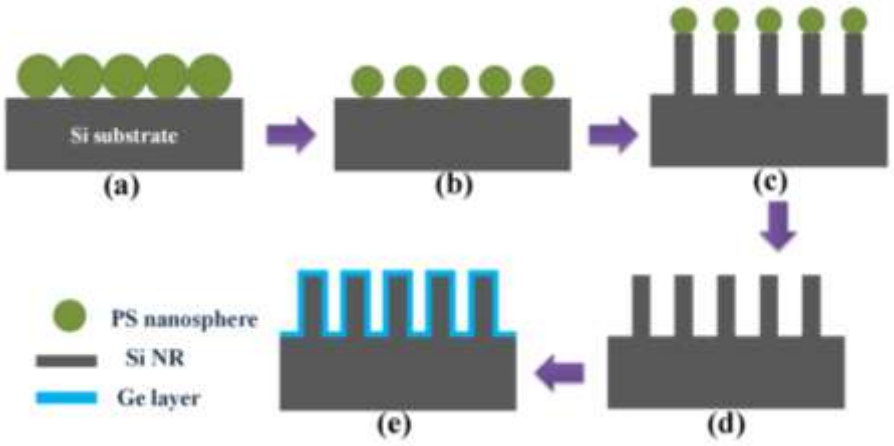
Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

Si/Ge Core-shell Nanoarrays as the Anode Material for 3D Lithium Ion Batteries

Jing Li, Chuang Yue, Yingjian Yu, Ying-San Chui, Jun Yin, Zhenguo Wu, Chundong Wang, Yashu Zang, Wei Lin, Juntao Li, Suntao Wu, and Qihui Wu*

1. Supplementary figures



Scheme S1 Schematic illustration of the fabrication processes for Si/Ge NR arrays.

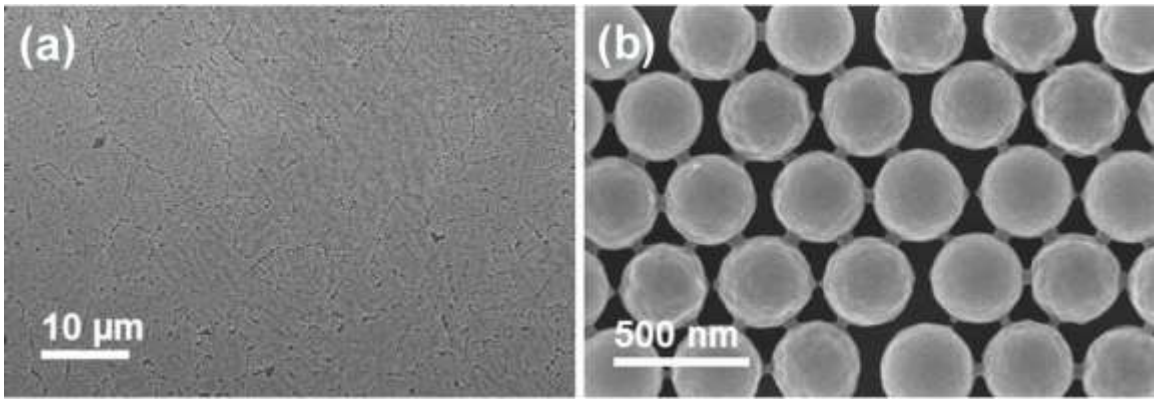


Figure S1 The SEM images of (a) the as-fabricated PS template by assembling the 360-nm-diameter PS nanospheres on a Si substrate, and (b) the modified PS template on Si substrate by O_2 plasma etching for 60 s used for the following ICP etching to produced Si NR arrays.

