Electronic supplementary information

Highly Mesoporous Silicon Derived from Waste Iron Slag for High Performance Lithium Ion Battery Anodes

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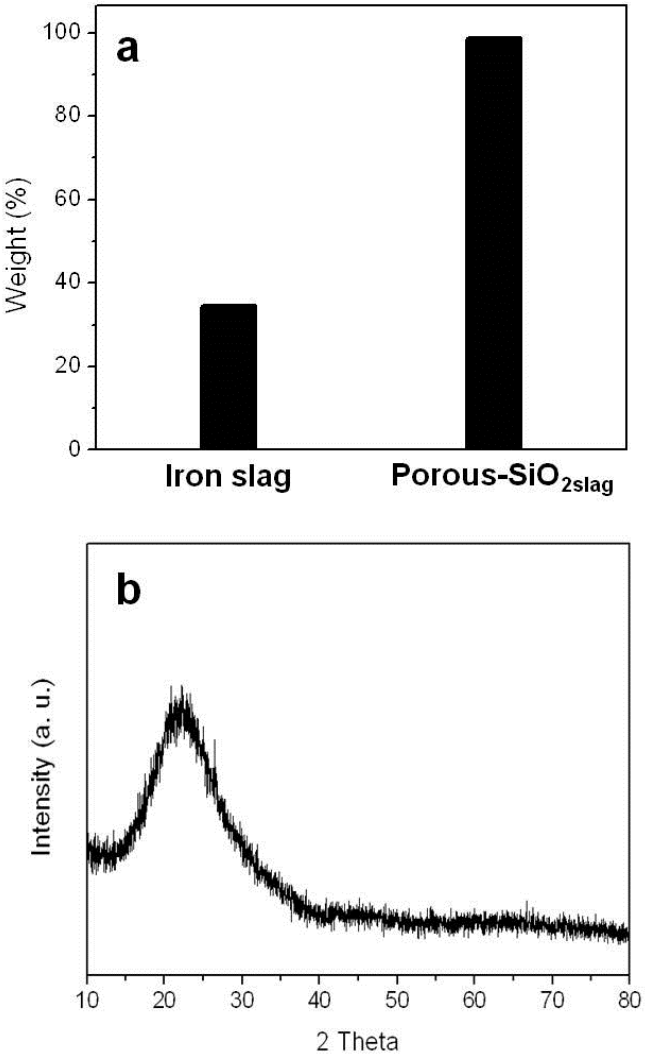

Fig. S1. ICP-AES result and XRD pattern of Porous-SiO_{2slag} (intermediate product). (a) Weight ratio of SiO_2 in the iron slag (34.6 wt%) and Porous-SiO_{2slag} (98.7 wt%). (b) XRD pattern of Porous-SiO_{2slag}.

