Supplementary Information

Micro-Sized Bimodal Meso-/Microporous Si Anode from Modified Al-Si Melt for Lithium-Ion Batteries

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Supporting Figures

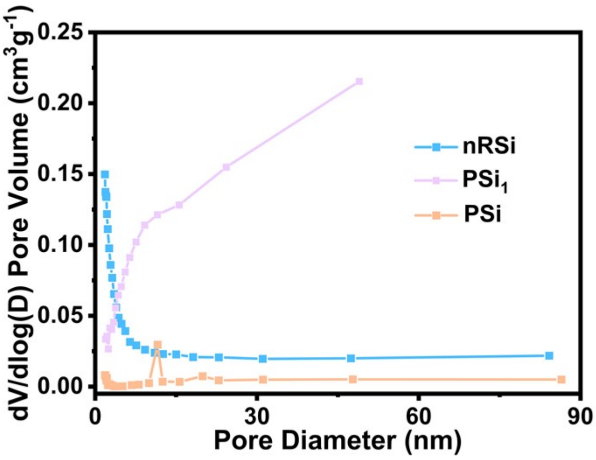

Figure S1. Pore diameter distributions of nRSi, PSi$_1$, and PSi.

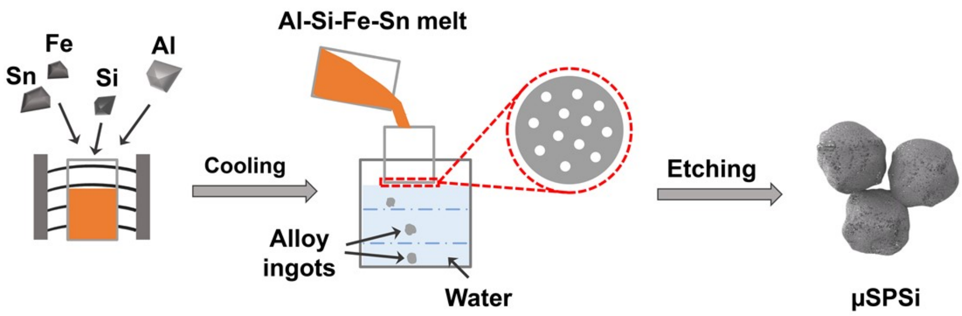

Figure S2. Schematic diagram of synthesis procedure for μSPSi.

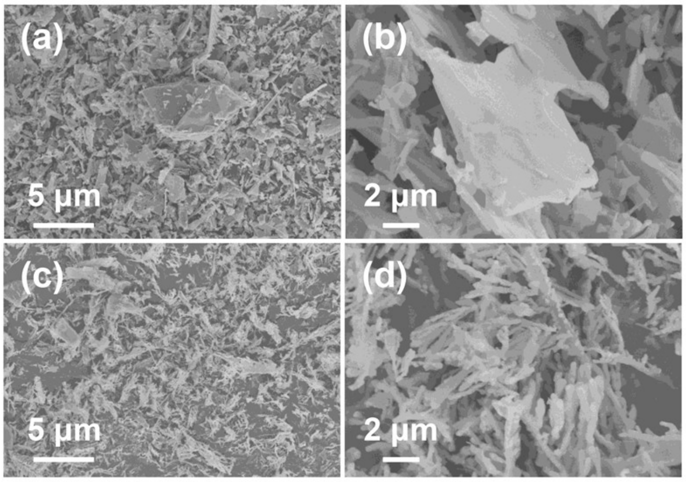

Figure S3. SEM images of PSi (a, b) and nRSi (c, d) at different magnifications.

