Electronic Supplementary Material (ESI)

Sandwich-like Si/SiC/nanographite sheet as high performance anode for lithium-ion batteries

Yi Zhang[1,], Kai Hu[1], Jinghui Ren[1], Yuping Wu[1], Nengfei Yu[1], Ailing Feng[1], Zhengyong Huang[2,*], Zirui Jia[3], Guanglei Wu[3,]**

[1] School of Energy Sciences and Engineering, Nanjing Tech University, Nanjing 211816, Jiangsu Province, China

[2] State Key Laboratory of Power Transmission Equipment & System Security and New Technology, Chongqing University, Chongqing 400040, China

[3] Institute of Materials for Energy and Environment, State Key Laboratory of Bio-fibers and Eco-textiles, College of Materials Science and Engineering, Qingdao University, Qingdao 266071, China

***Corresponding Authors.** E-mail: zhangy@njtech.edu.cn (Yi Zhang); huangzhengyong@cqu.edu.cn (Huangzheng Huang); wuguanglei@qdu.edu.cn (Guanglei Wu).

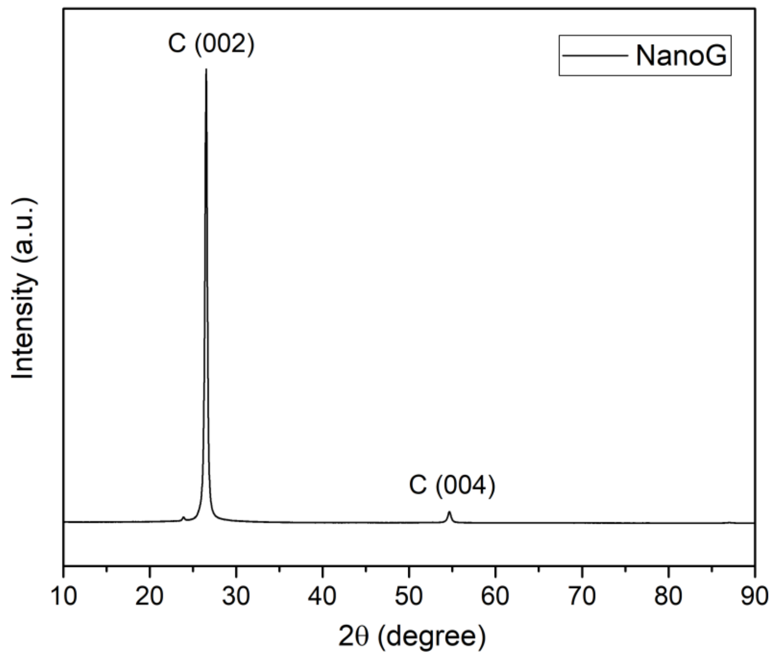

Figure S1 XRD pattern of NanoG.

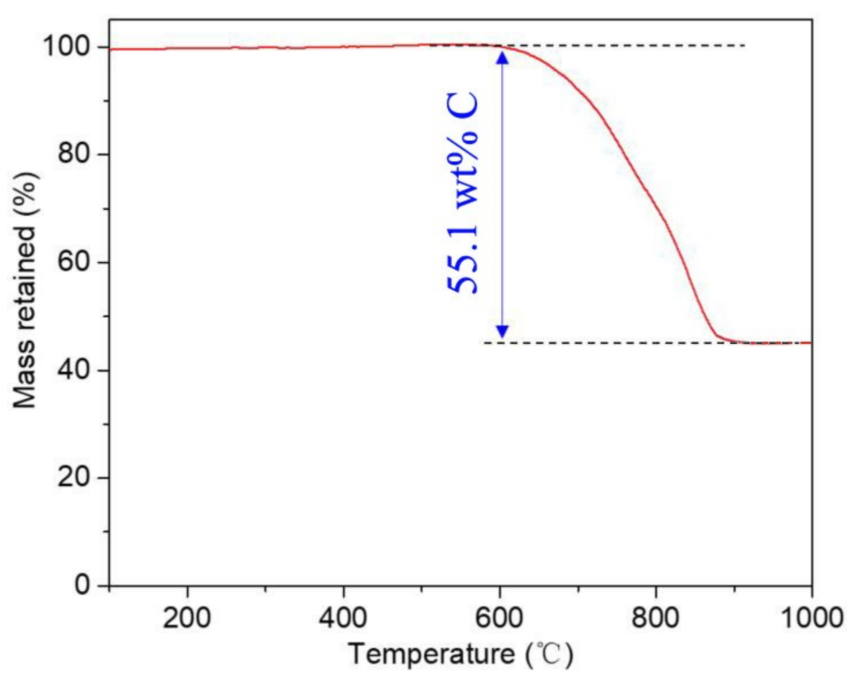

Figure S2 Thermogravimetric analysis (TGA) of the Si/SiC/NanoG nanocomposite conducted in air at scan rate of 5 °C min^{-1}.

