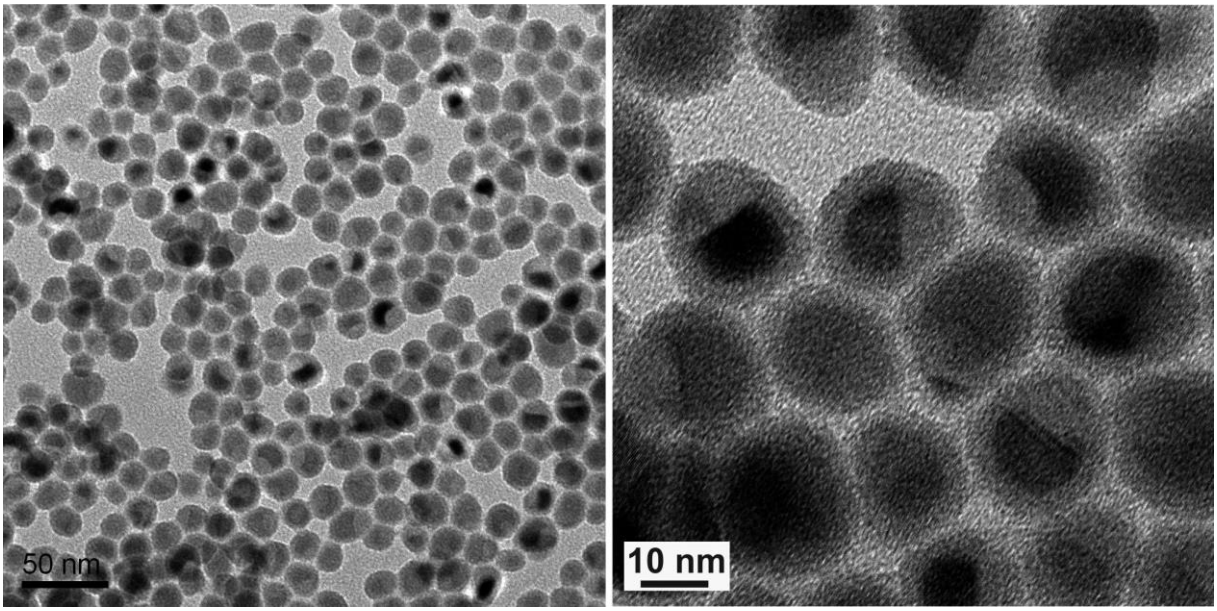

Figure S10. Sn-Ge NRs grown in a one-pot synthesis (Ge:Sn=10) by injecting Ge precursor at 230 °C, followed by the heating to 250 °C (ca. 2 minutes for 230-250 °C temperature ramp) with immediate cooling after reaching 250 °C.

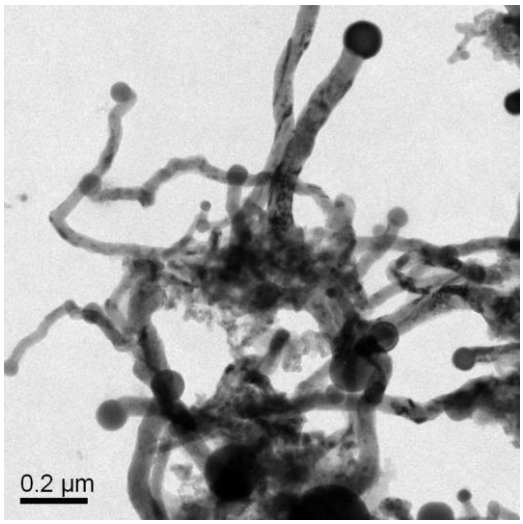

Figure S11. TEM image of nanowire-like Ge structures grown at 340 °C.