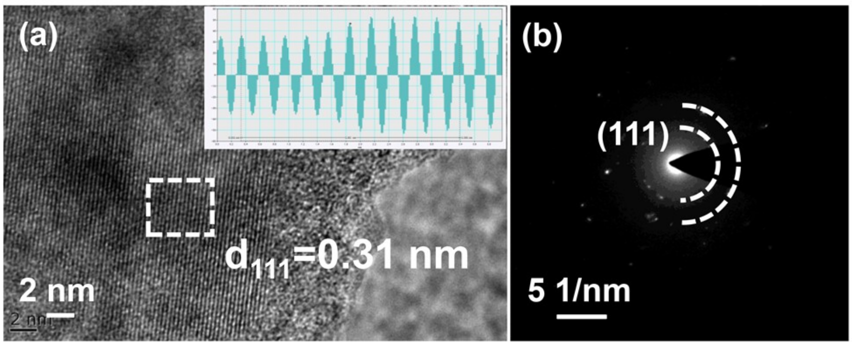

Figure S4. HR-TEM (a) and SAED (b) images of μSPSi.

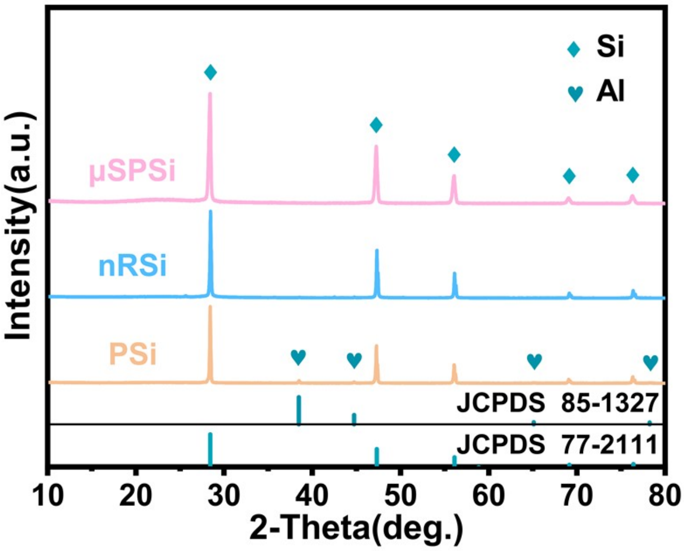

Figure S5. XRD pattern of μSPSi, nRSi, and PSi.

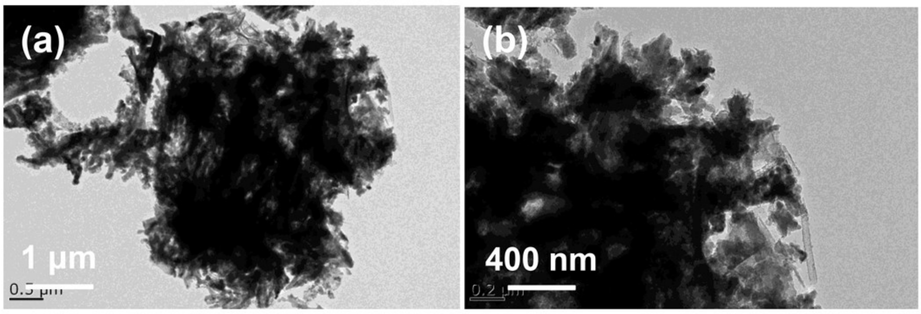

Figure S6. HR-TEM images of μSPSi.

