

†*Electronic Supplementary Information (ESI)*

# Biphasic Silicon Oxide Nanocomposites as High- Performance Lithium Storage Materials

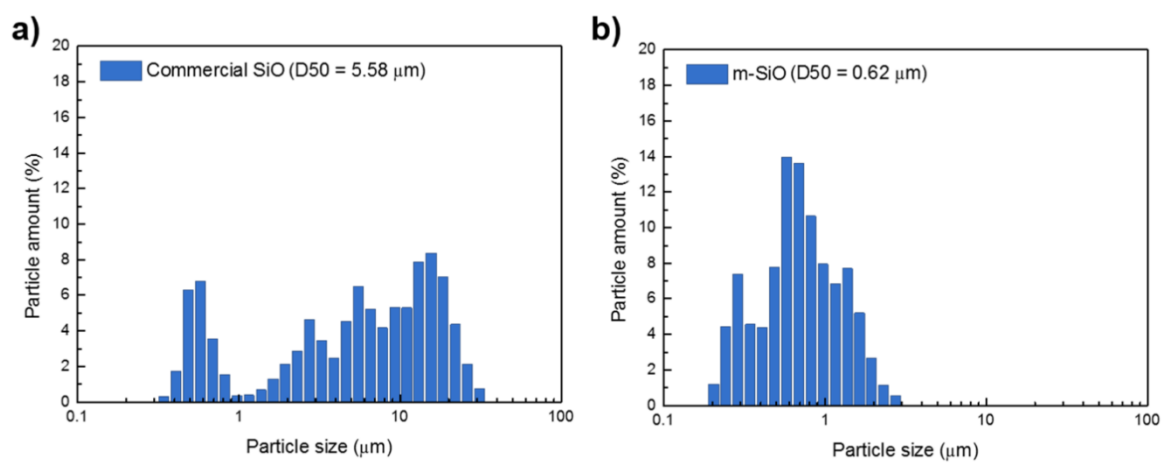
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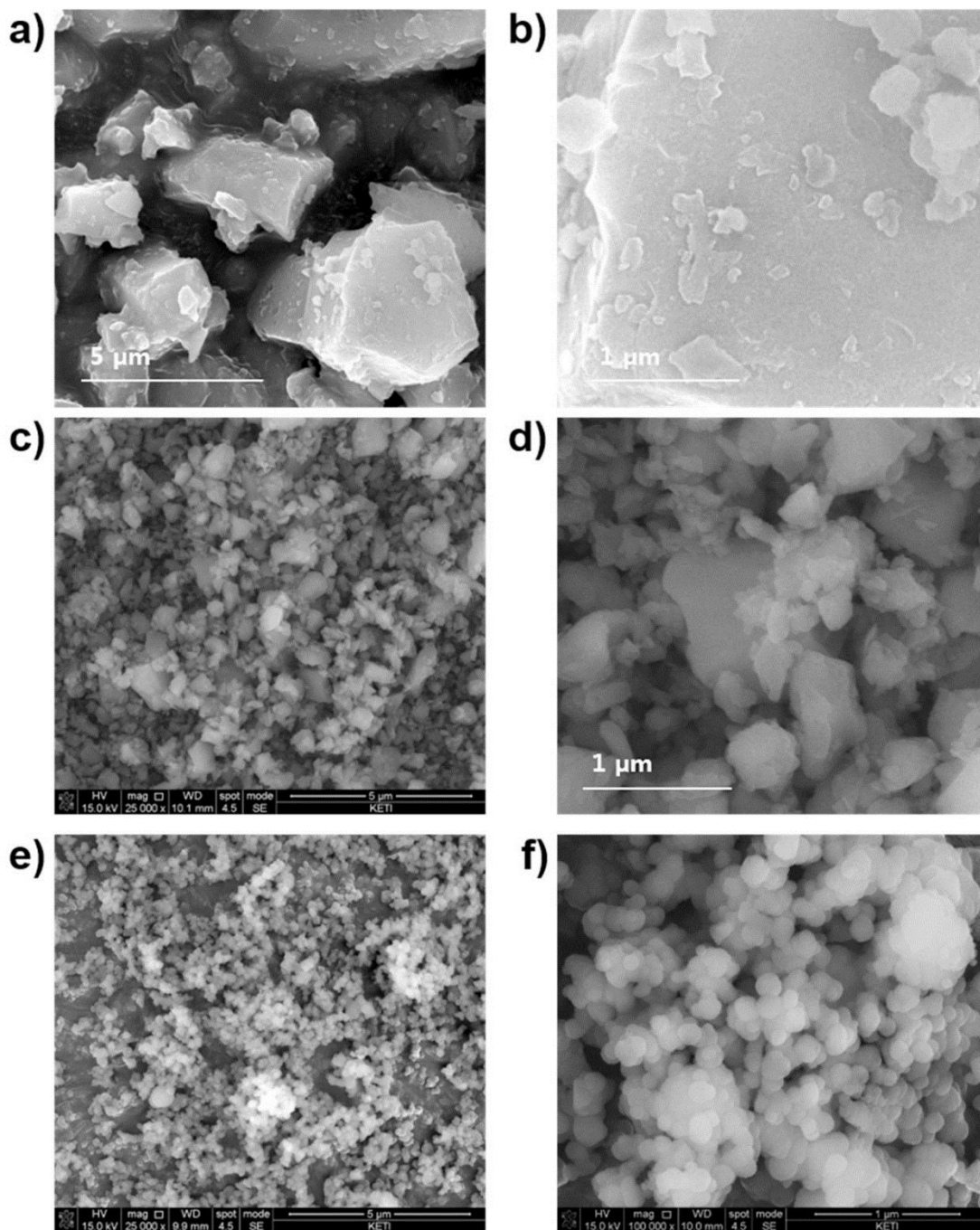
