

Supplemental Information

Near zero-strain silicon oxycarbide interphases for stable Li-ion batteries

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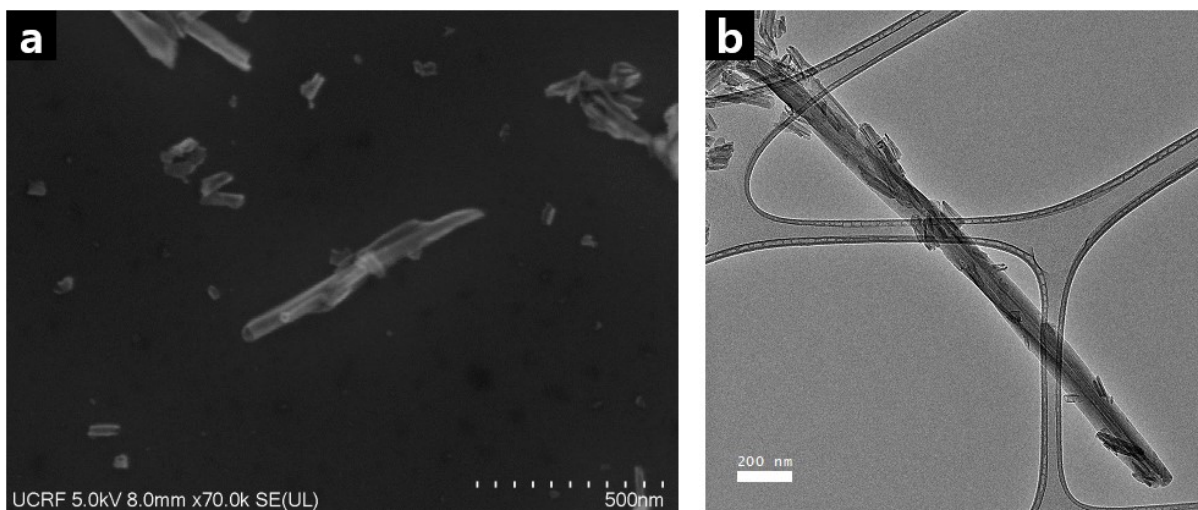


Figure S1. Morphology of SiNTs in (a) SEM and (b) TEM, magnification is rated as 25000X.