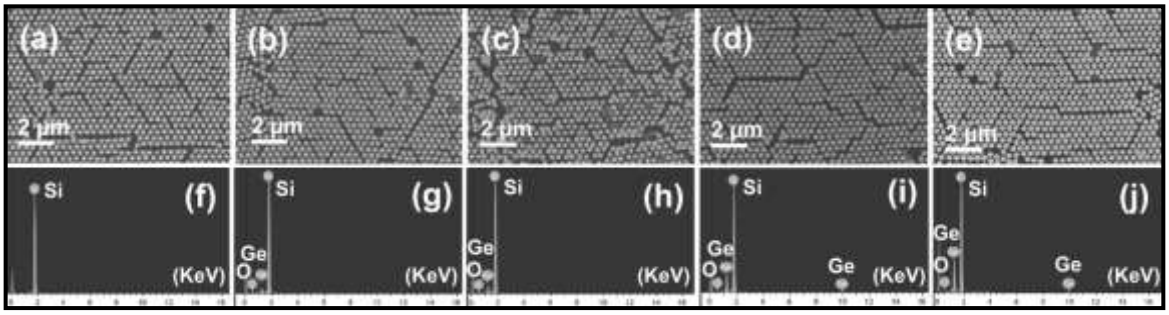


Figure S2 Top view SEM images of large area (a) Si NRs and (b-e) Si/Ge NRs by sputtering deposition with the power of 75 W, 100 W, 150 W and 200 W; and the corresponding EDS patterns of (f-j) from the sample (a-e) respectively.

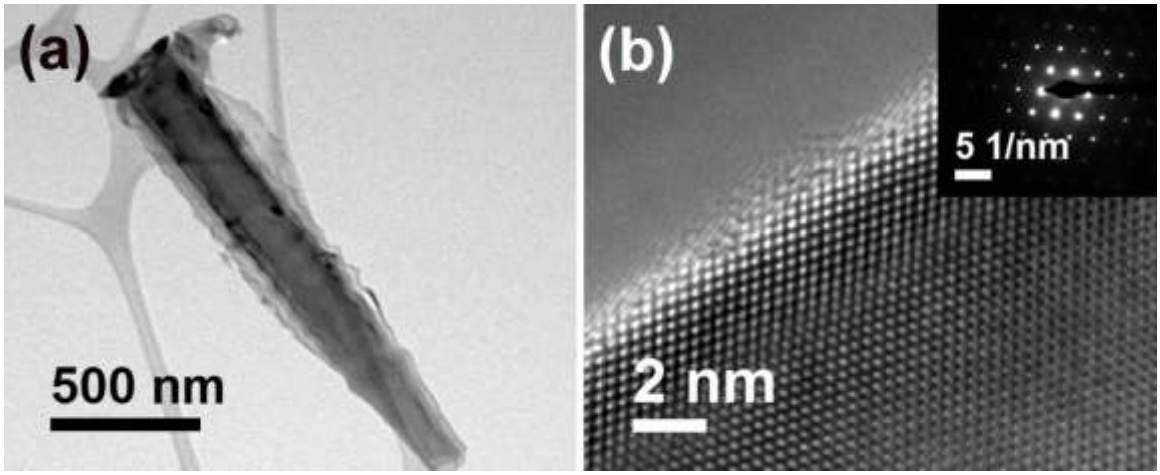


Figure S3 (a) TEM images of the as-fabricated individual Si NR and (b) HRTEM image from the edge of the Si NR.