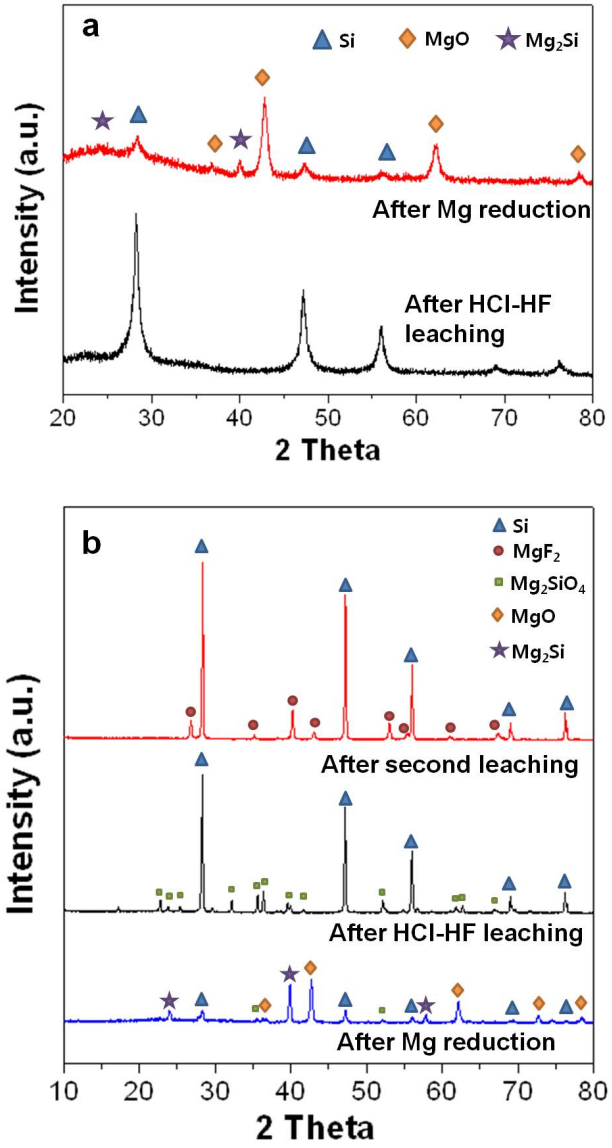

Fig. S2. (a) XRD patterns of the product after magnesiothermic reduction with NaCl following removal of NaCl, and the resulting Porous-Si_{slag} after HCl-HF leaching. (b) XRD patterns of the product after magnesiothermic reduction without NaCl, the intermediate product after HCl-HF leaching, and the resulting Bulk-Si_{slag} after second leaching with HF-CH_3COOH.

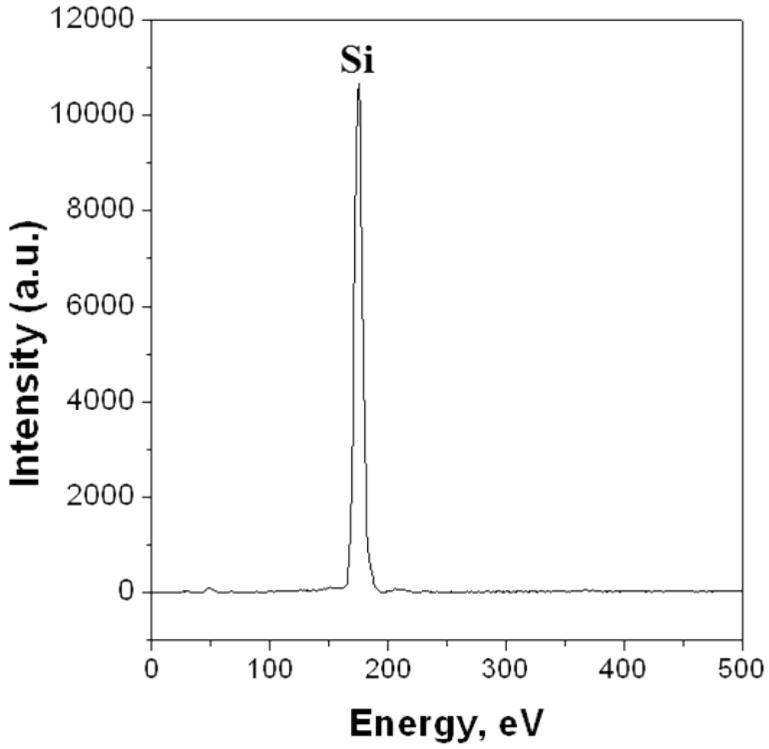

Fig. S3. Energy-dispersive X-ray spectrum of Porous-Si_{slag}.