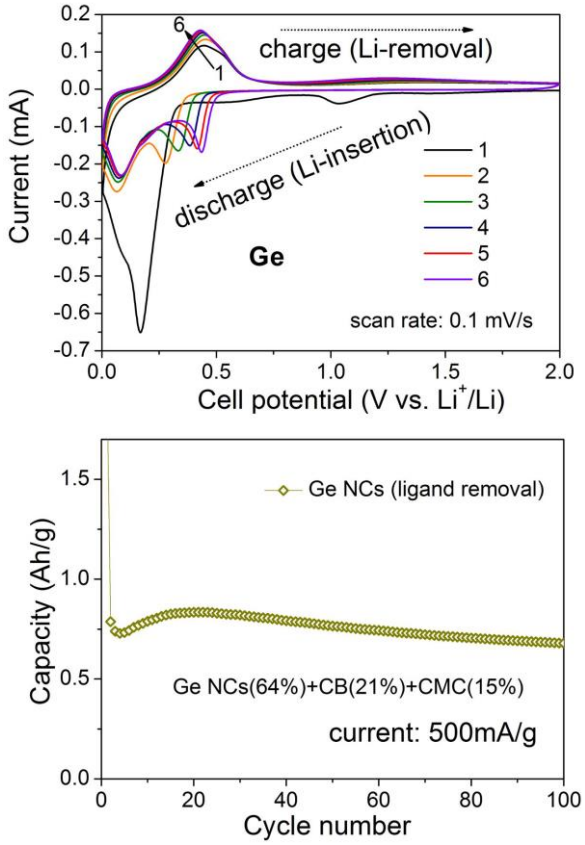

Figure S12. (top) Cycling voltammogram and (bottom) cycling stability test of Li-ion half-cells with colloidal Ge NPs as anode material (for TEM image see Figure S3).

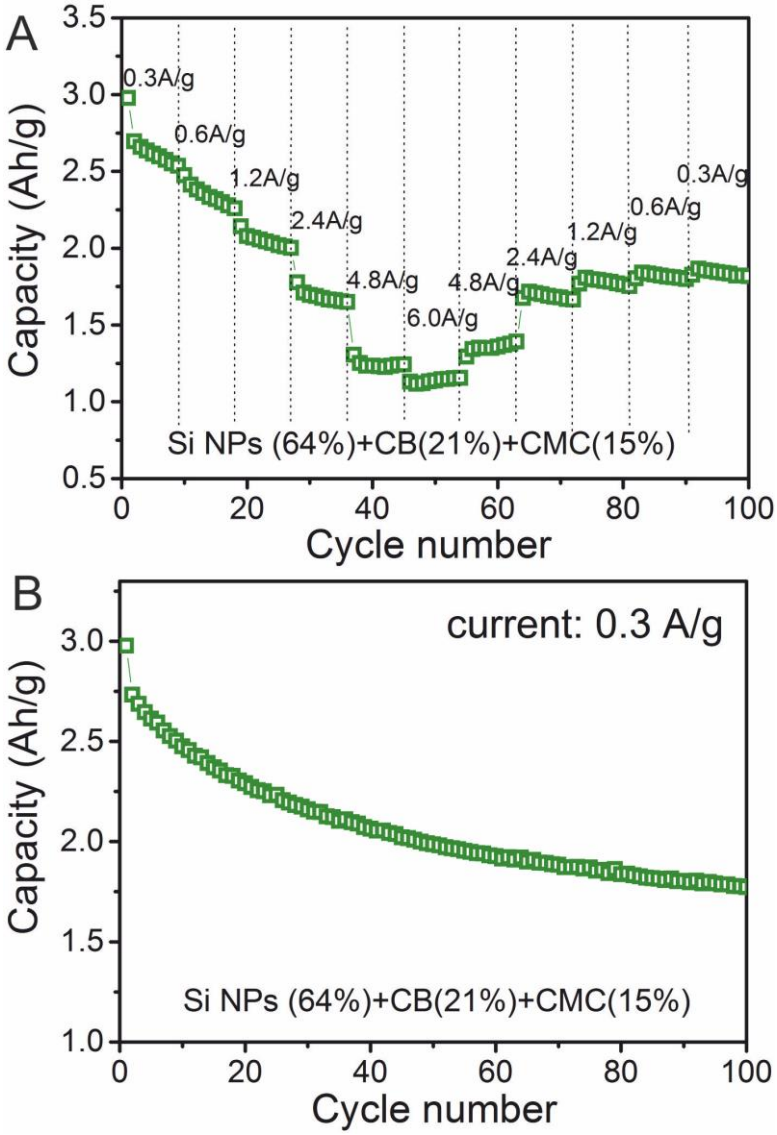

Figure S13. Electrochemical performance of electrodes comprising nano-sized Si powder (MTI Corporation, ≤50 nm).

SUPPORTING REFERENCES:

(1) Feutelais, Y.; Legendre, B.; Fries, S. G. Thermodynamic Evaluation of the System Germanium — Tin. *Calphad* **1996**, *20*, 109-123.

(2) Olesinski, R. W.; Abbaschian, G. J. The Ge−Sn (Germanium−Tin) system. *Bull. Alloy Phase Diagr.* **1984**, *5*, 265-271.