Supporting Information

Chitosan-g-Poly(Acrylic Acid) Copolymer and Its Sodium Salt as Stabilized Aqueous Binders for Silicon Anodes in Lithium-Ion Batteries

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No. of pages: 10

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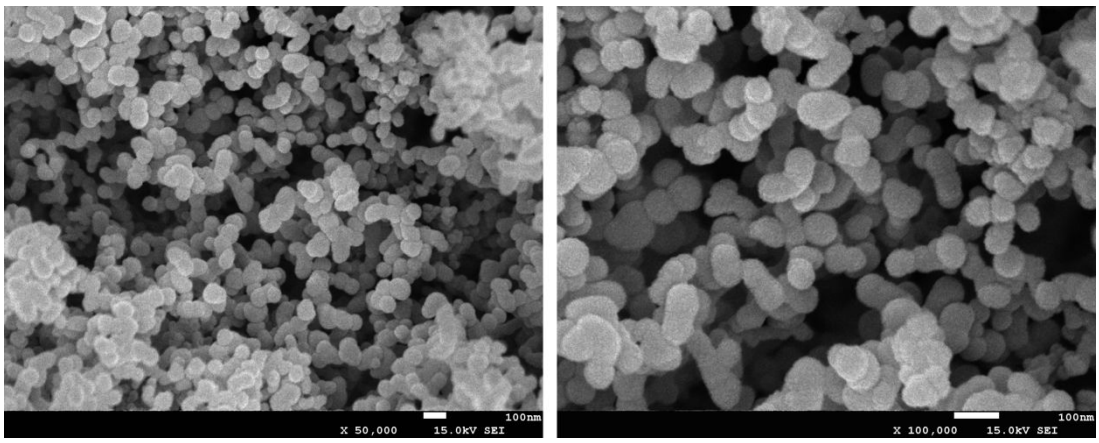


Figure S1. SEM images of Si nanoparticles.

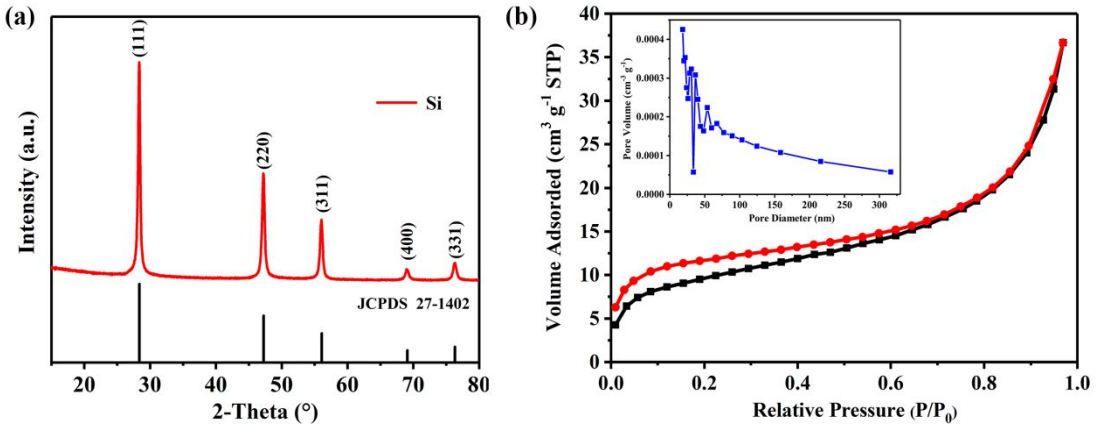
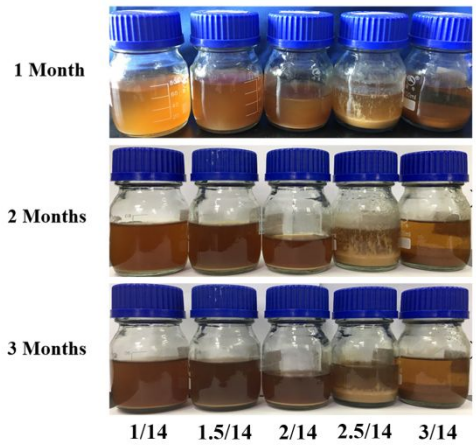
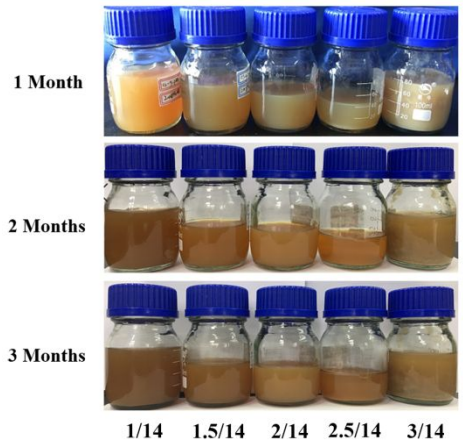


Figure S2. XRD pattern (a) and nitrogen adsorption-desorption isotherm and the (inset) pore size distribution (b) of Si nanoparticles.