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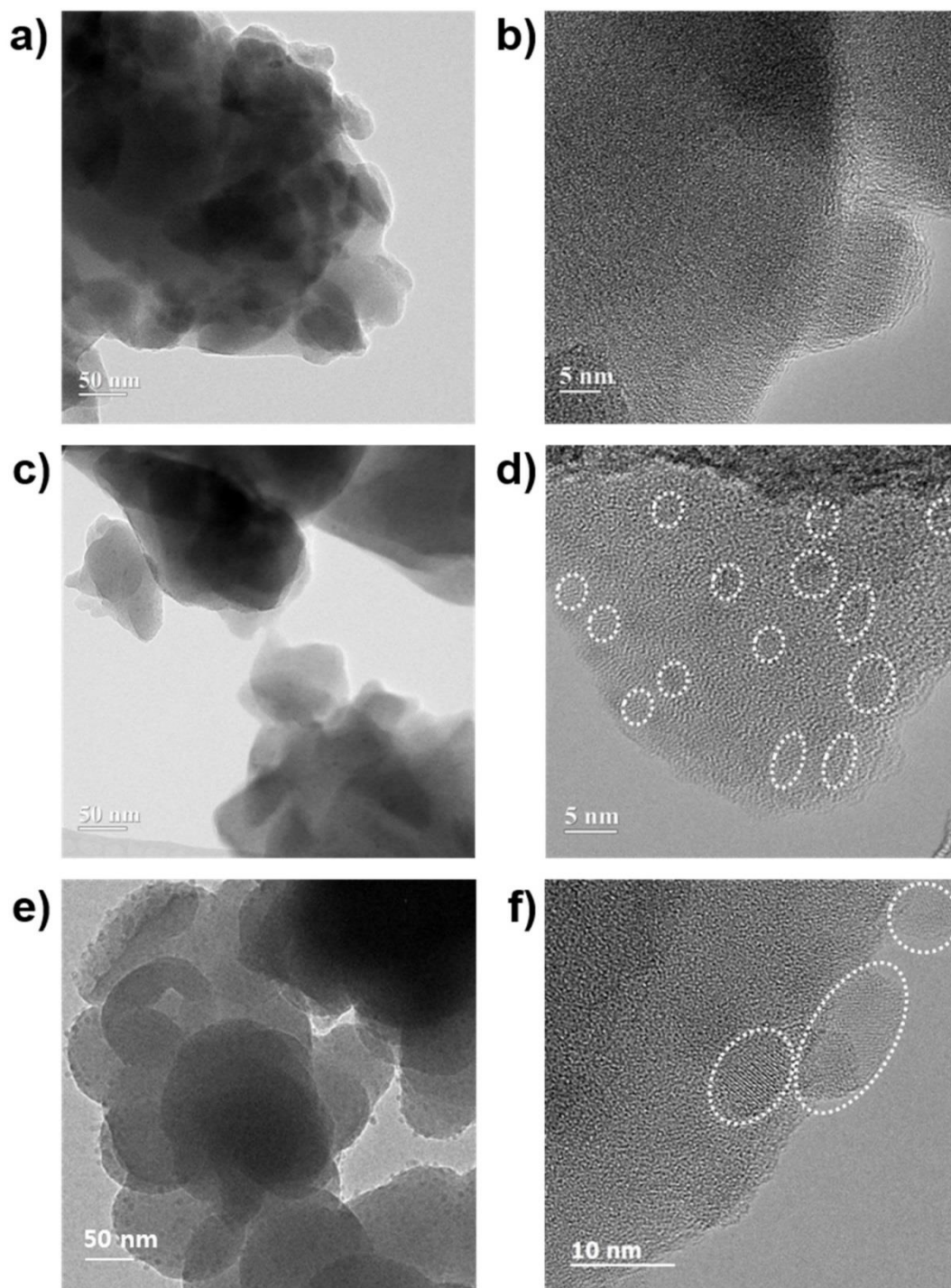
E-mail: [khansu@hanyang.ac.kr](mailto:khansu@hanyang.ac.kr). (H. Kim), [mspark@khu.ac.kr](mailto:mspark@khu.ac.kr) (M.-S. Park)