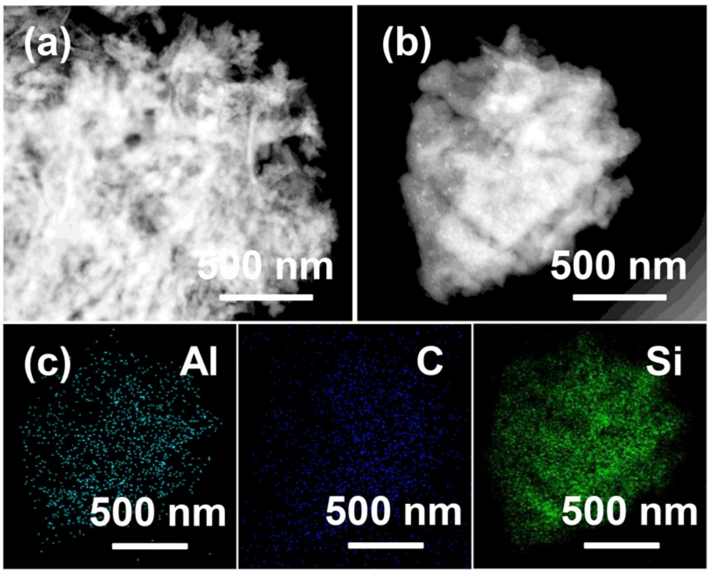

Figure S7. (a) HADDF image of μSPSi. (b, c) HADDF image of μSPSi@C and the corresponding EDS elemental mapping images of Al, C, and Si elements, respectively.

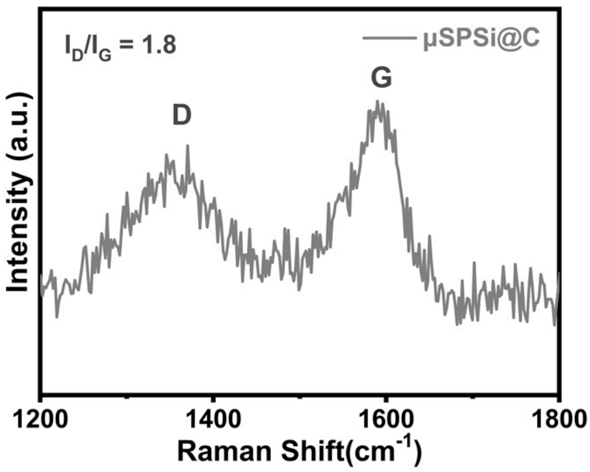

Figure S8. Magnified disordered and graphitic carbon bands in the Raman spectrum of μSPSi@C.

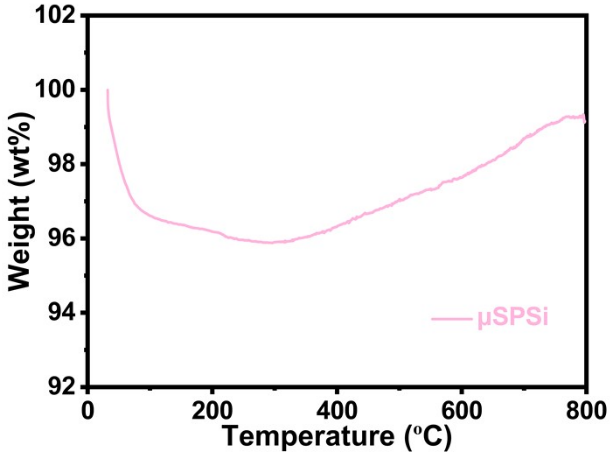

Figure S9. TGA curves of μSPSi.

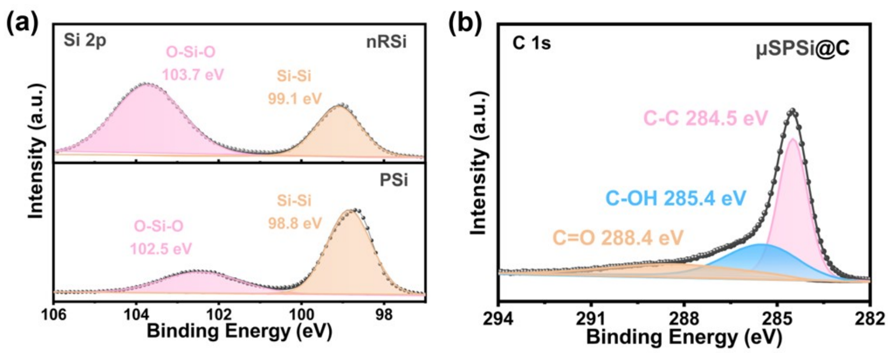

Figure S10. (a) XPS spectra of Si 2p for nRSi@C and PSi@C. (b) XPS spectra of C 1s for μSPSi@C.