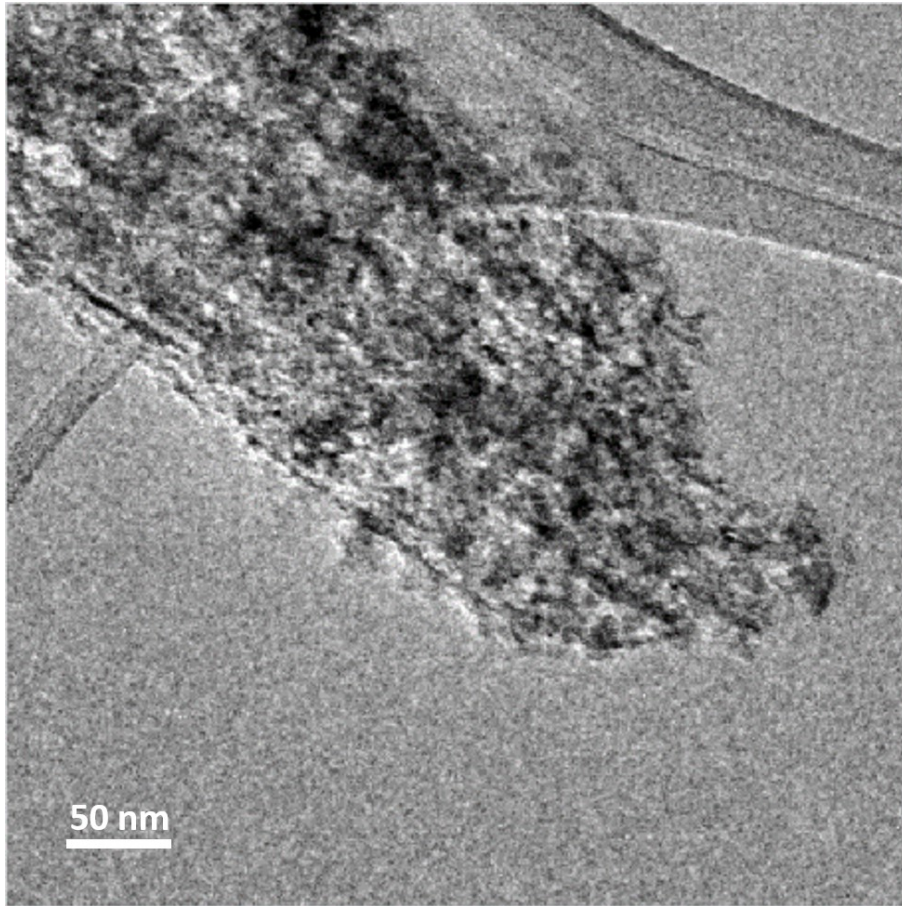
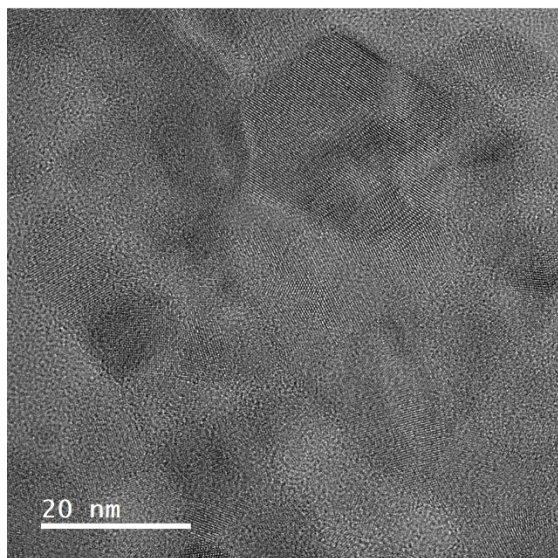


Figure S2. TEM images of SiNT@SiOC with bundles of interconnected nanoparticles.

SiNT@SiOC



SiOC NT

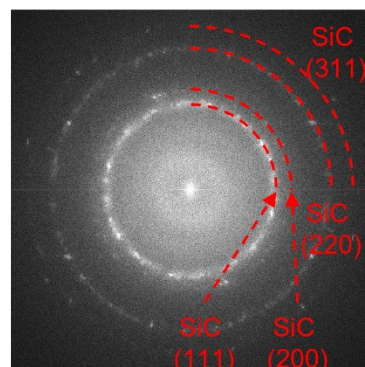
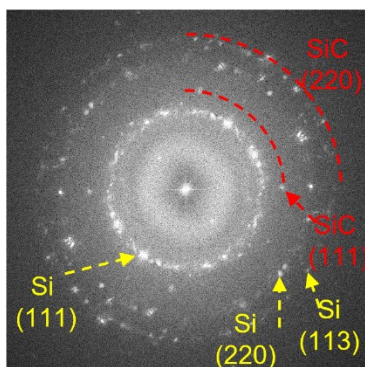
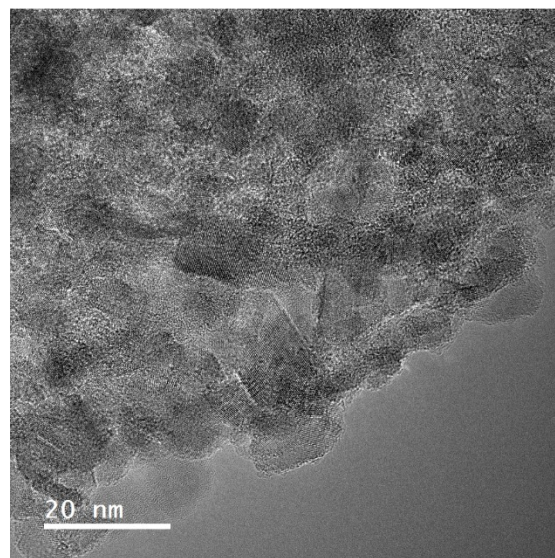


Figure S3. High magnification TEM images of SiNT@SiOC and pure SiOC nanotubes and according FFT images.