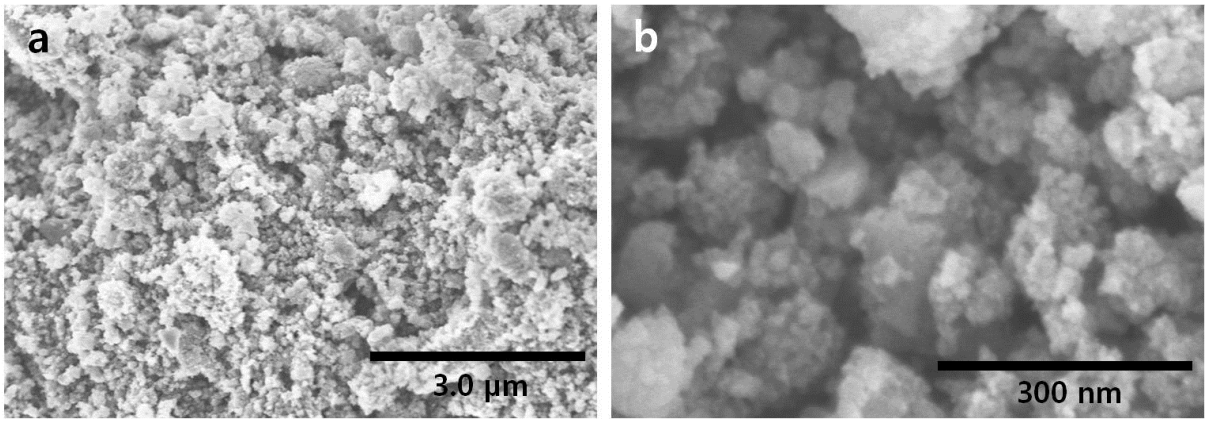

Fig. S4. (a,b) SEM images of C-Porous-Si_{slag}.

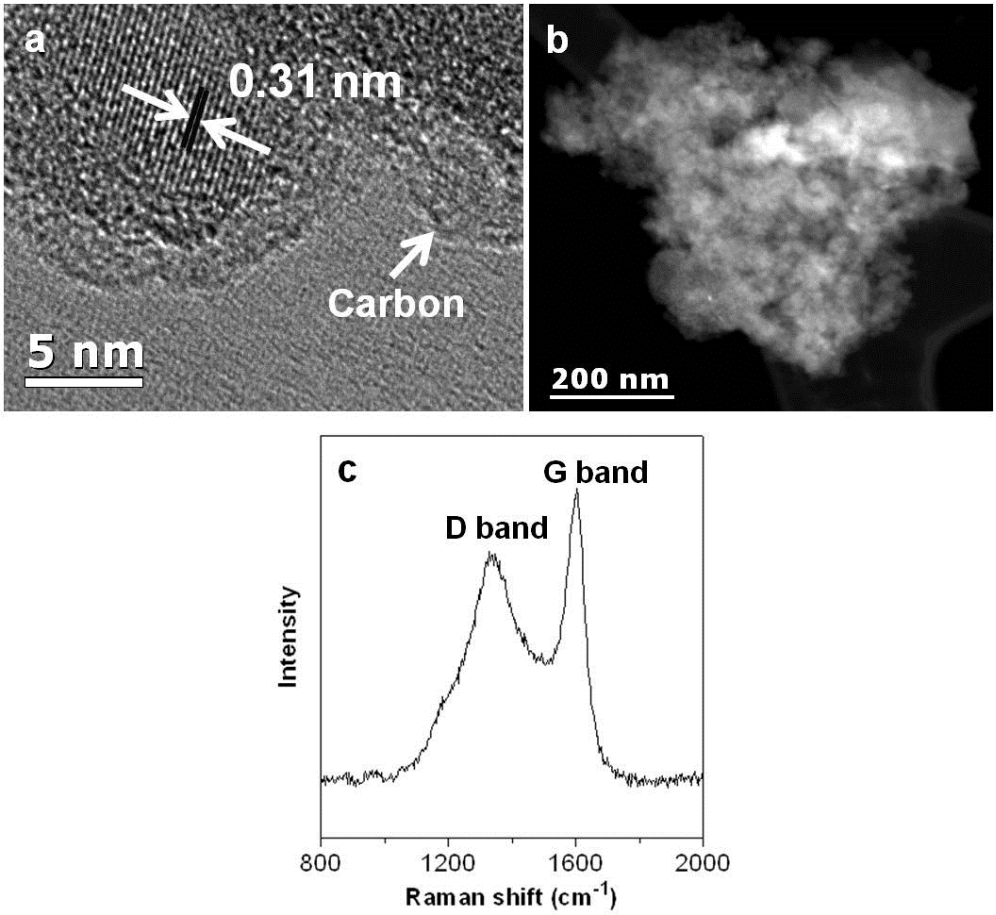

Fig. S5. (a) HR-TEM image, (b) STEM image and (c) Raman spectrum of C-Porous-Si_{slag}.