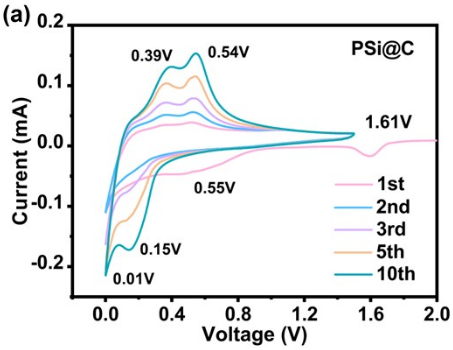

Figure S11. Cyclic voltammogram curves of PSi@C (a) and nRSi@C (b) anodes.

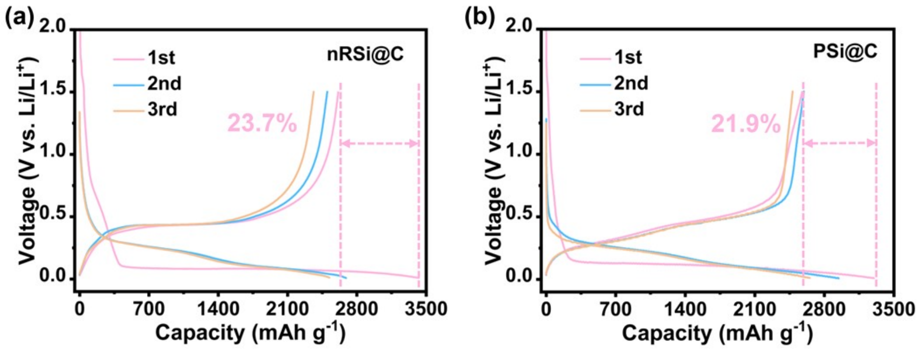

Figure S12. First three charge-discharge curves of (a) nRSi@C (a) and PSi@C (b) anodes.

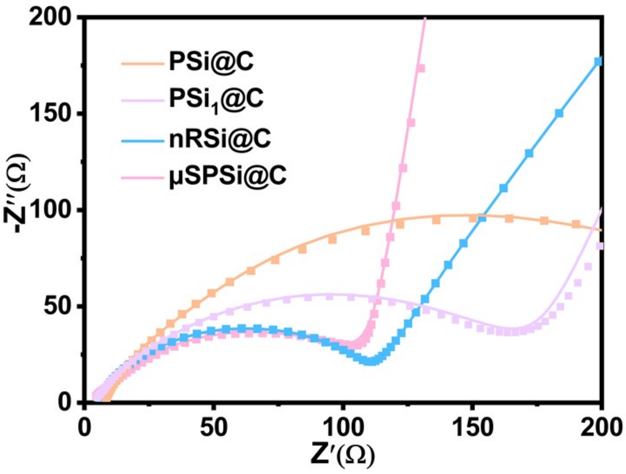

Figure S13. Nyquist plots and equivalent circuit fitting of μSPSi@C, nRSi@C, PSi@C, and PSi_1@C electrodes in high frequency region.

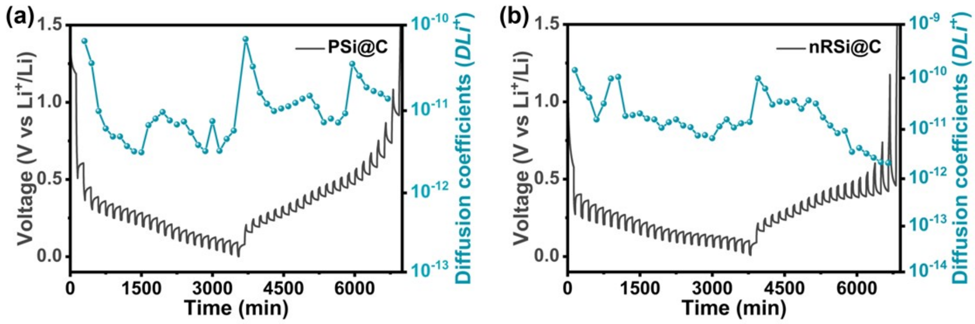

Figure S14. GITT potential profiles and calculated Li^+ diffusion coefficients of the nRSi@C (a) and PSi@C (b) electrodes.