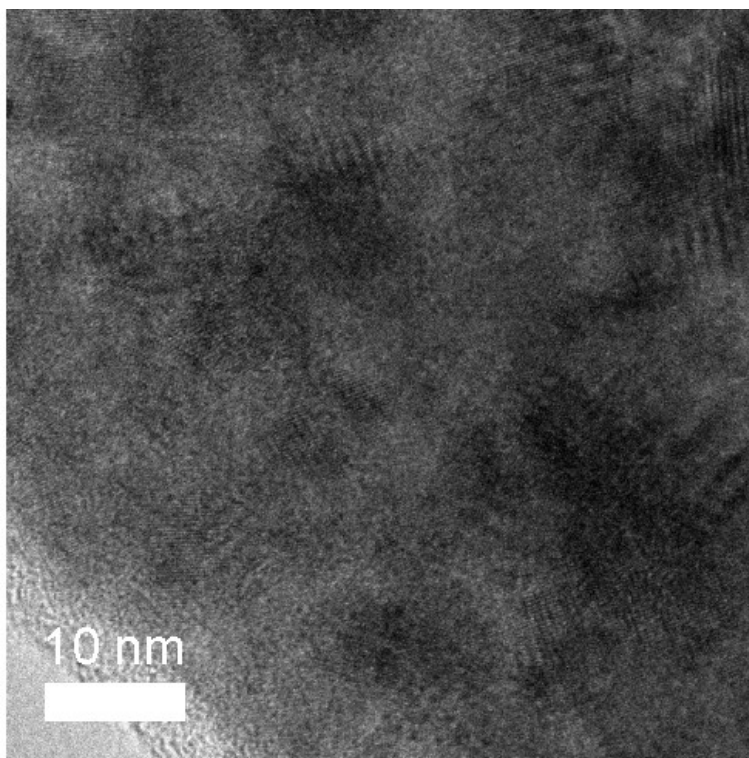


Figure S4. High-magnification image for the surface and bulk structure of SiNT@SiOC.