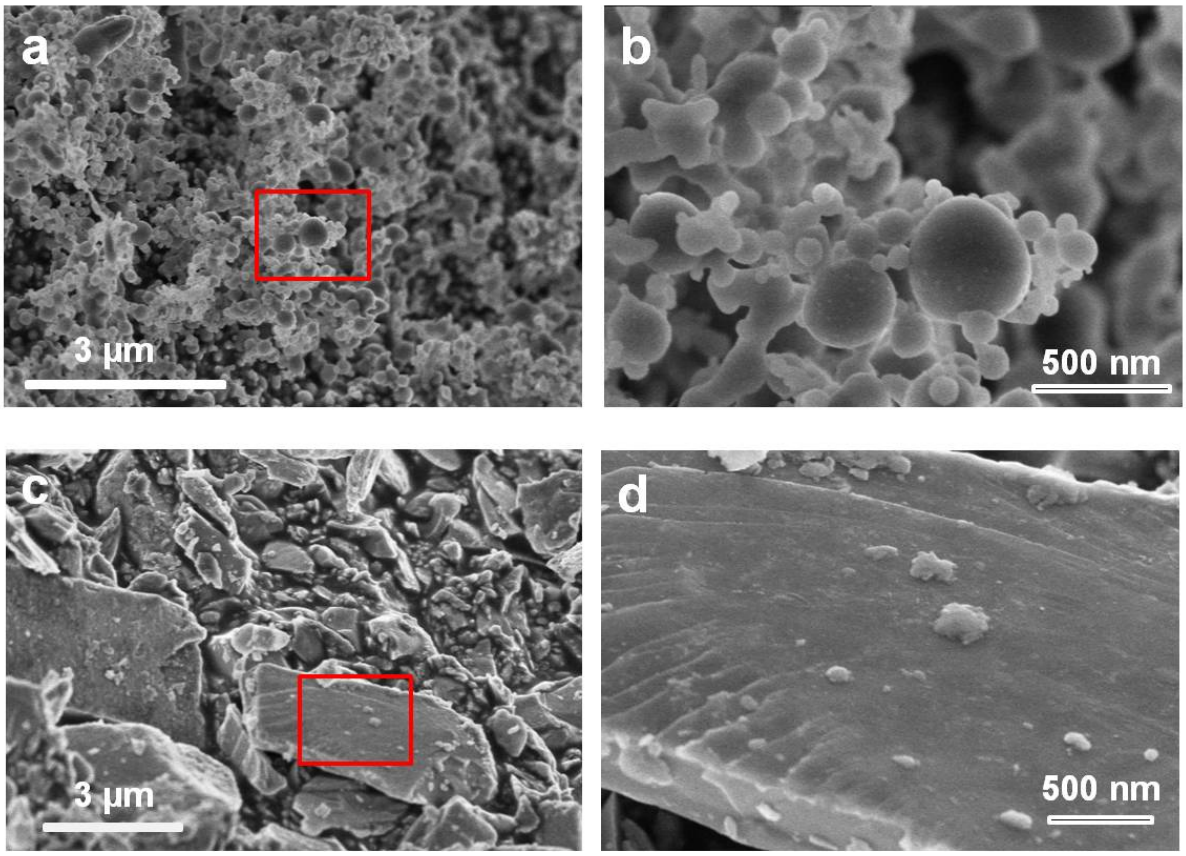

Fig. S6. (a) SEM image of Si-nano and (b) its magnified image from the red box in (a). (c) SEM image of Si-micro and (d) its magnified image from the red box in (c).

