

## Supporting Information

Synthesis of Si nanoparticles (80%-SiNPs). To highlight the critical role of the CNT template, a control sample of 80%-SiNPs was synthesized under similar conditions to SiNPs but add 20% CNTs.

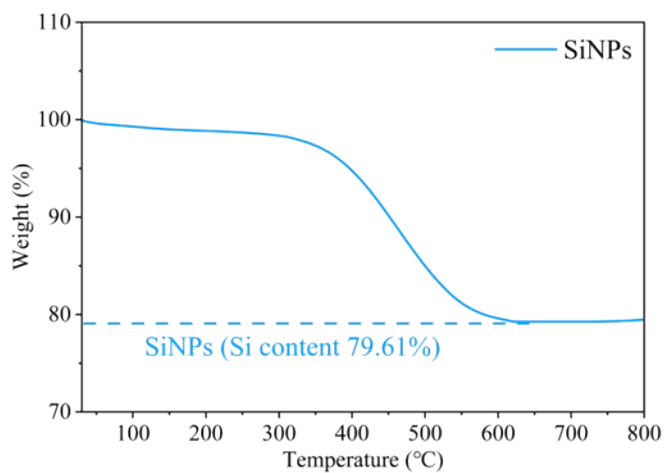


Figure S1 TGA curves of 20%-SiNPs.

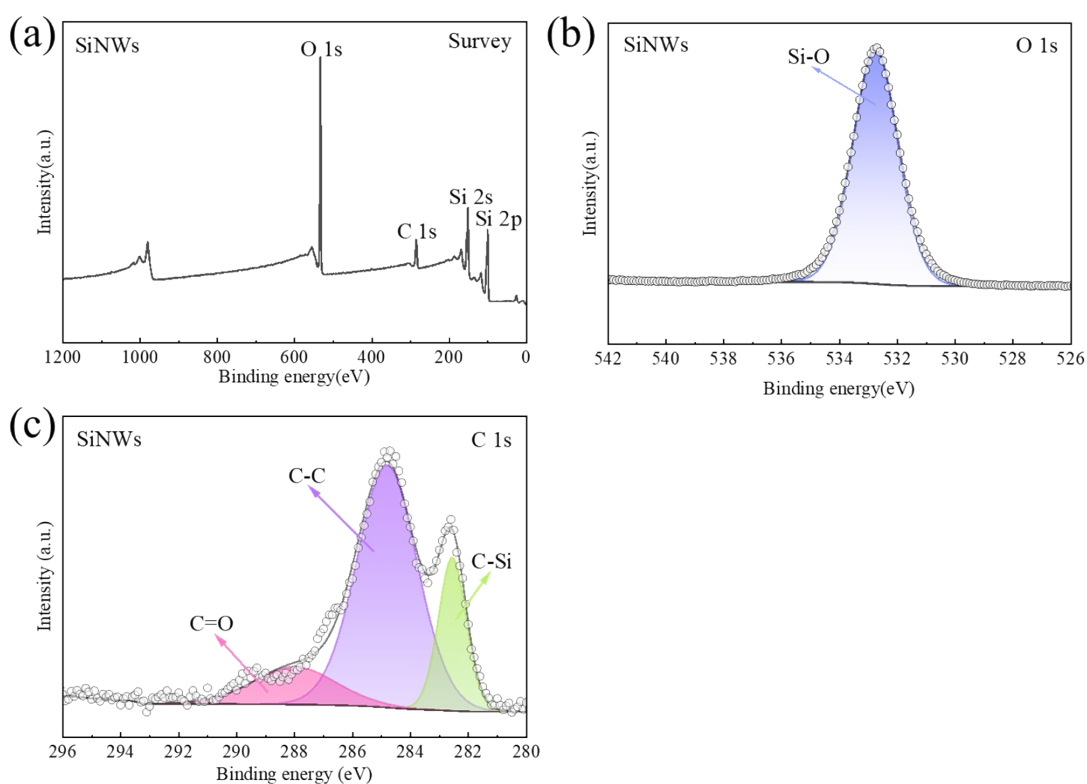


Figure S2. (a) Survey, (b) O 1s and (c) C 1s XPS spectra of SiNWs.