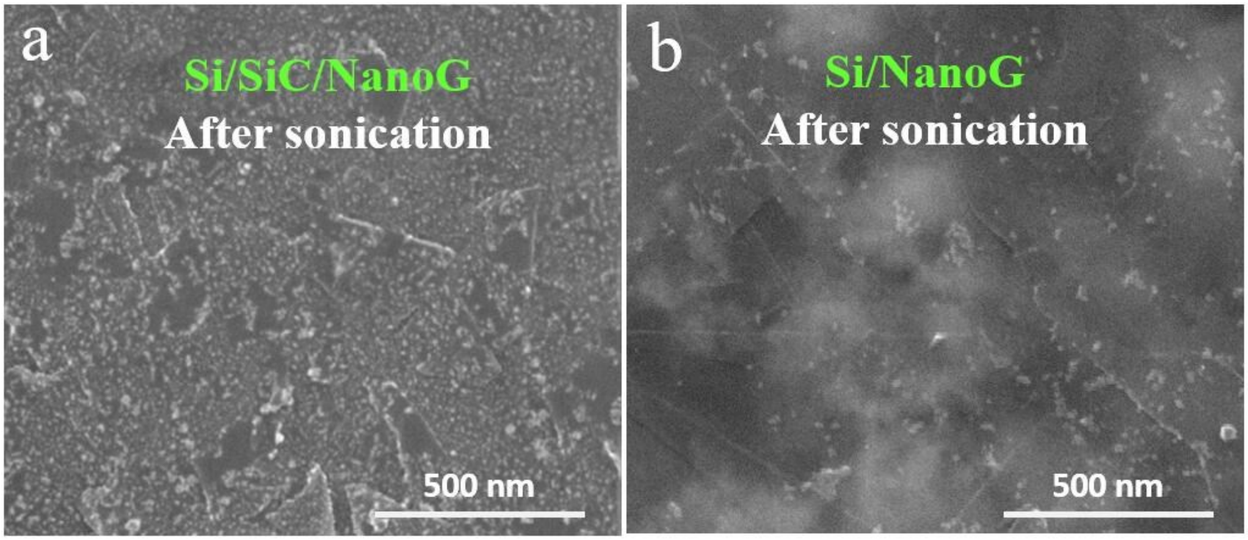

Figure S3 SEM images of Si/SiC/NanoG nanocomposite (a) and Si/NanoG nanocomposite (b) after sonication.

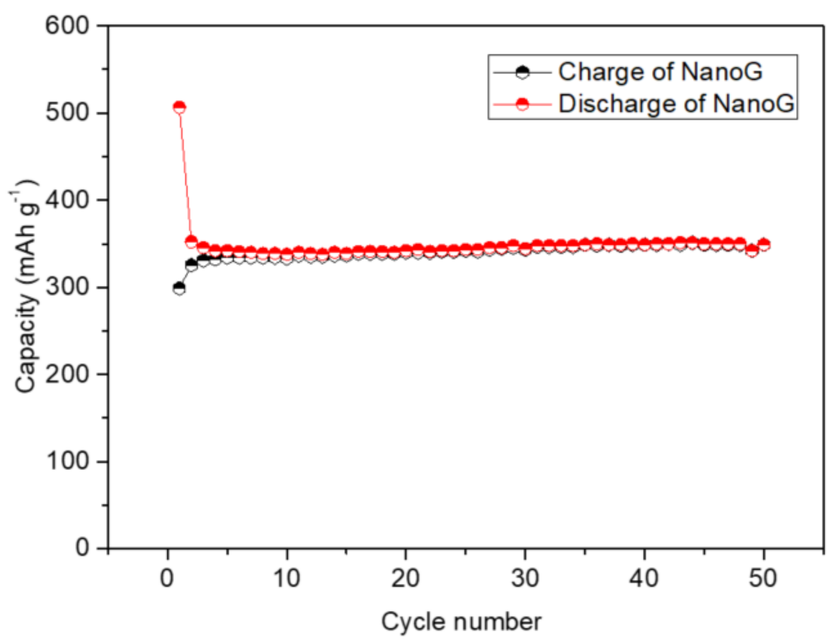

Figure S4 the cycle performance of NanoG at 100 mA g^{-1}.

