Supporting Information

Chessboard-like Silicon/Graphite Anode with High Cycling Stability towards Practical Lithium-ion Batteries

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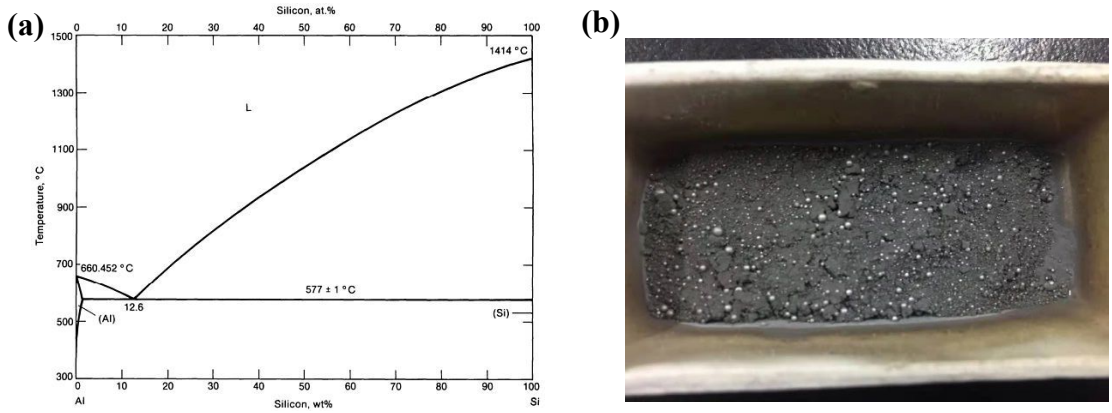

Figure S1 (a) Binary alloy phase diagram of Al-Si, (b) c-Gr+10 μm Al-Si alloy.

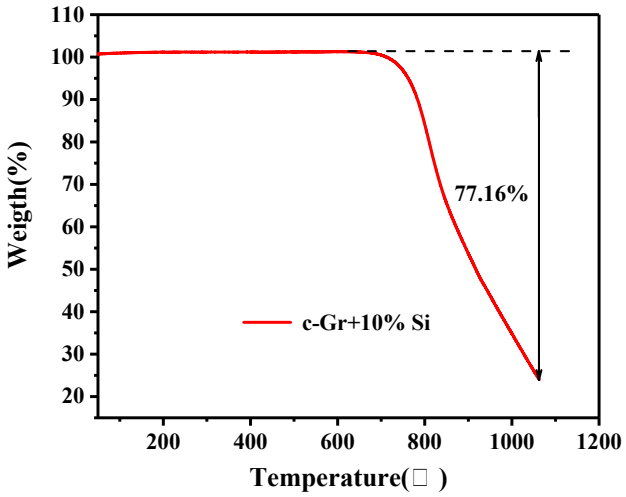

Figure S2 The thermogravimetric test curve of c-Gr+10%Si.

As shown in **Figure S2**., the weight loss of the sample continued until 1100℃, at which time the percentage of weight loss was 77.16%. When the temperature exceeds 600℃, silicon begins to oxidize5, so the quality of silicon increases. When the temperature reaches 1100℃, silicon is oxidized to silicon dioxide, and the original silicon mass of 1mg increases to 2.143mg, with an increased mass ratio of 11.43%.Therefore, the actual weightlessness ratio should be 88.59%, which is very close to the theoretical weightlessness value of 90%. Therefore the proportion of Si in the c-Gr+Si is controlled successfully.

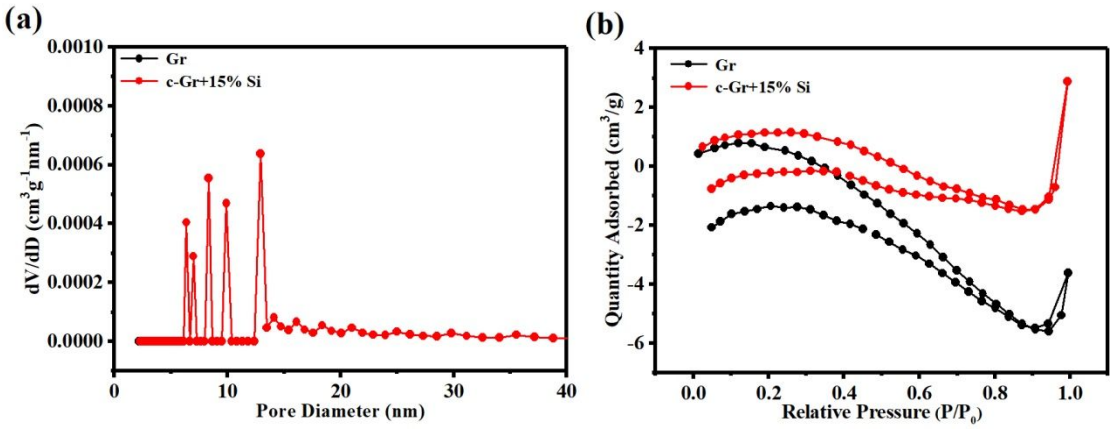

Figure S3 (a) Nitrogen adsorption-desorption isotherms of graphite and c-Gr+15%Si.