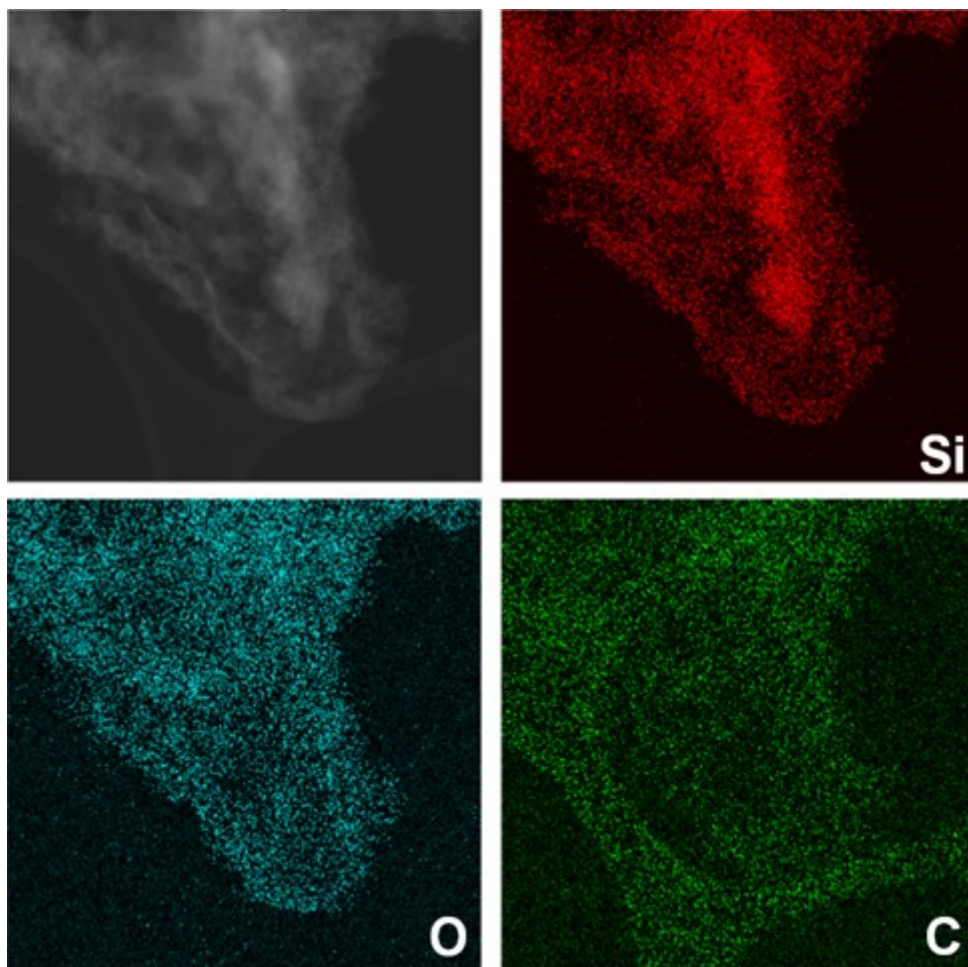


Figure S5. TEM-EDS mapping results of SiOC nanotubes.