Mass ratio	Phenomenon			Storage stability
	1 Month	2 Months	3 Months	
1/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
1.5/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
2/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
2.5/14	Distinct precipitation	Distinct precipitation	Distinct precipitation	Unstable
3/14	Distinct precipitation	Distinct precipitation	Distinct precipitation	Unstable

Figure S3. Storage stability of CS-PAA prepared under different CS/AA weight ratios.



Mass ratio	Phenomenon			Storage stability
	1 Month	2 Months	3 Months	
1/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
1.5/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
2/14	Homogeneous	Homogeneous	Homogeneous	**Stable**
2.5/14	Homogeneous	Slight precipitation	Slight precipitation	Unstable
3/14	Distinct flocculation	Distinct flocculation	Distinct flocculation	Unstable

Figure S4. Storage stability of CS-PAANa prepared under different CS/AA weight ratios.

Table S1. Solubility of CS-PAA and CS-PAANa films in different solvents under 25 °C and 50 °C.

Sample	Soak for 18 hours (25 °C)	Solubility	Soak for 18 hours (50 °C)	Solubility
CS-PAA membrane	Acetic acid solution (3 wt%)	Insoluble	Acetic acid solution (3 wt%)	Insoluble
	DMSO		DMSO	
	NMP		NMP	
	MeOH		MeOH	
CS-PAANa membrane	Acetic acid solution (3 wt%)	Insoluble	Acetic acid solution (3 wt%)	Insoluble
	DMSO		DMSO	
	NMP		NMP	
	MeOH		MeOH	

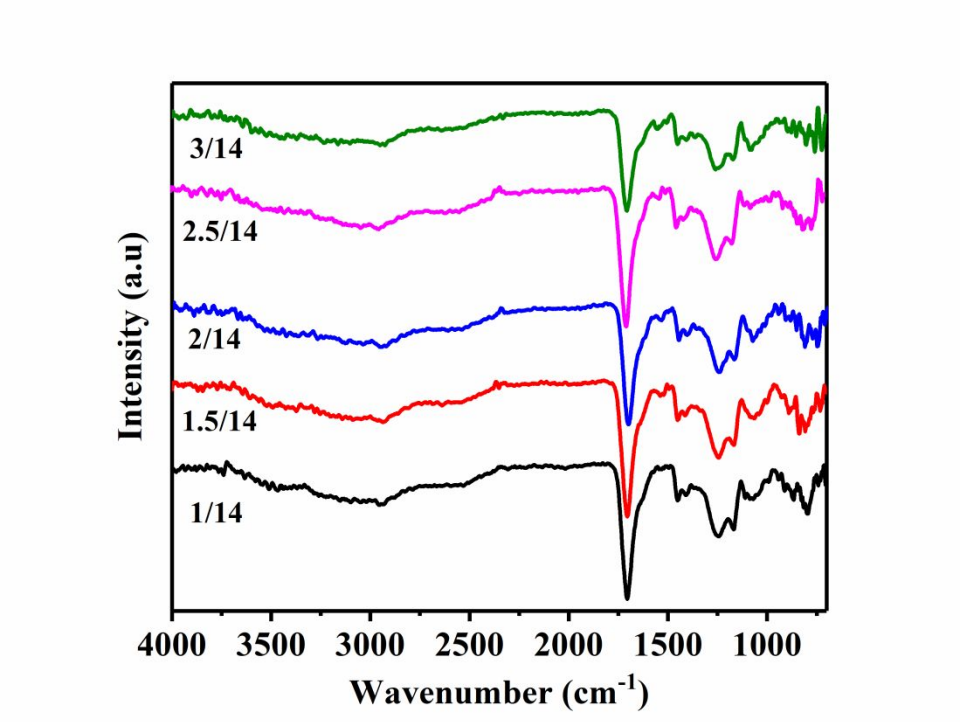


Figure S5. FT-IR spectra of CS-PAA binder films with different CS/AA weight ratios.

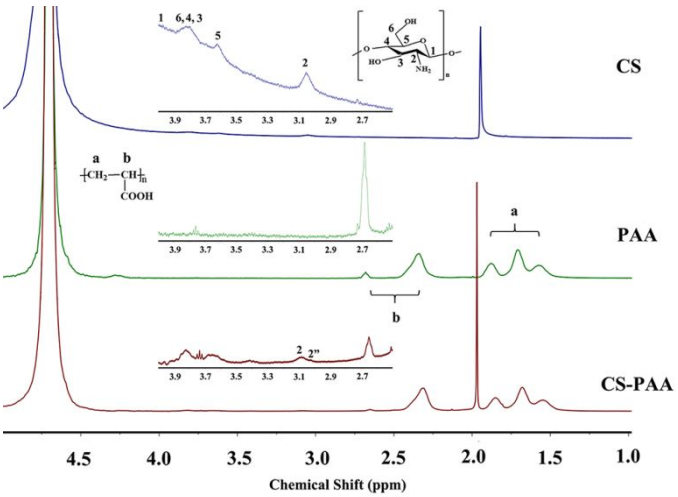


Figure S6. ^{1}H-NMR spectra of CS, PAA, and CS-PAA binders.