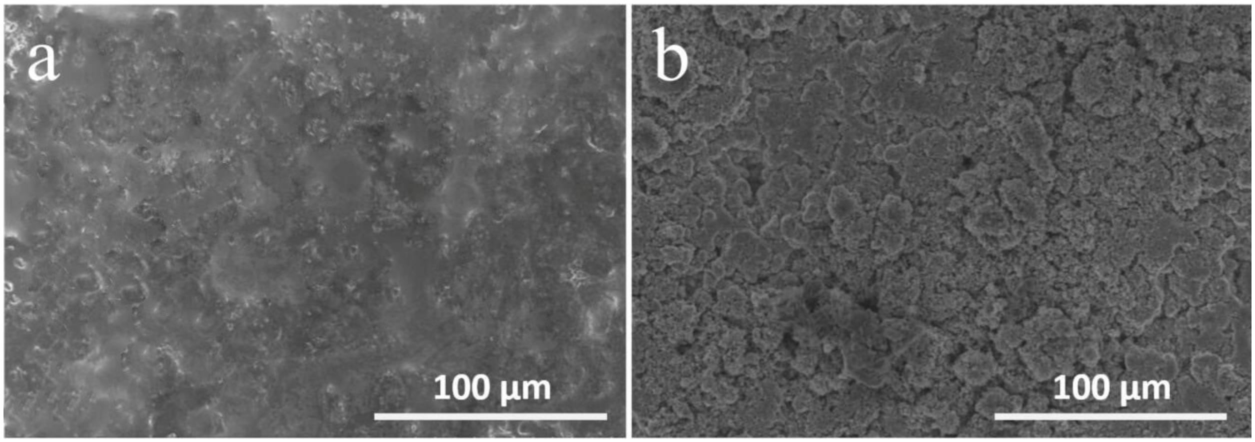

Figure S5 the electrode morphologies of Si/SiC/NanoG electrode (a) and Si/NanoG electrode (b) after 100 cycles.

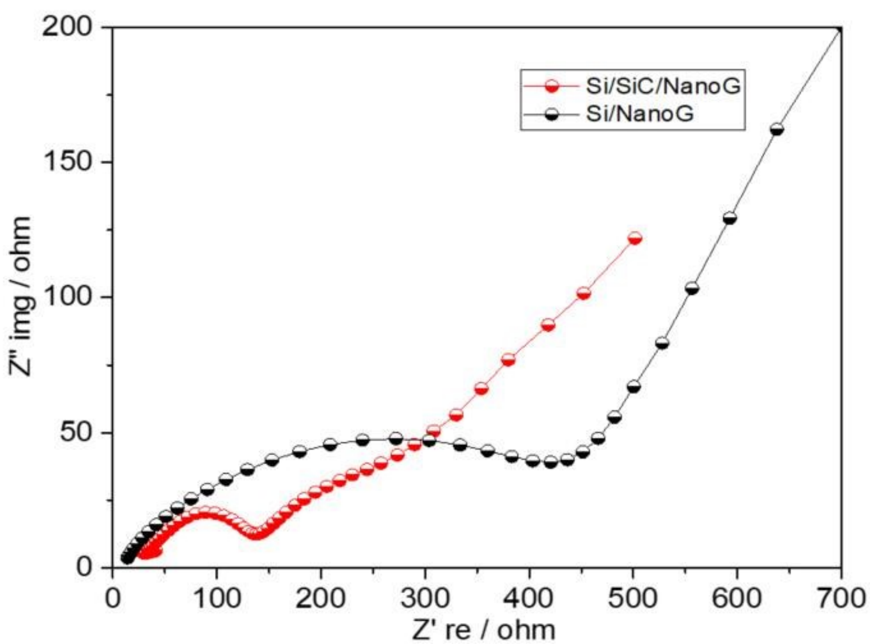

Figure S6 the EIS spectra of Si/SiC/NanoG and Si/NanoG after 100 cycles.

Table S1 The components' content of Si/SiC/NanoG nanocomposite.

Component	Weight %
Si	28.3
SiC	17.6
Graphite	54.1

Table S2 Performance comparison of our Si/SiC/NanoG anode with other similar anodes.