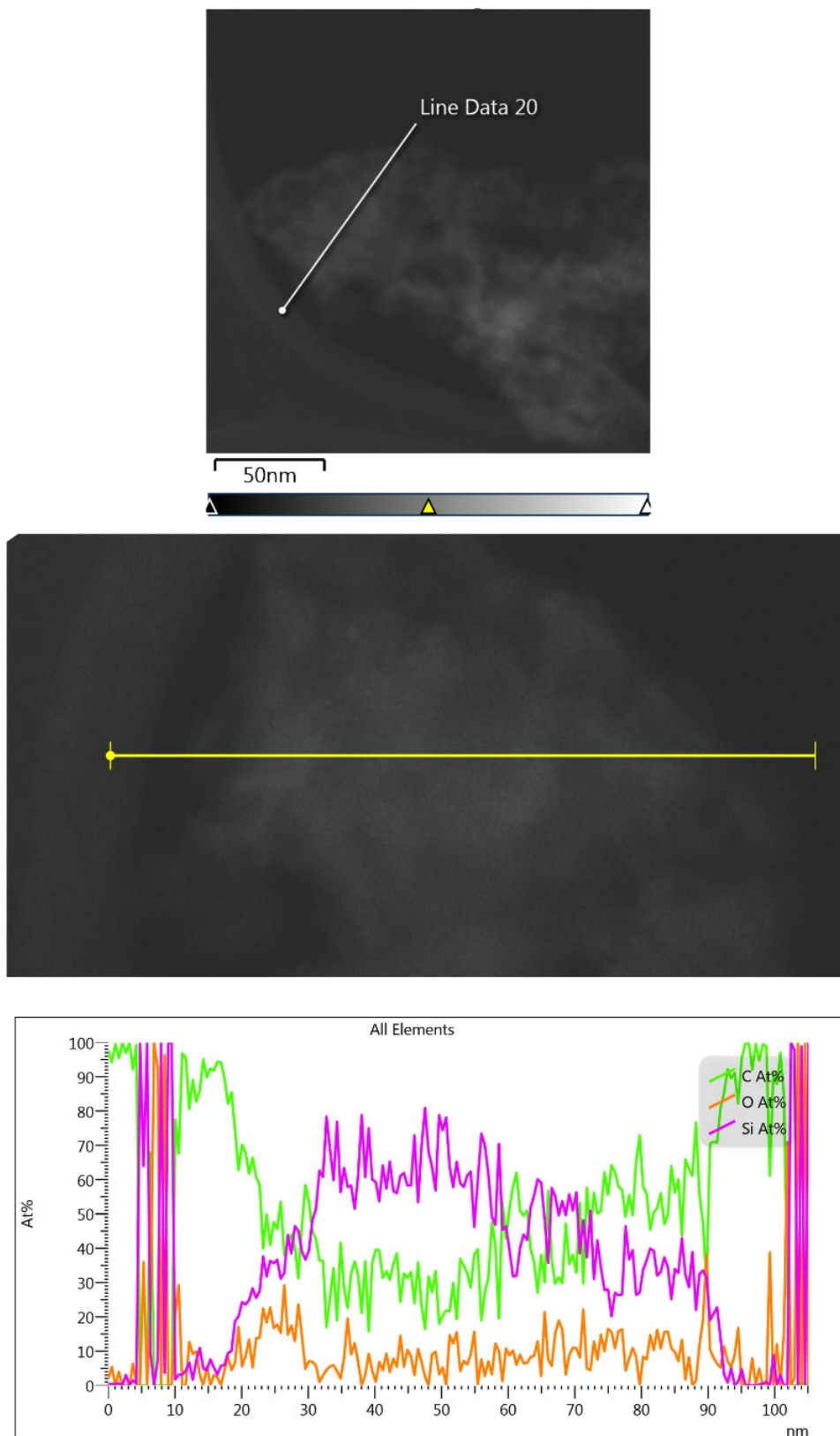


Figure S6. TEM-EDS line scan of SiOC horizontally across its structure.

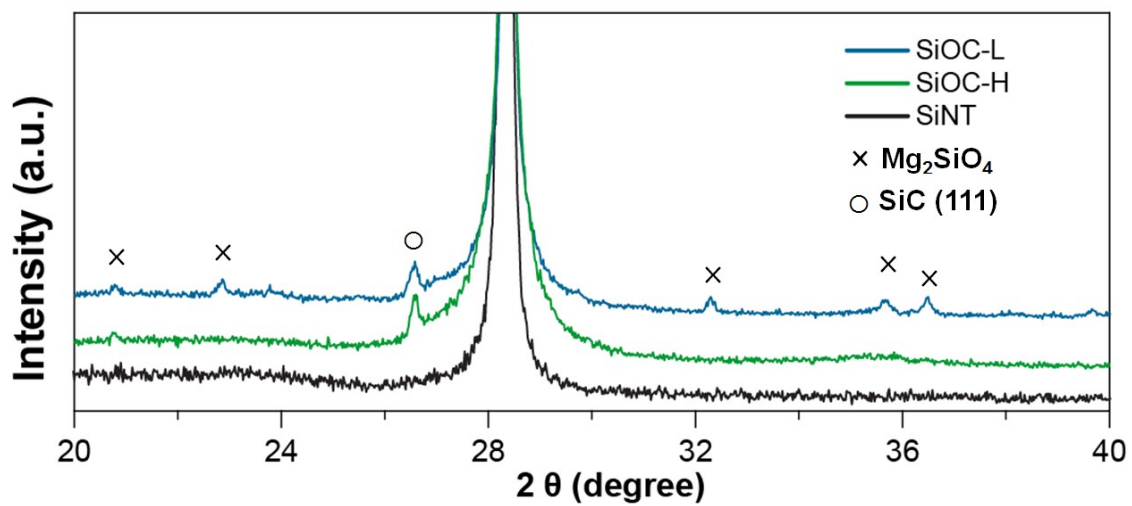


Figure S7. Structural characterization of SiOC-nanotubes. XRD spectra of the pristine SiNT, SiOC-L and SiOC-H.