The ^{1}H-NMR spectra of CS, PAA, and CS-PAA binders are shown in **Figure S6**, Proton signals at 3.0-3.1 ppm (C-2), 3.5-3.7 ppm (C-5), 3.7-3.9 ppm (C-6, 4, 3) and 3.9-4.0 ppm (C-1) are observed, which conform to the ^{1}H-NMR spectrum of CS as a reference.[1-3] The proton signals at 1.4-1.9 (a) and 2.2-2.8 (b) ppm in PAA are attributed to the protons of the acrylic unit.[4] For CS-PAA, all proton signals for CS and PAA are observed after graft polymerization. Meanwhile, a shifted proton signal (~3.0 ppm) is detected, corresponding to the reaction of PAA onto C2-NH_2 of CS.[5,6]

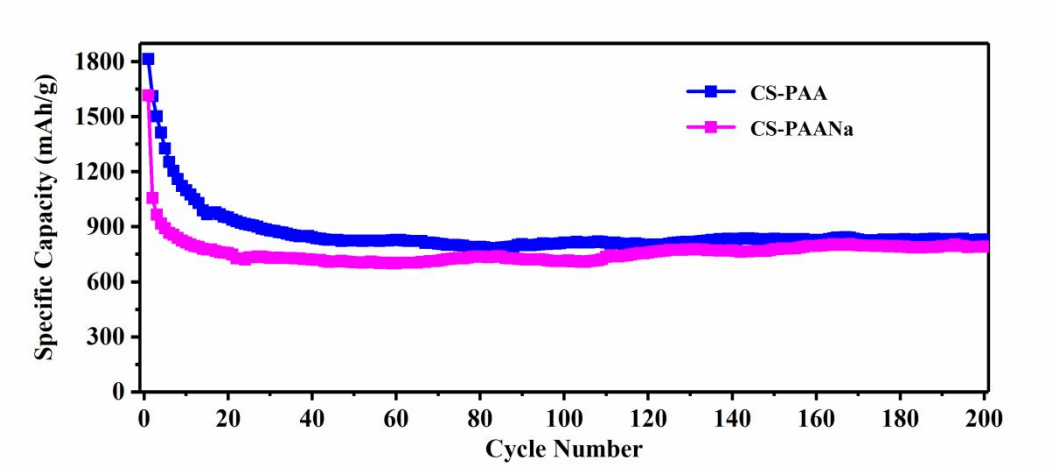


Figure S7. Cycling performance of electrodes at 2.7 A/g (mass loading is ~0.3 mg).

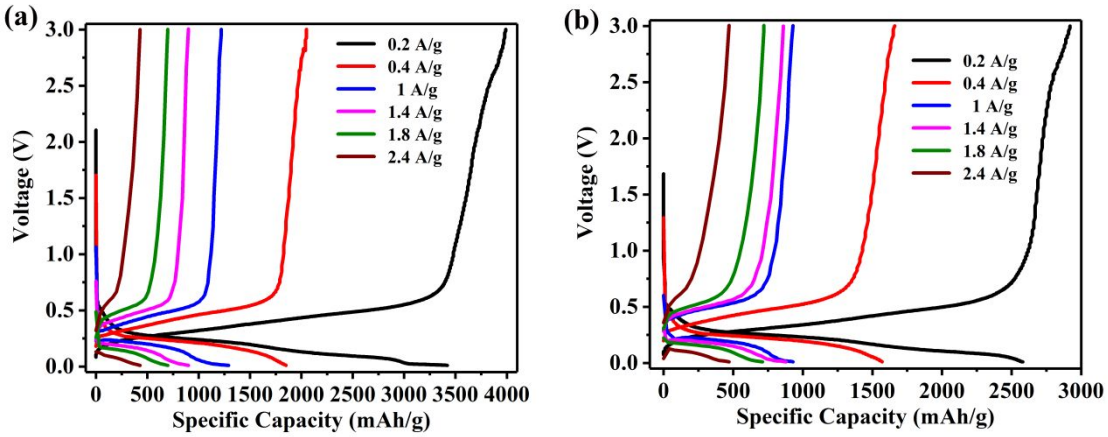


Figure S8. Galvanostatic voltage profiles of (a) Si/CS-PAA and (b) Si/CS-PAANa electrodes (mass loading is ~1 mg).