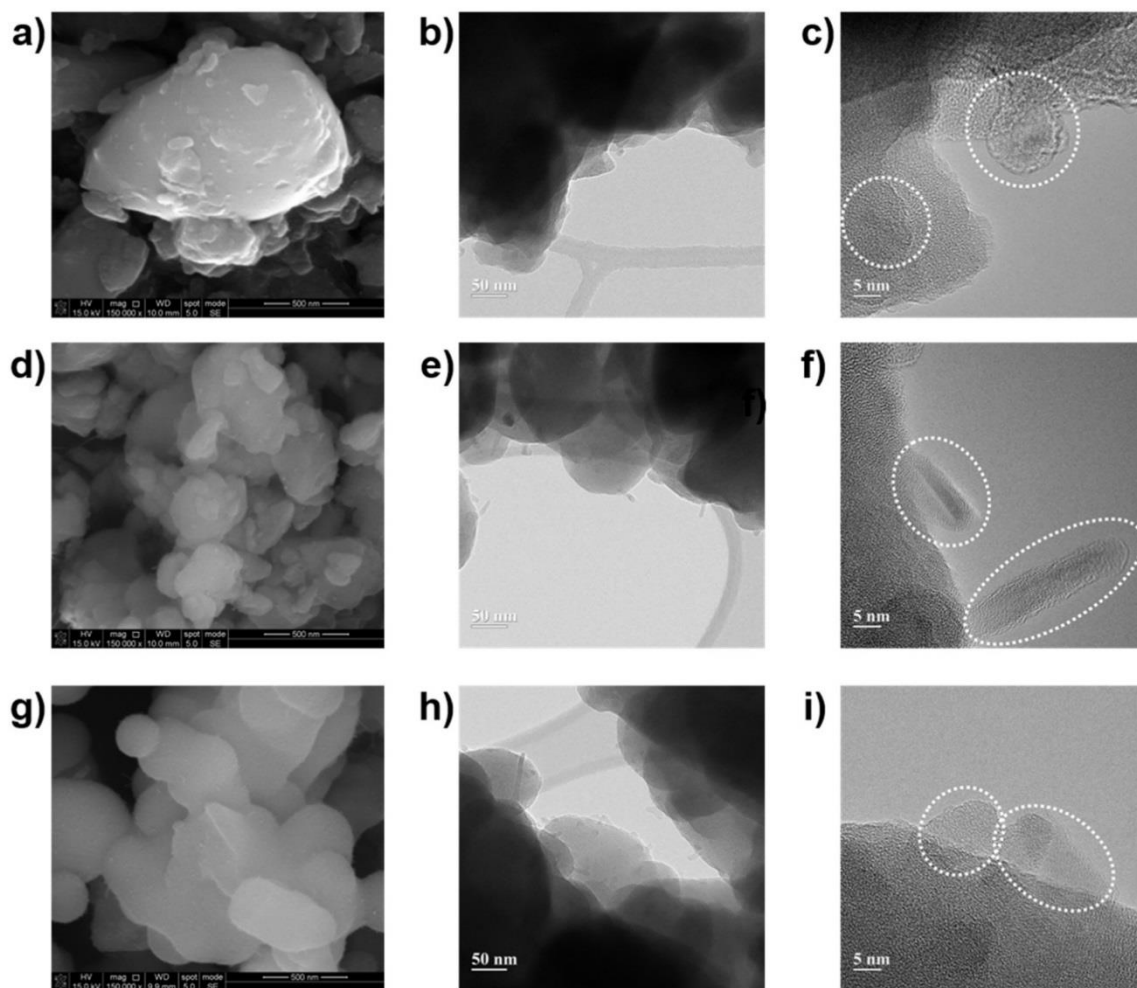
**Fig. S1** Particle size distribution of (a) commercial SiO and (b) m-SiO.



