

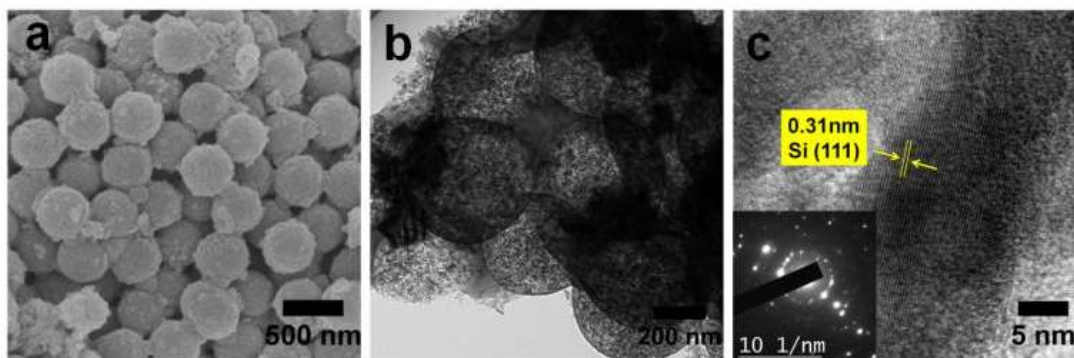
# High-Temperature Magnesiothermic Reduction Enables HF-Free Synthesis of Porous Silicon with Enhanced Performance as Lithium-Ion Battery Anode

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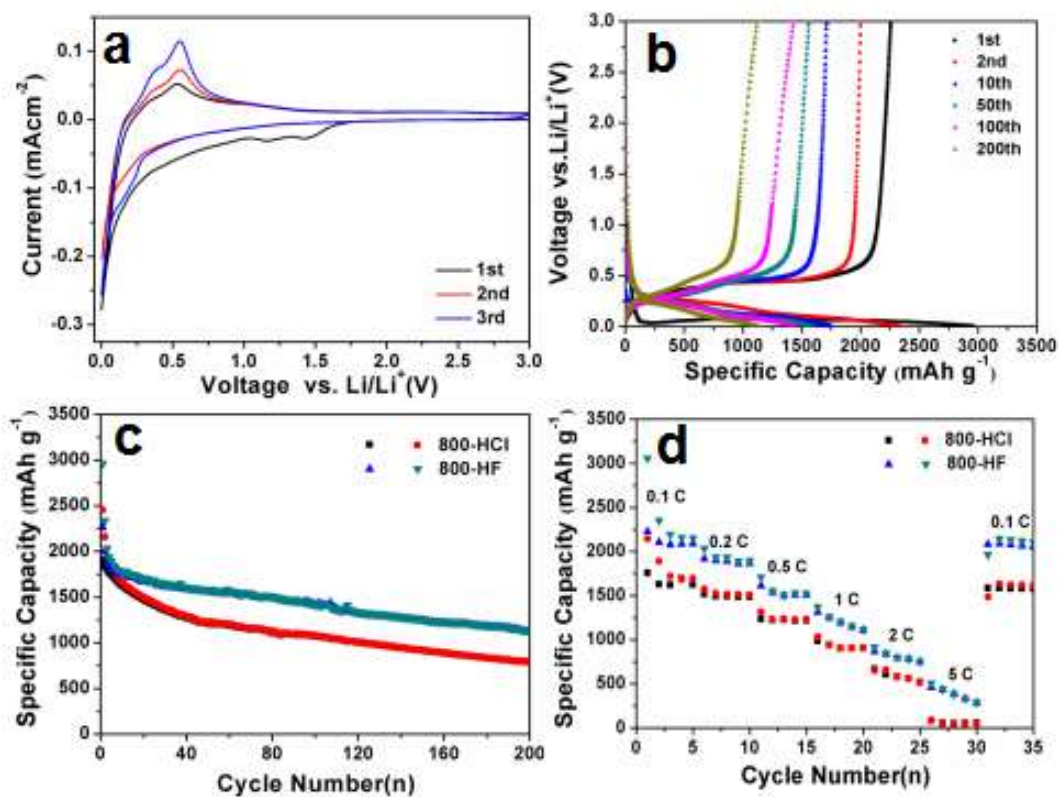
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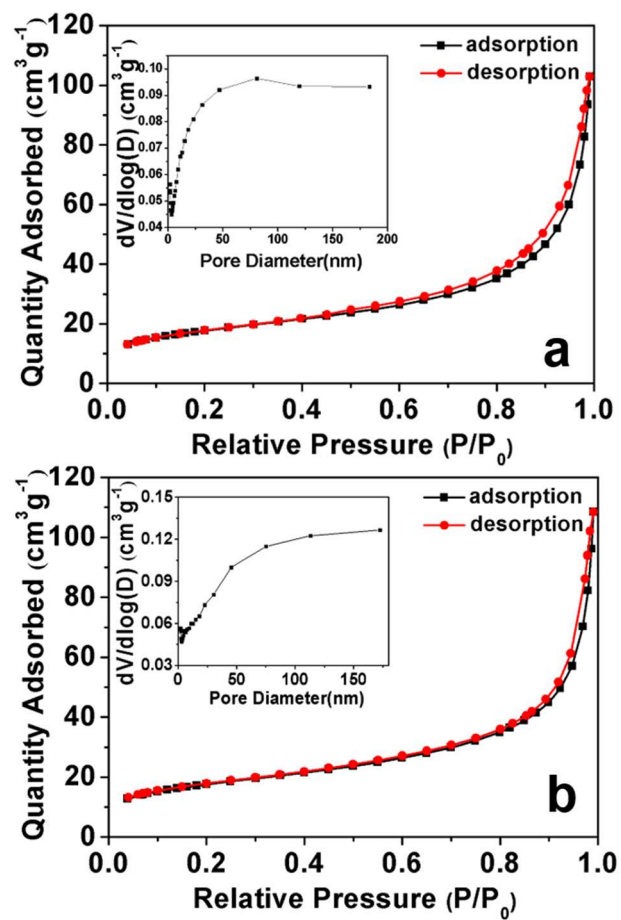
## Supplementary Material