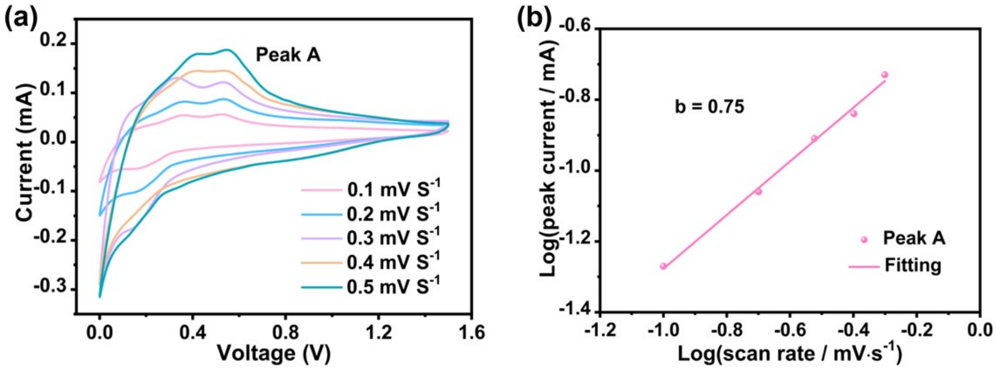

Figure S15. (a) Cyclic voltammogram curves of μSPSi@C electrode at various scan rates from 0.1 to 0.5 mV S^{-1}. (b) Relationship between peak current and scan rate.

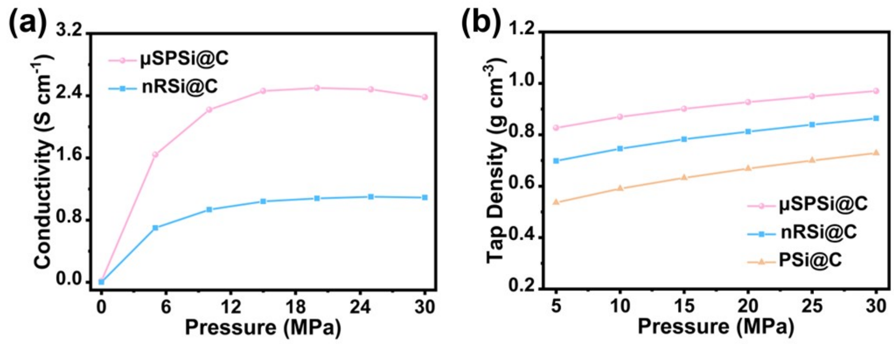

Figure S16. Conductivity (a) and Tap density (b) of μSPSi@C, nRSi@C, and PSi@C.