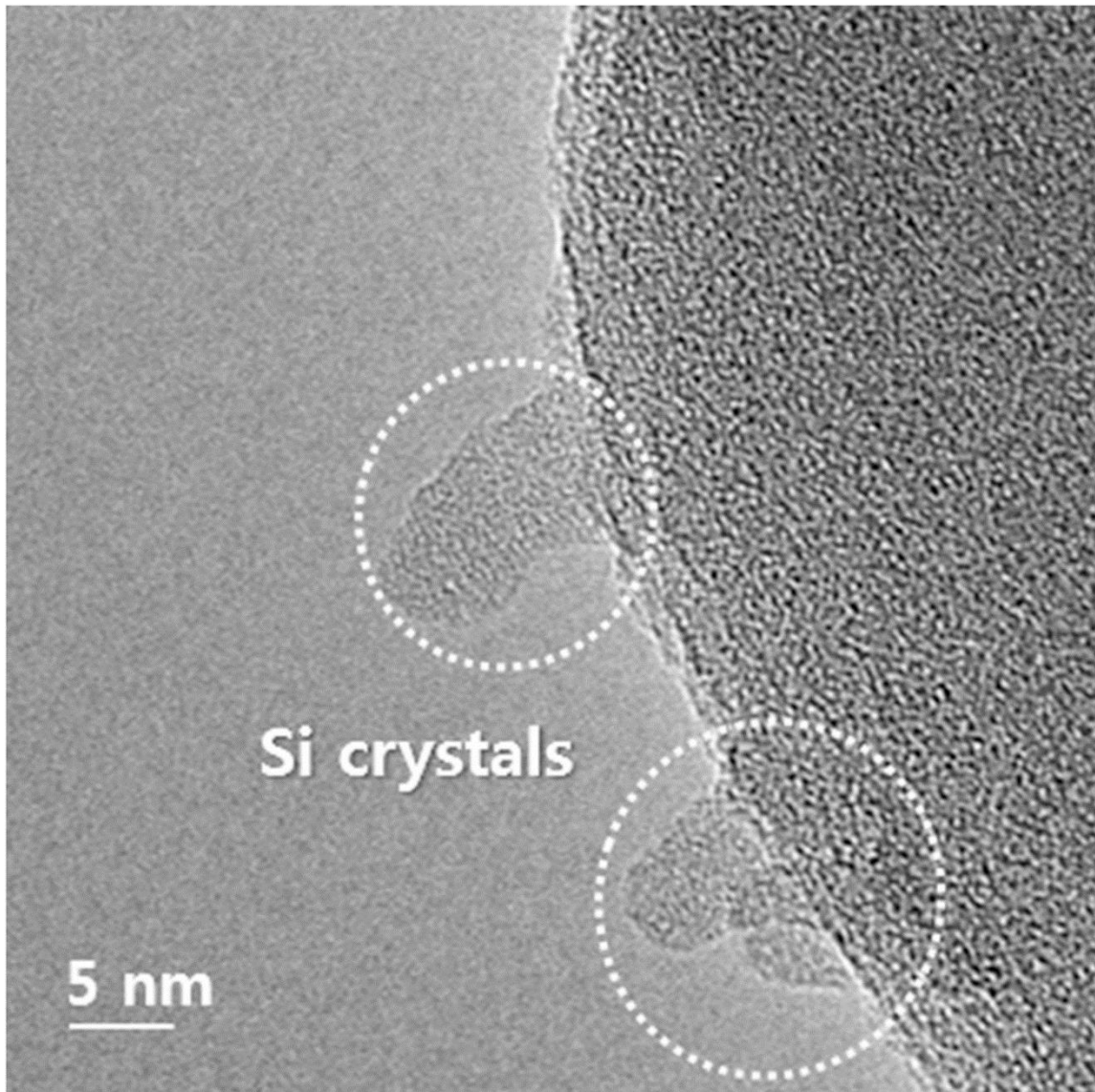
**Fig. S2** FESEM images of the SiO (core material) and Si/SiO<sub>x</sub> (shell material): (a,b) commercial SiO, (c,d) m-SiO, and (e,f) Si/SiO<sub>x</sub> nanospheres.