**Figure S1.** SEM (a), TEM (b), HRTEM (c) images and SAED pattern (inset of image c) of the 700-HCl sample.



**Figure S2.** Cyclic voltammetry curves (a, scanning rate:  $0.2 \text{ mV sec}^{-1}$ ), galvanostatic discharge/charge profiles (b), cycling performance (c, current density:  $0.2 \text{ C}$ ) and rate performance (d) of the 800-HF sample.

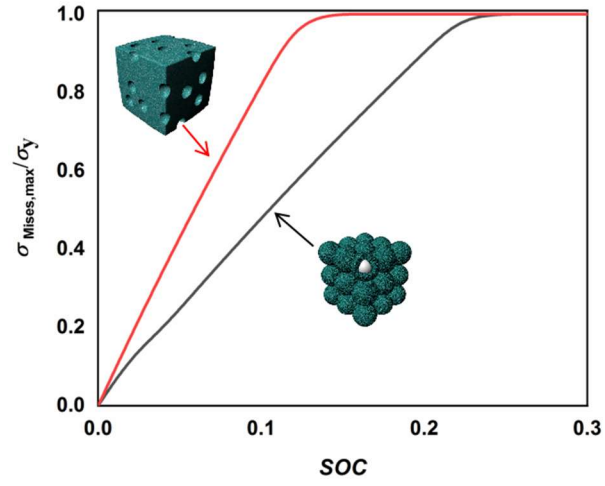


**Figure S3.** N<sub>2</sub> adsorption and desorption isotherms and the corresponding BJH pore size distribution curve of the 900-HCl sample(a) and 900-HF sample(b).

**Table S1.** Comparison of the cyclic performance of silicon based anodes in LIBs

| <b>sample</b>                                | <b>Current density/Ag<sup>-1</sup></b> | <b>Reversible capacity /mAhg<sup>-1</sup></b> | <b>Cylces</b> | <b>Capacity retention /%</b> | <b>Mass Loading /mgcm<sup>-2</sup></b> | <b>ref</b> |
|--|--|---|---------------|------------------------------|--|------------|
| silicon pomegranates                         | 0.23                                   | 950   | 100           | 94                           | <b>3.12</b>                            | [28]       |
| watermelon-inspired Si/C microspheres        | 0.3                                    | 620   | 500           | 80                           | <b>4.1</b>                             | [41]       |
| Si/C composite                               | 0.42                                   | 626   | 100           | 67                           | <b>5.0</b>                             | [42]       |
| porous Si/C                                  | 0.05                                   | 1036  | 100           | 71                           | <b>3.0</b>                             | [43]       |
| Non-filling carbon coating of porous silicon | 0.1                                    | 1420  | 100           | 88                           | <b>2.0</b>                             | [44]       |
| Nano -Si secondary clusters                  | 0.25                                   | 1150  | 100           | 66                           | <b>2.0</b>                             | [45]       |
| Si@rGO                                       | 0.5                                    | 1325  | 100           | 71                           | <b>2.6</b>                             | [46]       |
| macro-/mesoporous Si                         | 0.2                                    | 1298  | 100           | 76*                          | <b>2.4</b>                             | Our work   |

Note: \*The capacity retention is calculated against the maximum capacity value after the activation process and corresponds to the number of cycles listed in the fourth column.



**Figure S4.** Evolution of peak Mises stress of silicon in spherical-shell structure of 700-HCl and porous structure of 800-HCl/900-HCl with *SOC*.