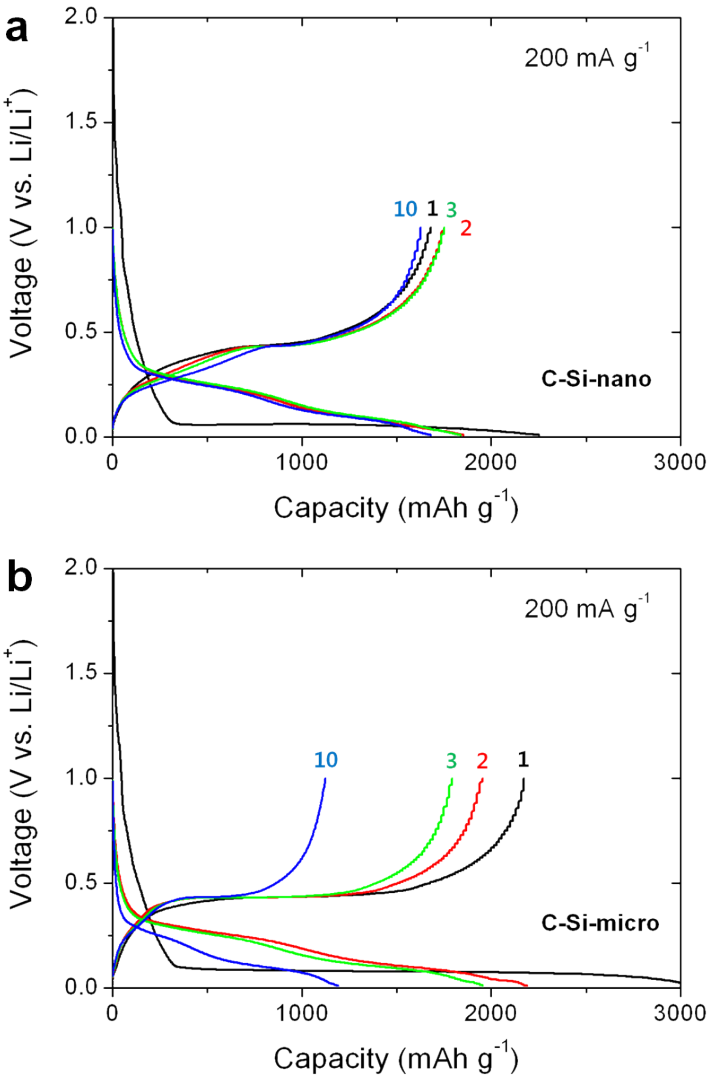

Fig. S7. The voltage profiles of (a) C-Si-nano and (b) C-Si-micro at 200 mA g^{-1} from 1 to 10 cycles.

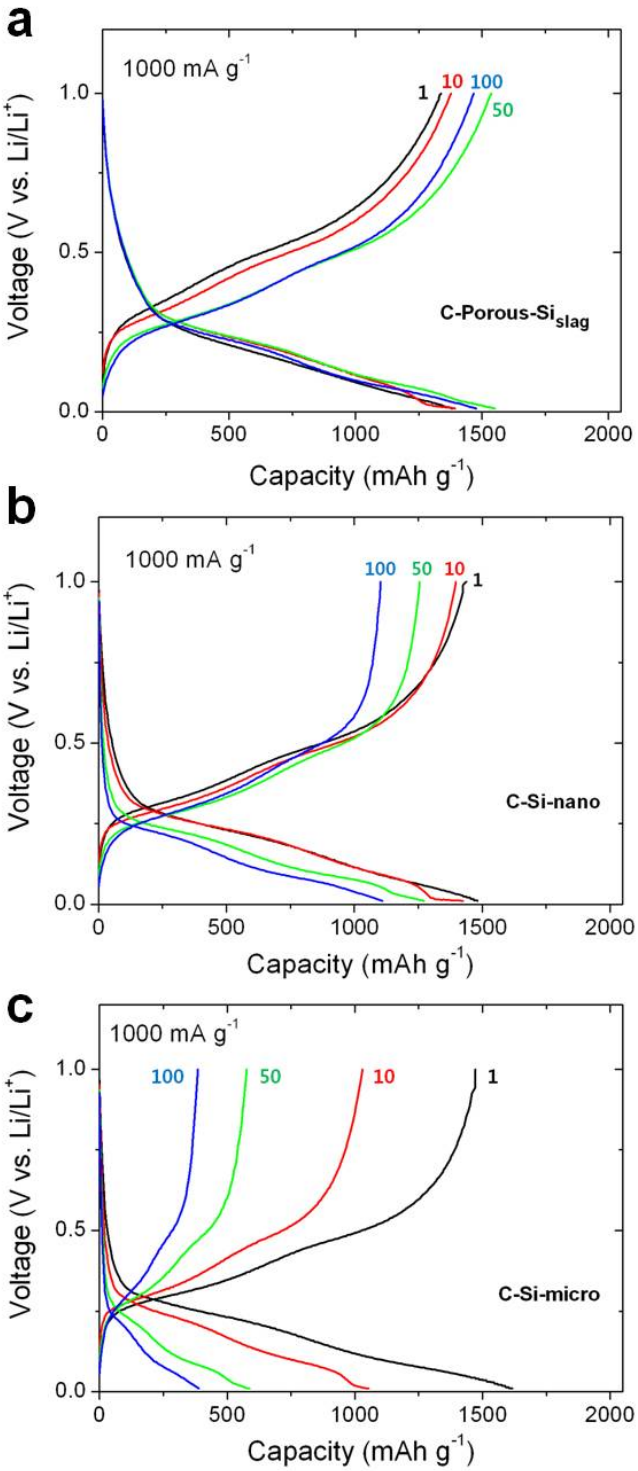

Fig. S8. Voltage profiles of (a) C-Porous-Si_{slag}, (b) C-Si-nano and (c) C-Si-micro at 1000 mA g^{-1} from 1 to 100 cycles.

