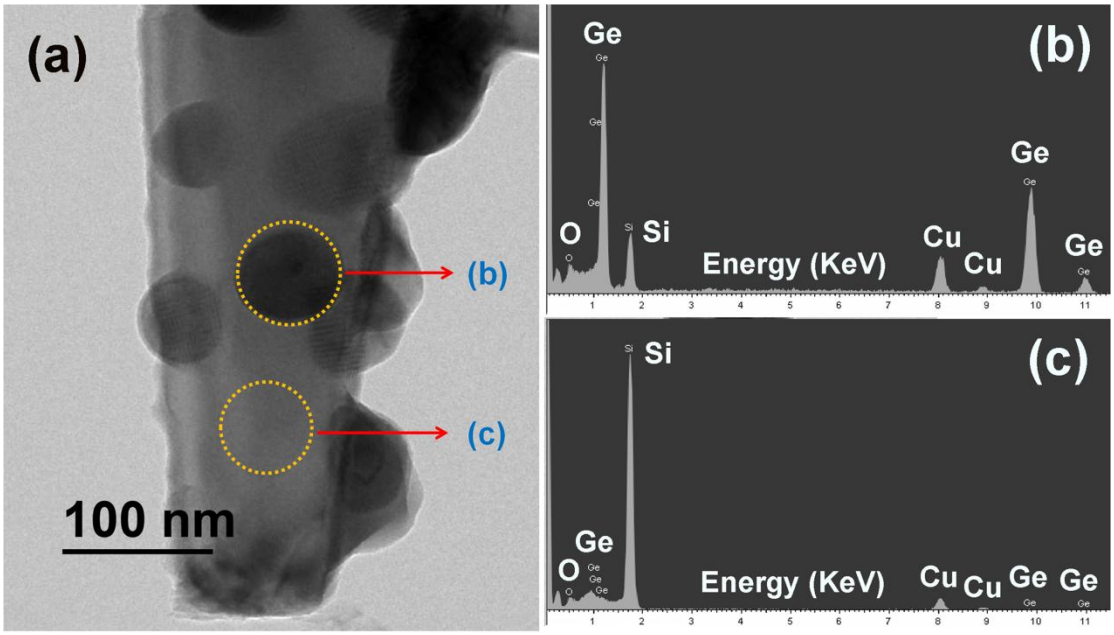
Supporting Information

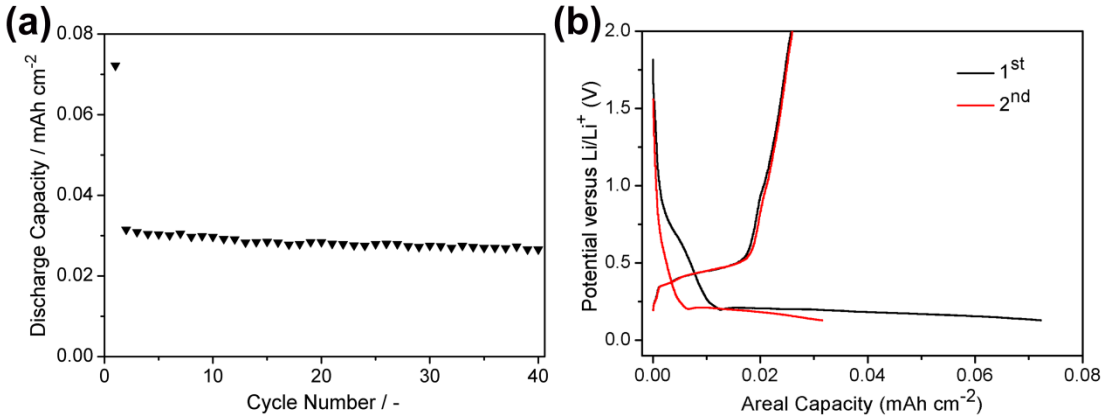
Enhanced reversible Lithium storage in Germanium nano-island coated 3D hexagonal bottle-like Si nanorod arrays

Chuang Yue, Yingjian Yu, ZhenGuo Wu, Xu He, JianYuan Wang, JunTao Li, Cheng Li, Suntao Wu, Jing Li, and Junyong Kang*