(b) Pore size distribution of graphite and c-Gr+15% Si.

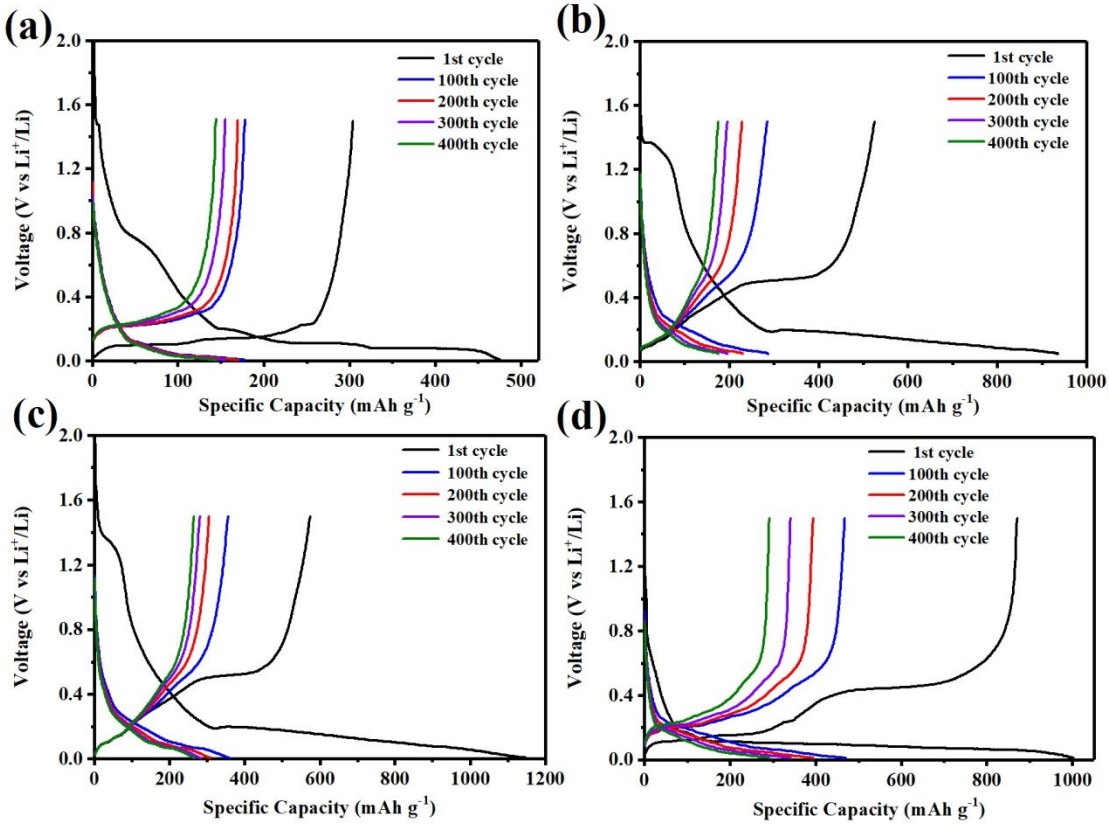

Figure S4 The charge/discharge profiles of (a) graphite, (b) c-Gr+5%Si, (c) c-Gr+10%Si, (d) c-Gr+20%Si.

Table S1 Electrochemical performance comparison of the reported Si/G anodes

name	approaches	capacity ($mAh\ g^{-1}$)	capacity retention	cycles	reference
graphite/Si@reGO	spray drying	575.1	73.1%	50	1
Si/C composites	spray drying	723.8	81.8%	100	2
Si-nanolayer-embedded graphite/carbon	CVD	534	96%	100	3
nano-Si/pitch/graphite composite	liquid solidification	480	81%	1200	4
Si/C–graphite	CVD	650	82%	450	5
nano Si-coated graphite	Heating and ball-milling	761	71%	300	6
Si-C hybrid composite	CVD	1800	80%	500	7
c-Gr+15%Si	Calcination	522.4	92.9%	400	Our work