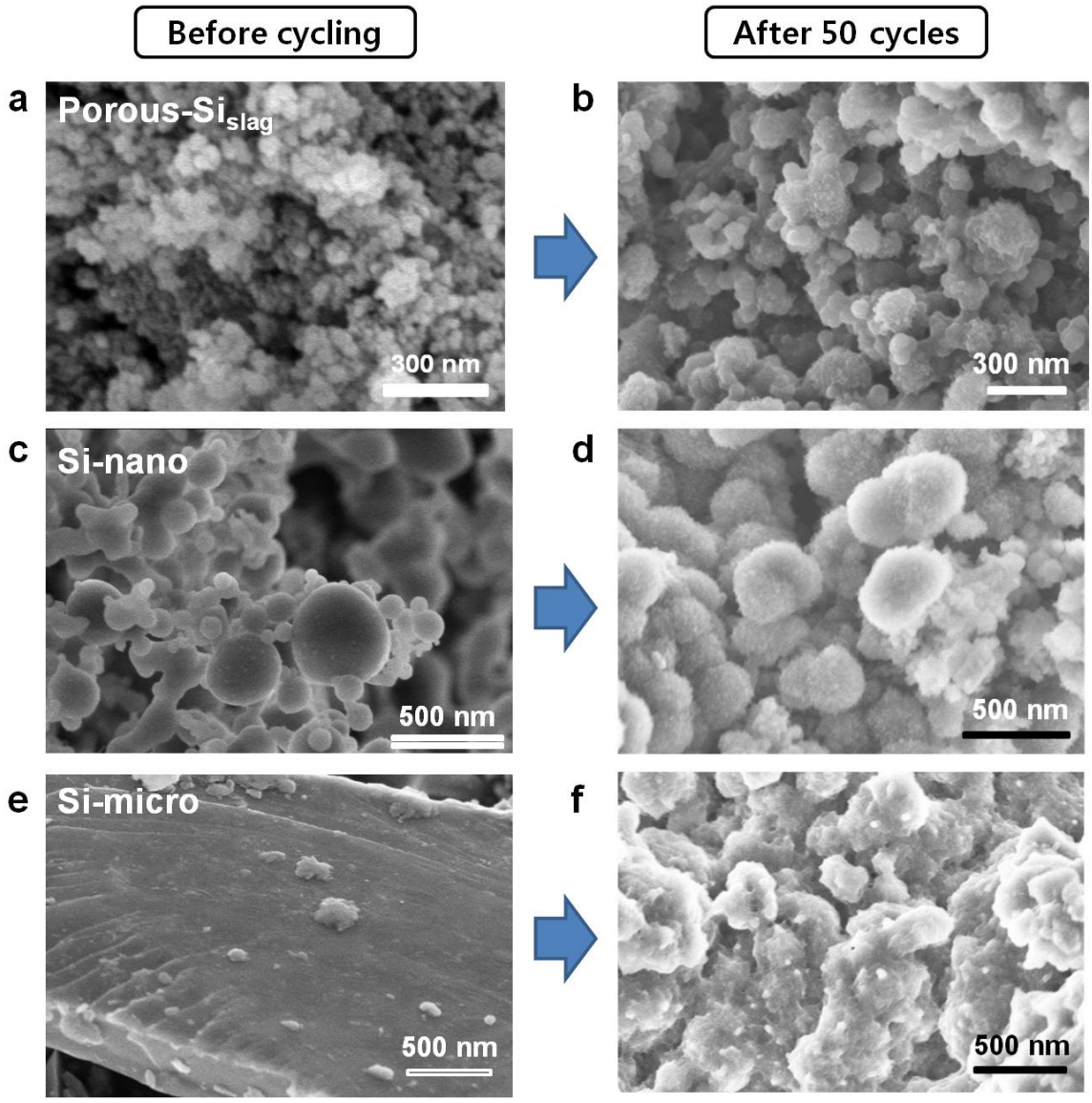

Fig. S9. SEM images of Porous-Si_{slag} (a) before and (b) after 50 cycles. SEM images of Si-nano (c) before and (d) after 50 cycles. SEM images of Si-micro (e) before and (f) after 50 cycles.