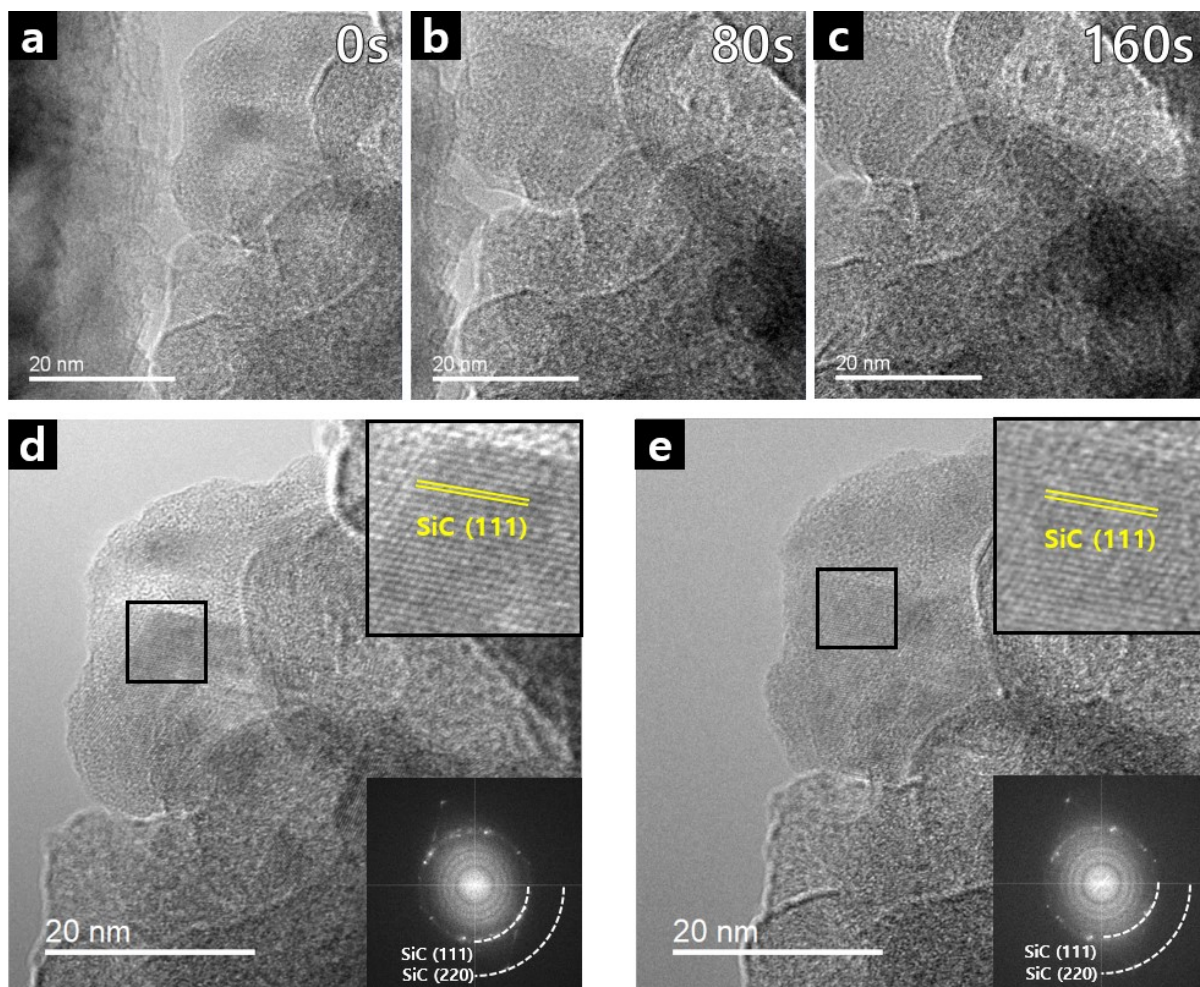


Figure S8. Lithiation behavior of pure silicon carbide observed by in-situ TEM analysis. (a)-(c) Time series of lithiation of pure silicon carbide for 160 s. High-magnification TEM images and according FFT images as an inset of (d) pristine silicon carbide and (e) lithiated silicon carbide.