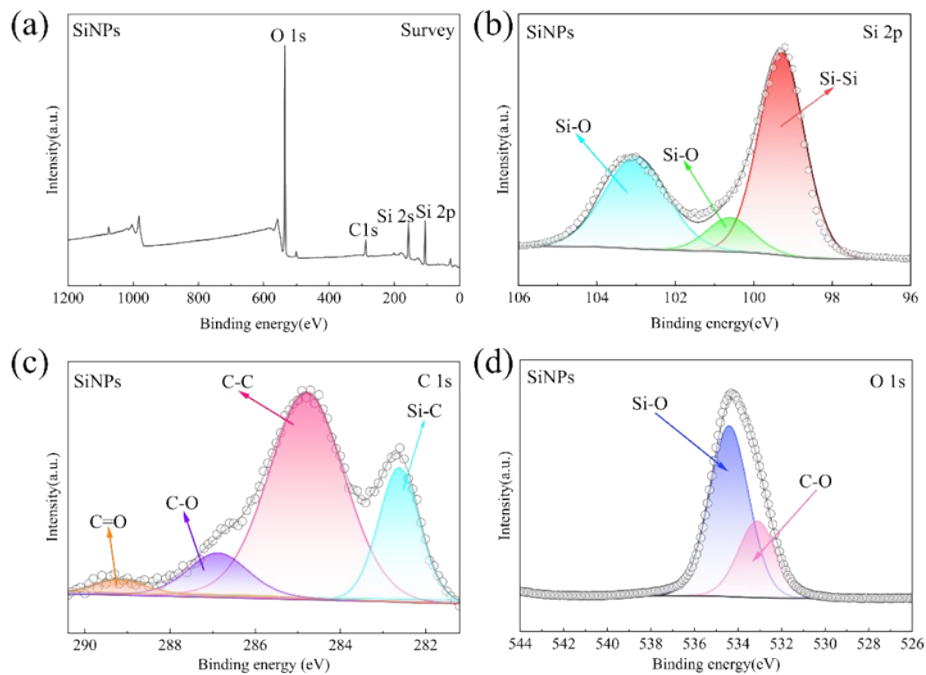


Figure S3 Si 2p, C1s, O1s XPS spectra of 20%-SiNPs.

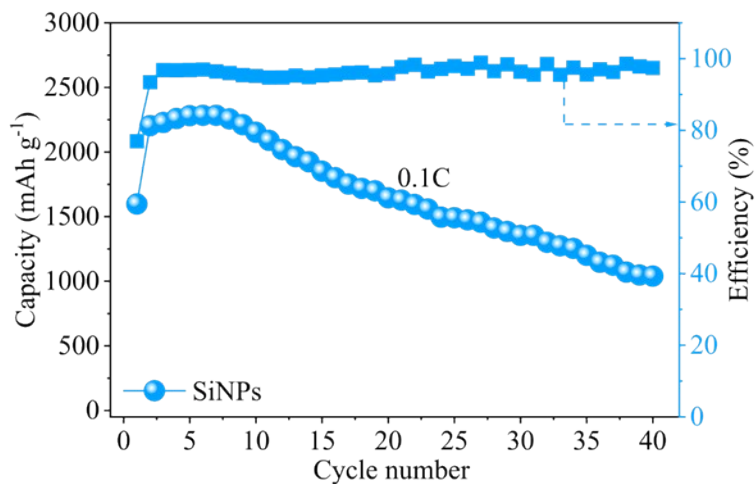


Figure S4 Cycling performances of Li/ 20%-SiNPs cells

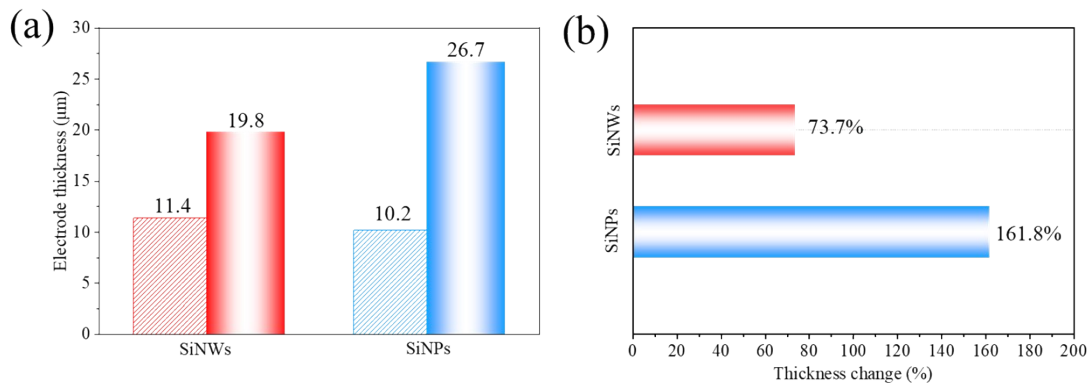


Figure S5. (a) Volume expansion of SiNWs and SiNPs before and after cycling; (b) Percentage of volume expansion after cycling.

Table S1 Comparison chart of the as-prepared SiNWs with other silicon nanowires.

Method	Sample	Discharge capacity (mAh g <sup>-1</sup> )/Cycle numbers	Cycle retention	Potential range (V)	Current density (mA g <sup>-1</sup> )
MACE	Ag-coated SiNW[40]	707/30	\	0.01-1 V	500
CVD	37 nm-SiGt[41]	900/125	85%	0.01-1 V	200
CVD	30 nm UTSiNW[42]	933.1/50	87.5%	0.01-1.5 V	300
New bi-metal-assisted chemical etching process.	CNTs@SiO <sub>2</sub> /Si@C[43]	960/100	89.8%	0.01-3.0 V	200
Sol-gel method and magnesiothermic reduction process	SC-3[44]	745.8/100	91.3 %	0.001-2 V	500
CVD	Si wires[45]	710.2/100	24.9%	0.01-1.5 V	100
Molten salt electrolysis	SiNWs/G[46]	608.5/100	90.04%		500
Molten salt electrolysis	SC650[47]	594/100	90.38%	0.01-1.50 V	65
Sol-gel method and magnesiothermic reduction process	SiNWs(This work)	1480.2/100	70.81%	0.005-2V	200
Sol-gel method and magnesiothermic reduction process	SiNWs(This work)	997.3/200	47.71%	0.005-2V	200