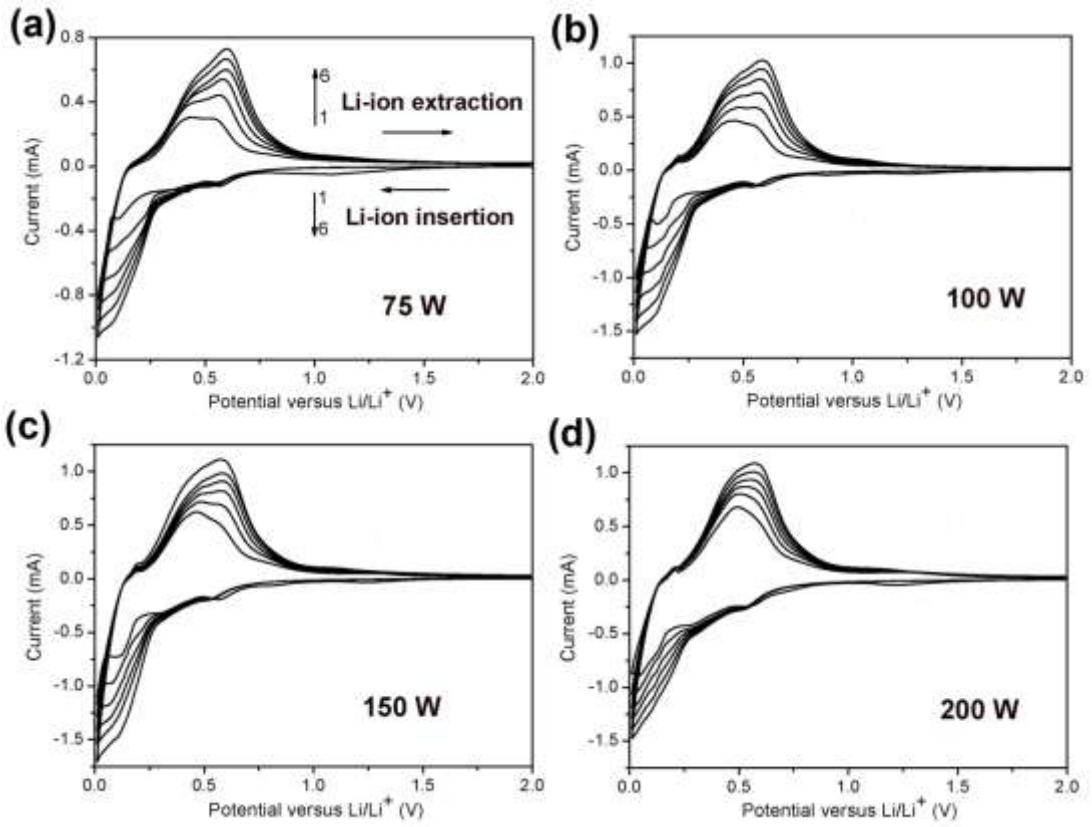


Figure S4 First six cyclic voltammogram (CV) curves of the Ge composited Si NR electrodes by sputtering deposition employing the powers of (a) 75 W, (b) 100 W, (c) 150 W, and (d) 200 W at a scan rate of 0.5 mV S^{-1} within the voltage window between 0.01 V to 2.0 V vs. Li/Li^+.

In all the samples, the Li-ion insertion (discharge) branch exhibits a reduction peak located at a potential of about 300 mV vs. Li/Li^+ and then extending to about 100 mV, which is commonly attributed to the formation of Li_xSi and Li_xGe alloys. In the Li-ion extraction (charge) branch, the broad oxidation peak centering at about 550 mV corresponds to the Li-ion de-lithiation to form amorphous Si and Ge respectively. The increase of the reduction or oxidation current with cycling is believed to be induced by the activation process.

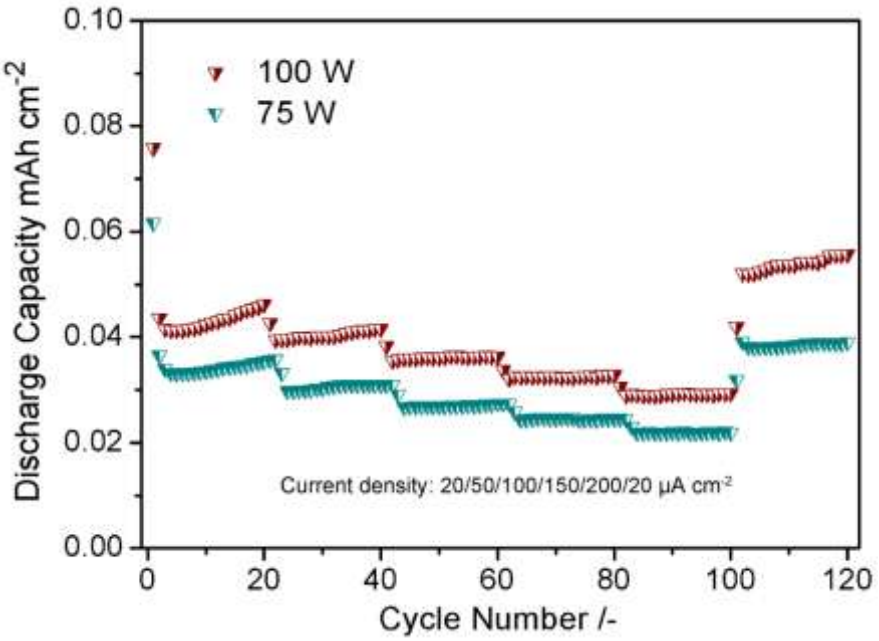


Figure S5 Rate capacities of 75W-Si/Ge and 100W-Si/Ge NRs electrodes within the voltage window of 0.13-2.0 V vs. Li/Li^+ at the current densities increasing from 20 to 200 μAcm^{-2} and then returning to 20 μAcm^{-2}.