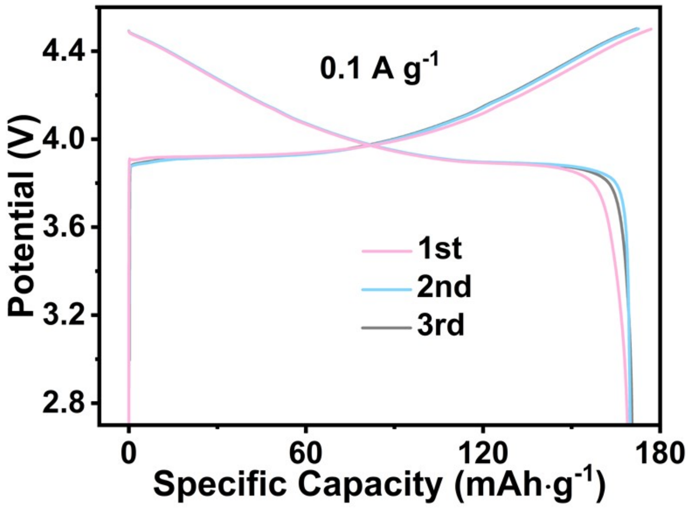

Figure S17. First three charge-discharge curves of LCO || μSPSi@C full cell.

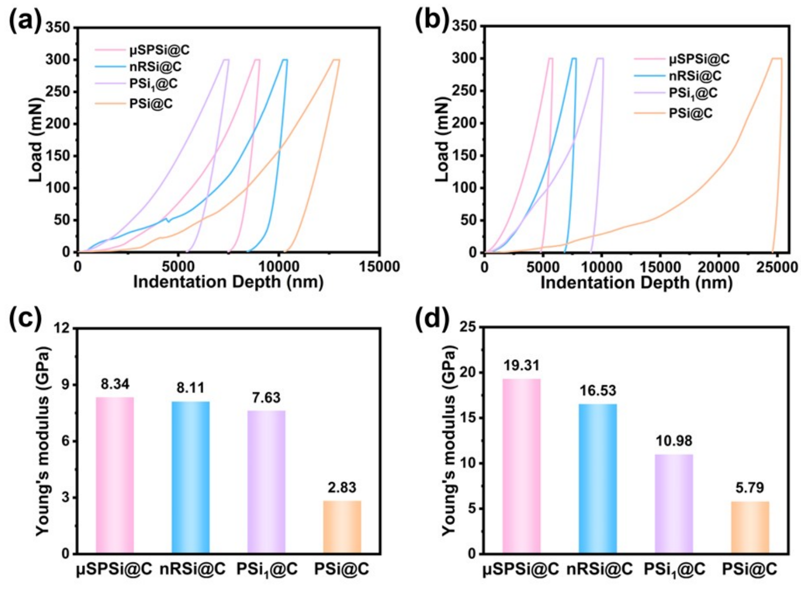

Figure S18. (a, b): Comparison of load-indentation depth curves for different electrodes before (a) and after (b) cycling. (c, d): Young's modulus for different electrodes before (c) and after (d) cycling.

Supporting Tables

Table S1. EIS fitting data of μSPSi@C, nRSi@C, PSi_1@C, and PSi@C in half cells.

Sample	R_s (Ω)	R_f (Ω)	R_{ct} (Ω)
μSPSi@C	3.24	2.48	87.52
nRSi@C	5.83	8.33	96.06
PSi_1@C	3.42	13.69	88.86
PSi@C	7.28	22.36	167.3

Table S2. Comparison of the electrochemical performance for the porous Si@C anodes.

Materials	ICE (%)	Rate capacity (mAh·g^{-1} at 2 A g^{-1})	Cycle number (n)	Residual capacity (mAh·g^{-1})	Ref.
μSPSi@C	**82.2**	**1019**	**500**	**897**	**This work**
μP-Si/CNT@C	65.6	750	200	1000	[1]
EC-SiOC	98.2	362.3	1000	350	[2]
SN-MCB	80	1480	500	1440	[3]
pSi@PC@MC	75.6	923.6	300	1650	[4]
HC-0.8@Si@C	88.41	1210	65	1335	[5]
p-Si@GN_{40}	81.1	700	150	1730	[6]
SiO_x@NC-2	67.2	620	300	602	[7]
pSiFe@C	82.3	1058	200	1162	[8]

Table S3. The measured Poisson's ratio (*v*) for different electrodes.

Samples	μSPSi@C	nRSi@C	PSi_1@C	PSi@C
v	0.43	0.31	0.13	0.21

References

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