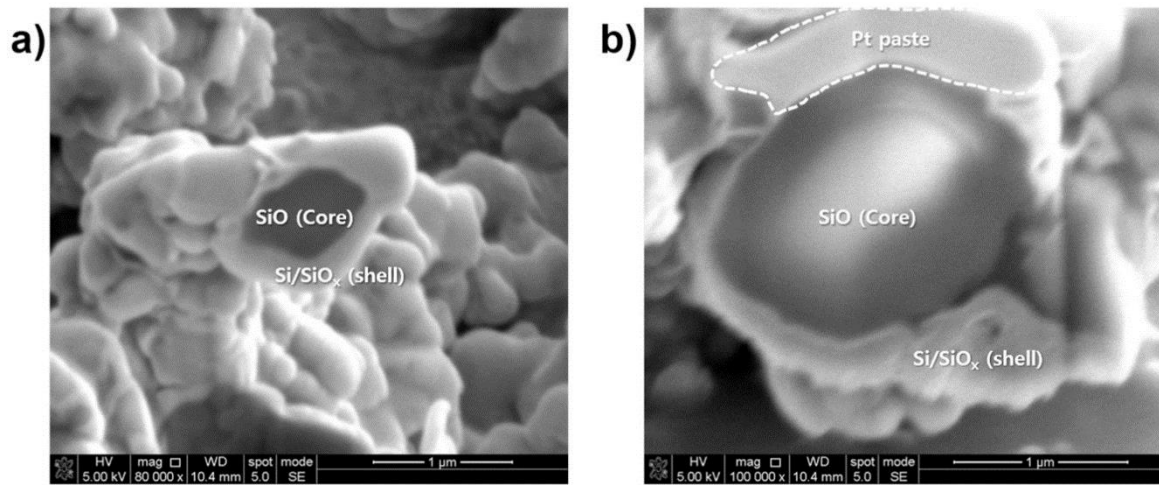
**Fig. S3** TEM and HRTEM images of the (a,b) m-SiO, (c,d) heated m-SiO, and (e,f) Si/SiO<sub>x</sub> nanospheres.