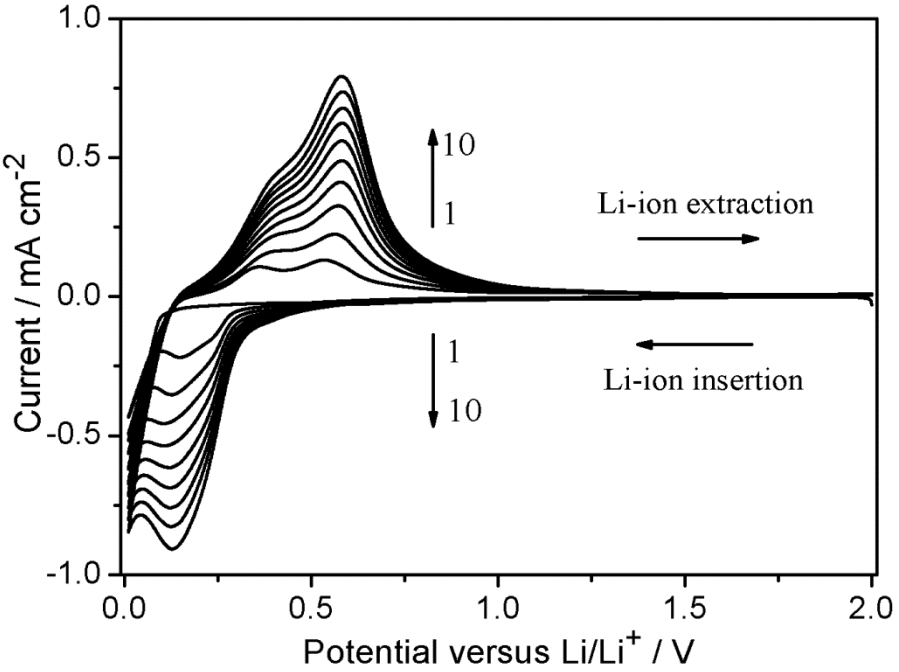
Supplementary figures



Supplementary Figure S1. (a) TEM image of Si/Ge NR composite and (b-c) the corresponding EDS patterns from two different areas on the NR surface marked in (a). It is obvious that the nano-islands coated NR surface contains more Ge content than that in the exposed surface area, so the whole Si/Ge composite NR arrays should exhibit good surface electrical conductivity to be beneficial for improving its electrochemical performance.

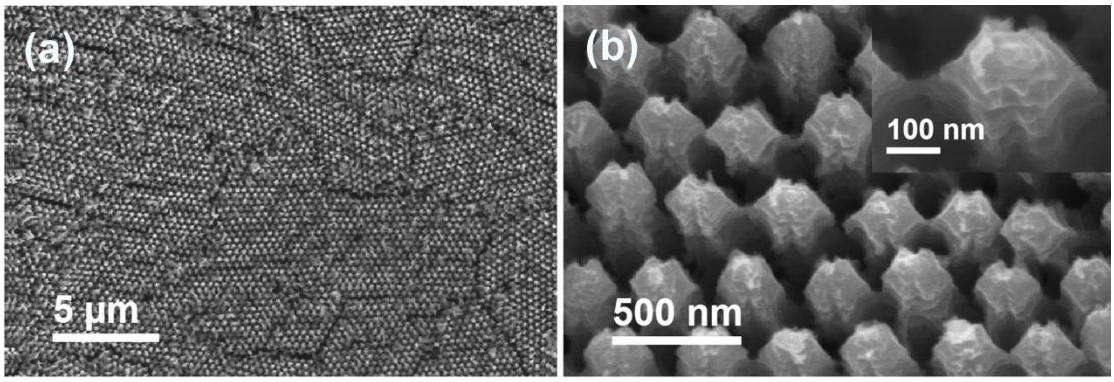


Supplementary Figure S2. (a) The capacity retention of the Si NR array electrode under the current density of 20 μA cm^{-2} within the voltage window of 0.13 V to 2.0 V *vs.* Li/Li^+ and (b) the corresponding voltage profiles for the first two cycles. The areal capacity of the Si NRs is only about 0.03 mAh cm^{-2} after 40 cycles and the CE for the first cycle is less than 40%.



Supplementary Figure S3. The electrochemical responses of the Si/Ge composite NR anode investigated by CV measurement at a scan rate of 0.5 mV s^{-1} within the voltage window of 0.01 V to 2.0 V *vs.* Li/Li^+.

During the Li-ion inserting process a reduction peak appears at a potential of about 300 mV *vs.* Li/Li^+ and then extends to about 130 mV in a quite large current, which is generally associated with the insertion of lithium ion into the Si/Ge active material to form Li_xSi and Li_xGe alloys. During the Li-ion de-inserting process, a double peak response located at about 380 mV and 580 mV is resolved, which usually can be attributed to a Li ion partial extraction from Li_xSi/Li_xGe alloy and a full Li-discharge resulting in amorphous Si/Ge respectively. The magnitude of the current peaks increases with cycling, which is caused by the activation of more material to react with Li in each increased cycle but the difference between adjacent cycles is gradually reduced revealing the gradual reaction saturation.



Supplementary Figure S4. SEM images of (a) Si/Ge composite NR electrode (*for the sample of Fig.4 (d) in the manuscript*) in a large area after 100 cycles at a current density of 300 μA cm^{-2} within the voltage window from 0.085 to 2.0 V *vs.* Li/Li^{+} and (b) the corresponding high magnification morphology showing the detailed volume expansion of the active material.