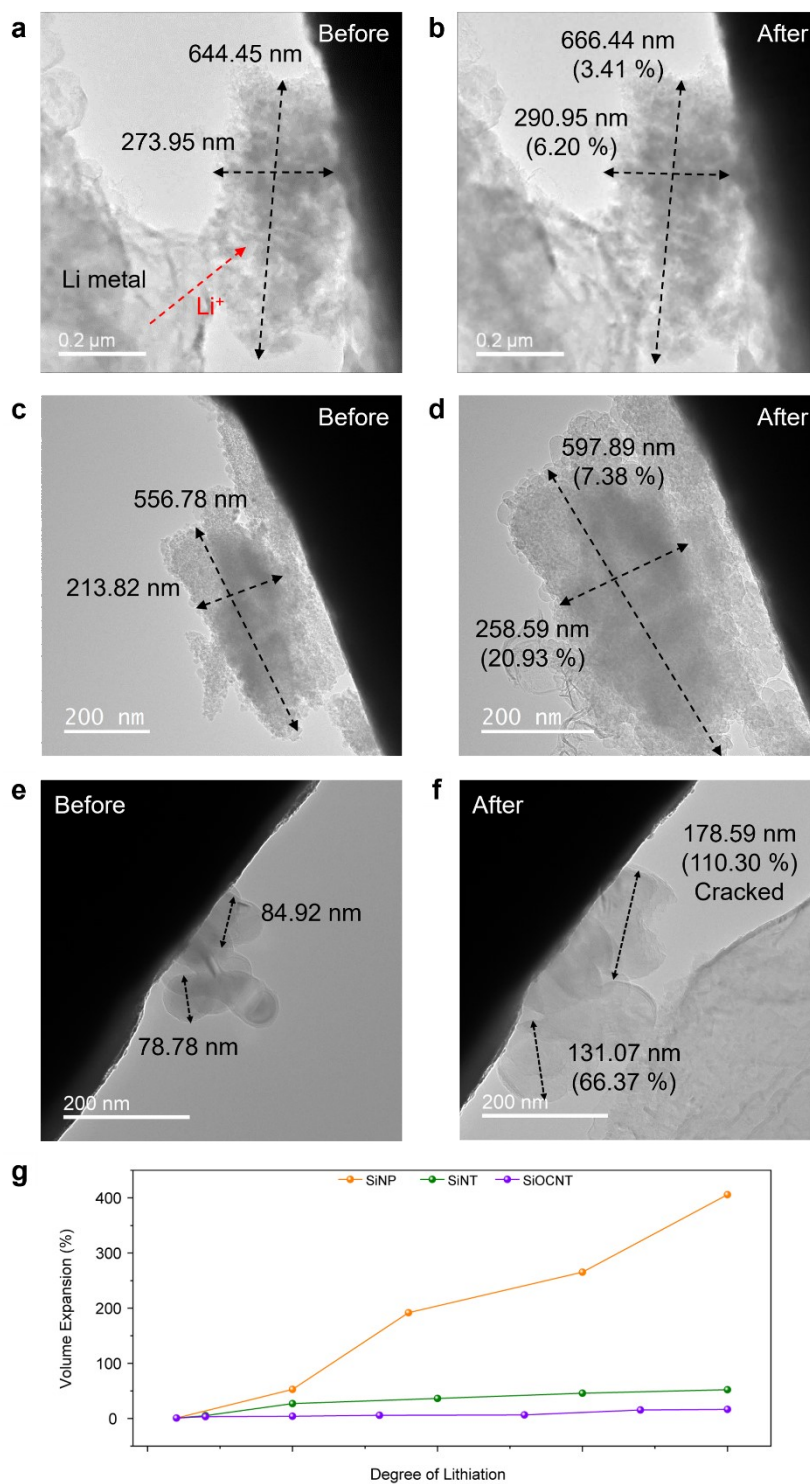


Figure S9. (a-f) Low magnification TEM images of SiNT@SiOC, SiNTs, and silicon nanoparticles (SiNPs) before and after lithiation reaction. (g) Fully lithiated SiNT@SiOC shows volume expansion ratio of only 3.41 % and 6.20 % in each length direction, respectively.

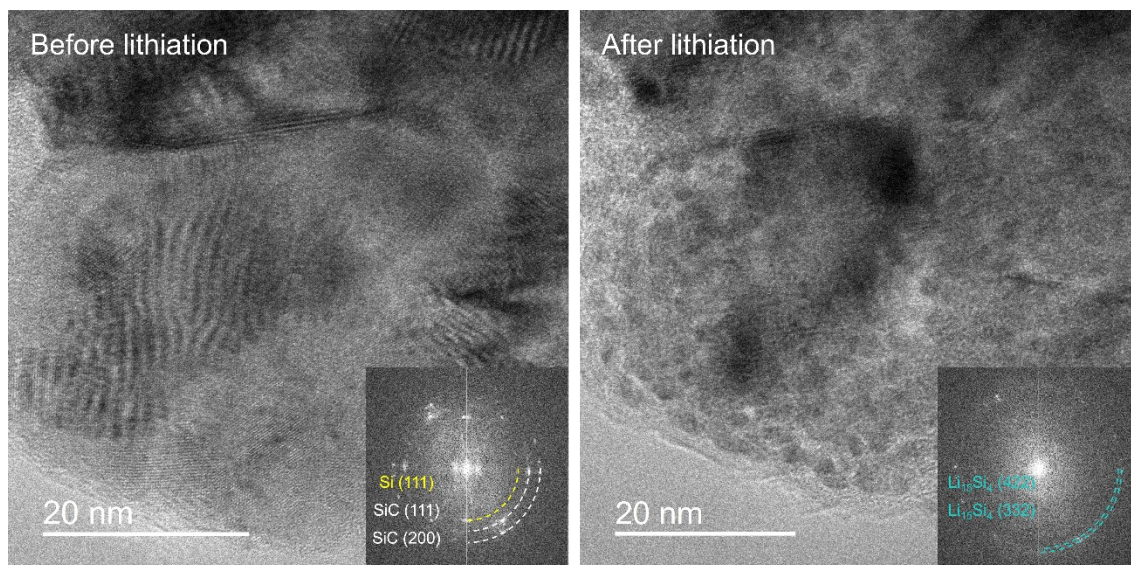


Figure S10. High magnification TEM images and corresponding FFT images inset of SiOC-L before and after lithiation.

Table S1. Atomic composition of SiNT, SiOC-L and SiOC-H confirmed by XPS.

at %	Si	O	C
SiNT	54	46	-
SiOC-L	55	21	24
SiOC-H	47	40	13

Movie S1. In-situ TEM movie of the lithiation behaviour of pure SiC in Figure S8.

Movie S2. In-situ TEM movie of the lithiation behaviour of SiOC-H in Figure 3.

Movie S3. In-situ TEM movie of the lithiation behaviour of SiNT@SiOC in Figure S9a,b.

Movie S4. In-situ TEM movie of the lithiation behaviour of SiNTs in Figure S9c,d.

Movie S5. In-situ TEM movie of the lithiation behaviour of SiNPs in Figure S9e,f.

Movie S6. In-situ TEM movie of the lithiation behaviour of SiOC-L in Figure S10.