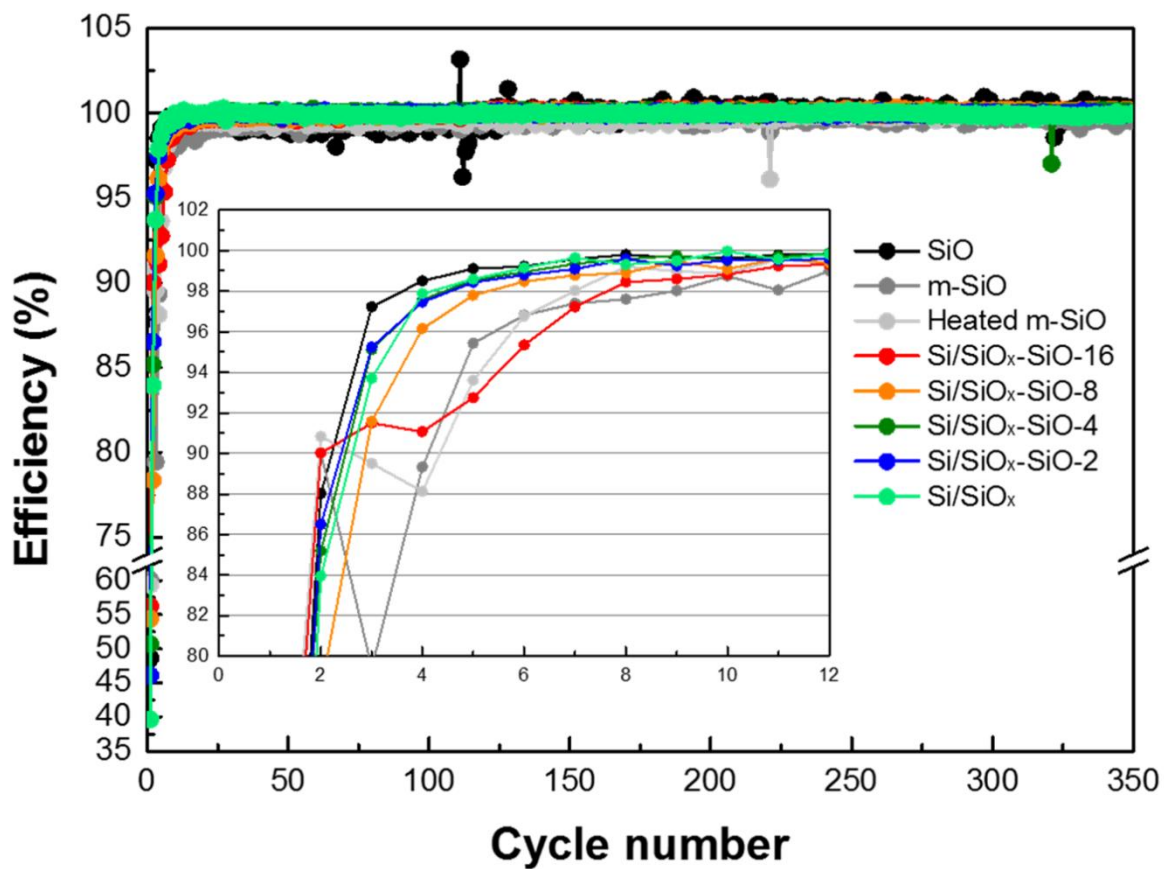
**Fig. S4** (a) FESEM, (b) TEM, (c) HRTEM images of Si/SiO<sub>x</sub>-SiO-16 composites, (d) FESEM, (e) TEM, (f) HRTEM images of Si/SiO<sub>x</sub>-SiO-8 composites, and (g) FESEM, (h) TEM, (i) HRTEM images of Si/SiO<sub>x</sub>-SiO-2 composites.