Anodes	cycle stability	capacity retention	Reference
Si/C [1]	initial reversible capacity is 2050 mAh g^{-1} while it is 1489 mAh g^{-1} after 20 cycles at 100 mA g^{-1}	72.6 %	Angewandte Chemie International Edition, 2006, 45(41): 6896-6899.
Si/C [2]	initial reversible capacity is 1910 mAh g^{-1} while it is 1356 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	71.0 %	Journal of Power Sources, 2017, 342: 529-536.
Si/CNFs [3]	initial reversible capacity is 1550 mAh g^{-1} while it is 726 mAh g^{-1} after 40 cycles at 50 mA g^{-1}	46.8 %	Energy & Environmental Science, 2010, 3(1): 124-129.
Si/CNTs [4]	initial reversible capacity is 1250 mAh g^{-1} while it is 727 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	58.2 %	Journal of Power Sources, 2018, 381: 156-163.
Si/SiC/ CNTs [5]	initial reversible capacity is 1379 mAh g^{-1} while it is 938 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	68.0 %	Carbon, 2016, 107: 600-606

Si/graphite [6]	initial reversible capacity is 1702.9 mAh g^{-1} while it is 975.7 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	57.3 %	Journal of Power Sources, 2015, 281: 425-431.
Si/graphite [7]	initial reversible capacity is 1350 mAh g^{-1} while it is 1000 mAh g^{-1} after 100 cycles at 74 mA g^{-1}	74.1 %	Chemical Communications, 2005, 12(12): 1566-1568
Si/SiO_x/ graphite [8]	initial reversible capacity is 1014 mAh g^{-1} while it is 710 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	70.0 %	Journal of Materials Chemistry, 2010, 20(23): 4854-4860.
Si/graphene [9]	initial reversible capacity is 1750 mAh g^{-1} while it is 1168 mAh g^{-1} after 30 cycles at 100 mA g^{-1}	66.7 %	Electrochemistry Communications, 2010, 12(2): 303-306.
Si/graphite@ graphene [10]	initial reversible capacity is 820.7 mAh g^{-1} while it is 500.0 mAh g^{-1} after 50 cycles at 100 mA g^{-1}	60.9 %	Electrochimica Acta, 2014, 116: 230-236.
Si@graphene /carbon fiber[11]	initial reversible capacity is 2670 mAh g^{-1} while it is 1604 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	60.1 %	International Journal of Hydrogen Energy, 2016, 41(46): 21268-21277.
Si/SiC/ NanoG	initial reversible capacity is 1135.4 mAh g^{-1} while it is 912.7 mAh g^{-1} after 100 cycles at 100 mA g^{-1}	**80.4 %**	**This work**

Reference:

[1] S.H. Ng, J. Wang, D. Wexler, K. Konstantinov, Z.P. Guo, H.K. Liu, Angew. Chem. Int. Ed., 2006, **45**, 6896-6899.

[2] J. Xie, L. Tong, L. Su, Y. Xu, L. Wang, Y. Wang, J. Power Sources, 2017, **342**, 529-536.

[3] L. Ji, X. Zhang, Energy & Environmental Science, 2010, **3**, 124-129.

[4] X. Zhou, Y. Liu, C. Du, Y. Ren, T. Mu, P. Zuo, G. Yin, Y. Ma, X. Cheng, Y. Gao, J. Power Sources, 2018, **381**, 156-163.

[5] Y. Jiang, H. Wang, B. Li, Y. Zhang, C. Xie, J. Zhang, G. Chen, C. Niu, Carbon, 2016, **107**, 600-606.

[6] Y. Zhang, Y. Jiang, Y. Li, B. Li, Z. Li, C. Niu, J. Power Sources, 2015, **281**, 425-431.

[7] M. Holzapfel, H. Buqa, W. Scheifele, P. Novák, F.-M. Petrat, Chem. Commun., 2005, **12**, 1566-1568.

[8] C. M. Park, W. Choi, Y. Hwa, J.-H. Kim, G. Jeong, H.-J. Sohn, J. Mater. Chem., 2010, **20**, 4854-4860.

[9] S.-L. Chou, J.-Z. Wang, M. Choucair, H.-K. Liu, J.A. Stride, S.-X. Dou, Electrochem. Commun. 2010, **12**, 303-306.

[10] M. Su, Z. Wang, H. Guo, X. Li, S. Huang, W. Xiao, L. Gan, Electrochim. Acta, 2014, **116**, 230-236.

[11] H. Tao, L. Xiong, S. Zhu, X. Yang, L. Zhang, Int. J. Hydrogen Energy, 2016, **41**, 21268-21277.