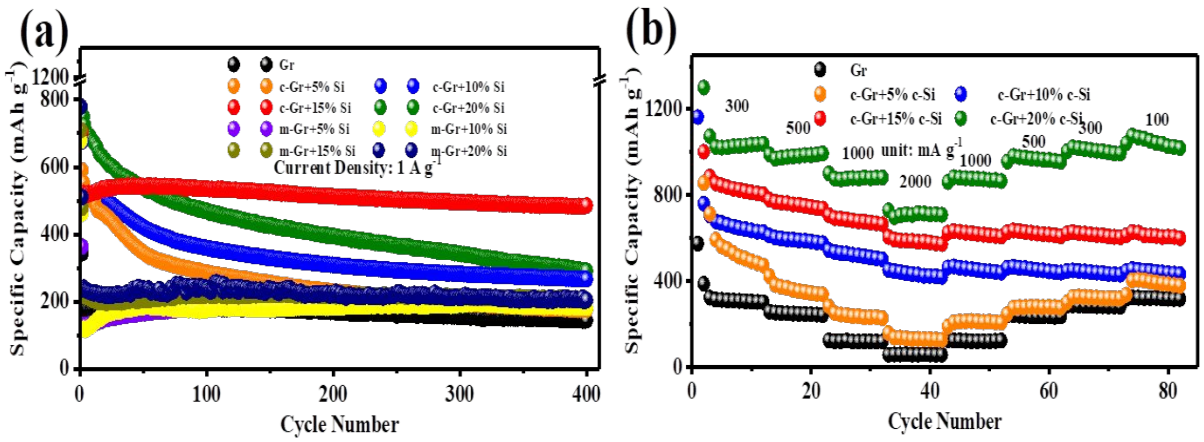

Figure S5 (a) Cycling performance and (b) rate capability of graphite, c-Gr+Si and m-Gr+Si.

References

(1) Gan, L.; Guo, H.; Wang, Z.; Li, X.; Peng, W.; Wang, J.; Huang, S.; Su, M. A facile synthesis of graphite/silicon/graphene spherical composite anode for lithium-ion batteries. *Electrochimica Acta* **2013,** *104*, 117-123, DOI: https://doi.org/10.1016/j.electacta.2013.04.083.

(2) Li, M.; Hou, X.; Sha, Y.; Wang, J.; Hu, S.; Liu, X.; Shao, Z. Facile spray-drying/pyrolysis synthesis of core–shell structure graphite/silicon-porous carbon composite as a superior anode for Li-ion batteries. *Journal of Power Sources* **2014,** *248*, 721-728, DOI: 10.1016/j.jpowsour.2013.10.012.

(3) Ko, M.; Chae, S.; Ma, J.; Kim, N.; Lee, H.-W.; Cui, Y.; Cho, J. Scalable synthesis of silicon-nanolayer-embedded graphite for high-energy lithium-ion batteries. *Nature Energy* **2016,** *1* (9), DOI: 10.1038/nenergy.2016.113.

(4) Kim, S. Y.; Lee, J.; Kim, B. H.; Kim, Y. J.; Yang, K. S.; Park, M. S. Facile Synthesis of Carbon-Coated Silicon/Graphite Spherical Composites for High-Performance Lithium-Ion Batteries. *ACS Appl Mater Interfaces* **2016,** *8* (19), 12109-17, DOI: 10.1021/acsami.5b11628.

(5) Li, X.; Yan, P.; Xiao, X.; Woo, J. H.; Wang, C.; Liu, J.; Zhang, J.-G. Design of porous Si/C–graphite electrodes with long cycle stability and controlled swelling. *Energy & Environmental Science* **2017,** *10* (6), 1427-1434, DOI: 10.1039/c7ee00838d.

(6) Yoon, Y. S.; Jee, S. H.; Lee, S. H.; Nam, S. C. Nano Si-coated graphite composite anode synthesized by semi-mass production ball milling for lithium secondary batteries. *Surface and Coatings Technology* **2011,** *206* (2-3), 553-558, DOI: 10.1016/j.surfcoat.2011.07.076.

(7) Kwon, H. J.; Hwang, J. Y.; Shin, H. J.; Jeong, M. G.; Chung, K. Y.; Sun, Y. K.; Jung, H. G. Nano/Microstructured Silicon-Carbon Hybrid Composite Particles Fabricated with Corn Starch Biowaste as Anode Materials for Li-Ion Batteries. *Nano Letters* **2020,** *20* (1), 625-635, DOI: 10.1021/acs.nanolett.9b04395.