**Fig. S5** HRTEM images of Si/SiO<sub>x</sub>-SiO-4 composites.

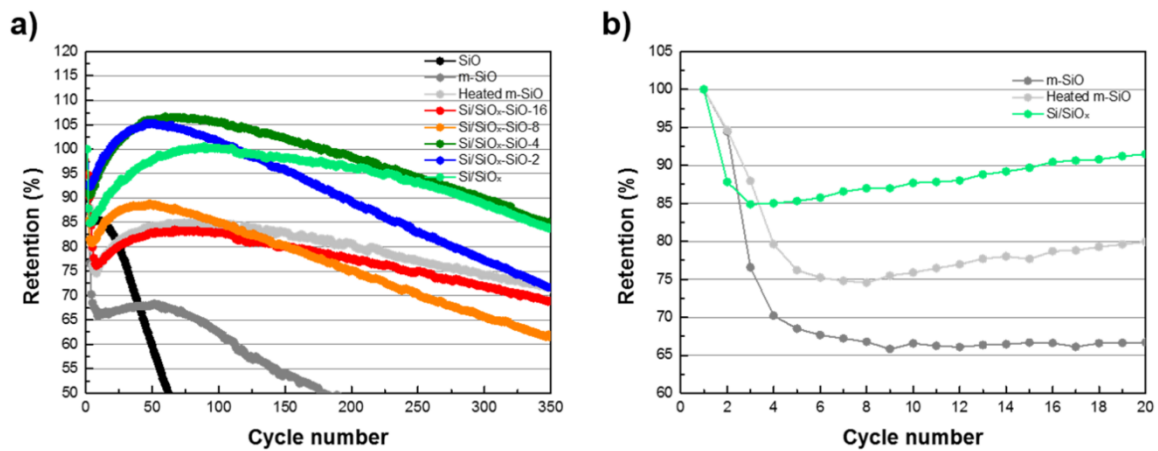


**Fig. S6** FESEM images of Si/SiO<sub>x</sub>-SiO-4 composites after milling using focused ion beam technique.

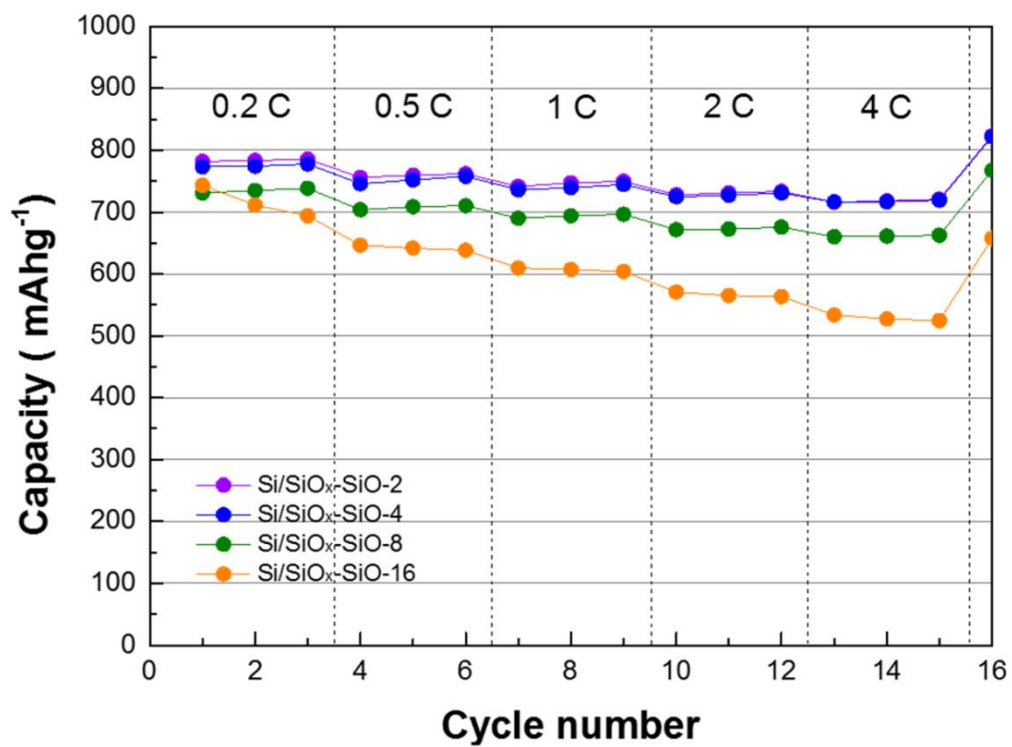


**Fig. S7** Coulombic efficiencies of the Si/SiO<sub>x</sub>-SiO composite anodes at a constant current of 0.2 C (200 mA g<sup>-1</sup>) for 350 cycles.