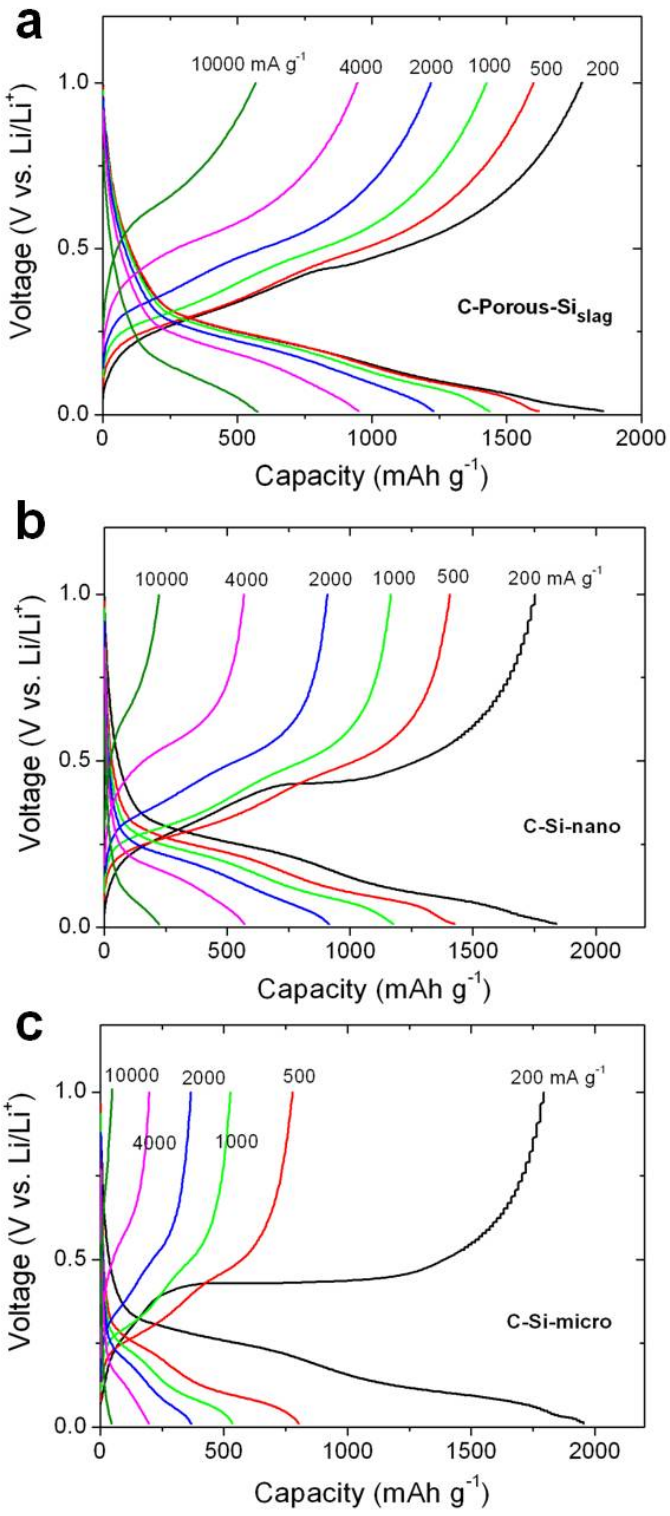

Fig. S10. Voltage profiles of (a) C-Porous-Si_{slag}, (b) C-Si-nano and (c) C-Si-micro at different current densities.

Table S1. Structural parameters of iron slag, Porous-SiO_{2slag}, Porous-Si_{slag}, Bulk-Si_{slag} and commercial Si materials.

	BET surface area ($m^2\ g^{-1}$)	Single point total pore volume ($cm^3\ g^{-1}$)
Iron slag	0.9	0
Porous-SiO_{2slag}	570	0.58
Porous-Si_{slag}	438	0.91
Bulk-Si_{slag}	5.6	0.03
Si-nano	12	0.02
Si-micro	3.8	0.01