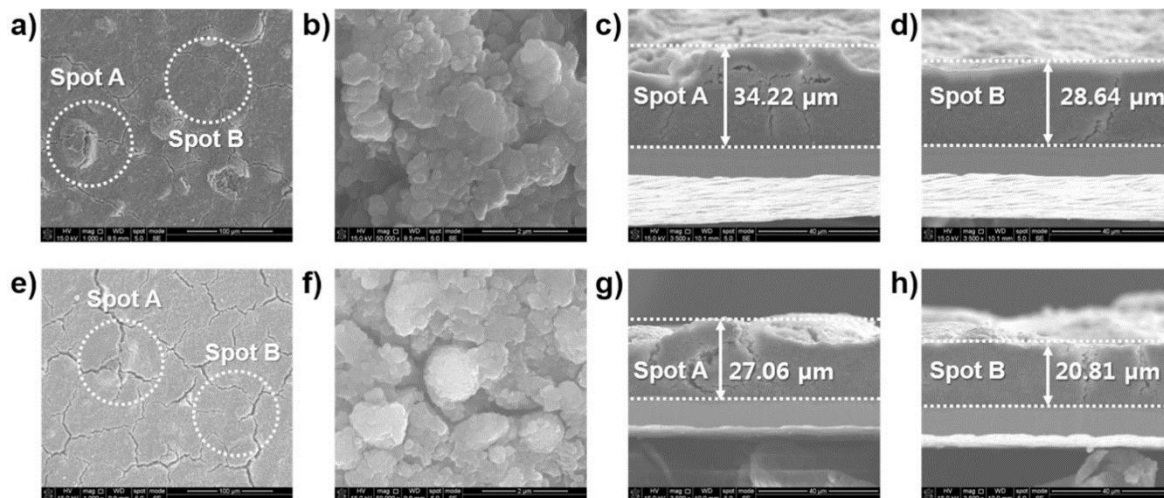




**Fig. S8.** Discharge capacity retentions of the Si/SiO<sub>x</sub>-SiO composite anodes at a constant current of 0.2 C (200 mA g<sup>-1</sup>) for (a) 350 cycles, and (b) 20 cycles.



**Fig. S9** Rate-capability of Si/SiO<sub>x</sub>-SiO composite anodes at different current densities of 0.1, 0.2, 0.5, 1.0, 2.0, and 4.0 C (1C = 1000 mA g<sup>-1</sup>).



**Fig. S10** (a,b) Top view and (c,d) cross-sectional FESEM images of the heated m-SiO electrodes at 1st charge states, (e,f) top view and (g,h) cross-sectional FESEM images of the heated m-SiO electrodes at 1st discharge states.

**Table S1** Electrochemical performances and electrode information of SiO-based anode materials.

Number	Anode materials	Mass loading (mg/cm <sup>2</sup> )	Current density (mA/g)	Discharge Capacity (mAh/g)	Cycles	Reference number
1	Si/SiO <sub>x</sub> -SiO	1.5	200	966	350	This work
2	Etched m-SiO	-	150	2366	50	[14]
3	Si-SiO-SiO <sub>2</sub>	3	~100	1670	100	[15]
4	SiO@F-doped C	1.5~1.7	100	1518	350	[17]
5	Si/SiO	-	0.2 mA cm <sup>-2</sup>	827	20	[18]
6	SiO <sub>x</sub> /Si/C	-	100, 300	2209	100	[19]
7	SiO/Graphite/C	2	100, 200	905	55	[20]
8	SiO/rGO	-	120	~1250	50	[22]
9	SiO@CNFs/Graphite	-	100	1032	100	[23]
10	SiO <sub>x</sub> -C	-	45	450	100	[24]
11	TiO <sub>2</sub> -coated SiO	2~3	60, 120	1265	50	[26]
12	Ag-coated porous SiO	10	130~220	1350	50	[28]
13	Si/SiO <sub>x</sub> nanowires	5	130	1290	50	[29]
14	Porous SiO <sub>x</sub>	-	150~300	1242	100	[30]
15	SiO <sub>x</sub> /C	3.5	130~325	645	500	[31]
16	2D-Si/SiO <sub>x</sub>	1.5	1000	740	200	[32]
17	Mesoporous SiO <sub>x</sub>	1.5	200	730	100	[33]