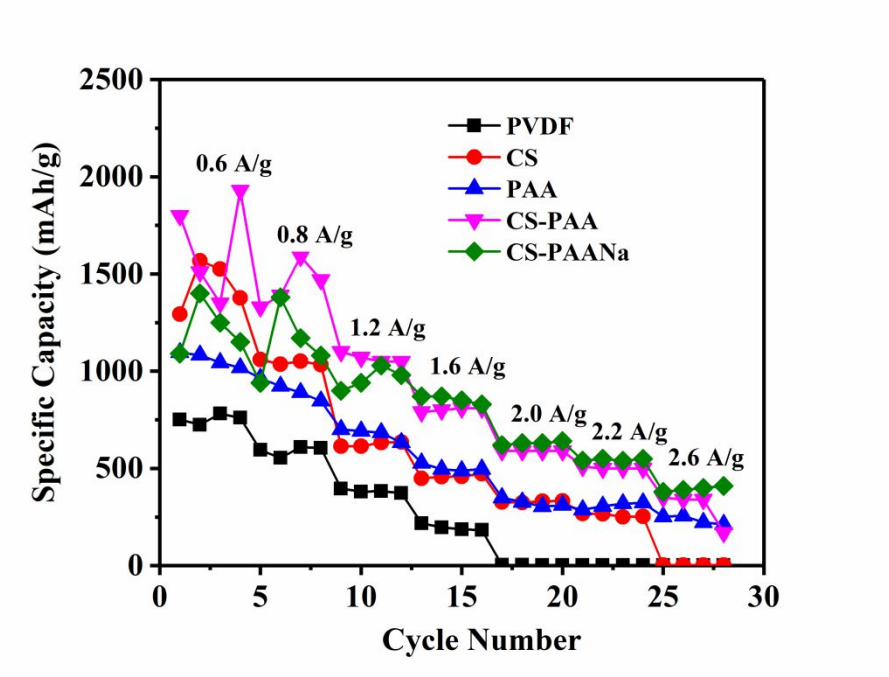


Figure S9. Rate performance of Si/PVDF, Si/CS, Si/PAA, Si/CS-PAA, and Si/CS-PAANa electrodes (mass loading is ~1 mg).

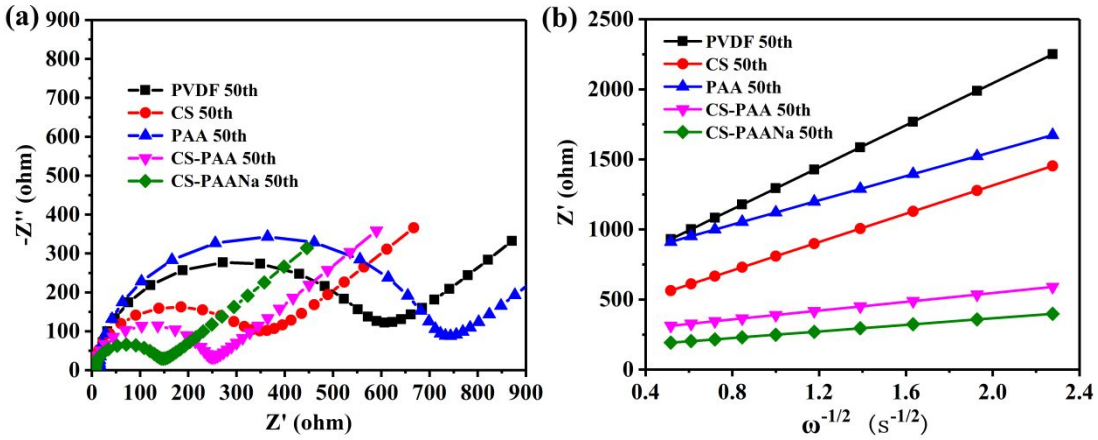


Figure S10. Electrochemical impedance spectra (a) and the plots of Z_{re} vs $\omega^{-1/2}$ for Si/PVDF, Si/CS, Si/PAA, Si/CS-PAA and Si/CS-PAANa electrodes after 50 cycles (b).

Table S2. Impedance parameters of Si/PVDF, Si/CS, Si/PAA, Si/CS-PAA and Si/CS-PAANa electrodes after 50 cycles.

Sample	Rs (Ω)	Rct (Ω)	Warburg coefficient	D ($\times 10^{-17}$ cm^2 s^{-1})
PVDF 50th	13.33	534.40	119.37	0.30
CS 50th	5.87	303.00	80.50	0.99
PAA 50th	15.29	674.2	68.95	1.57
CS-PAA 50th	6.28	225.90	25.10	32.51
CS-PAANa 50th	6.08	126.80	18.65	79.25

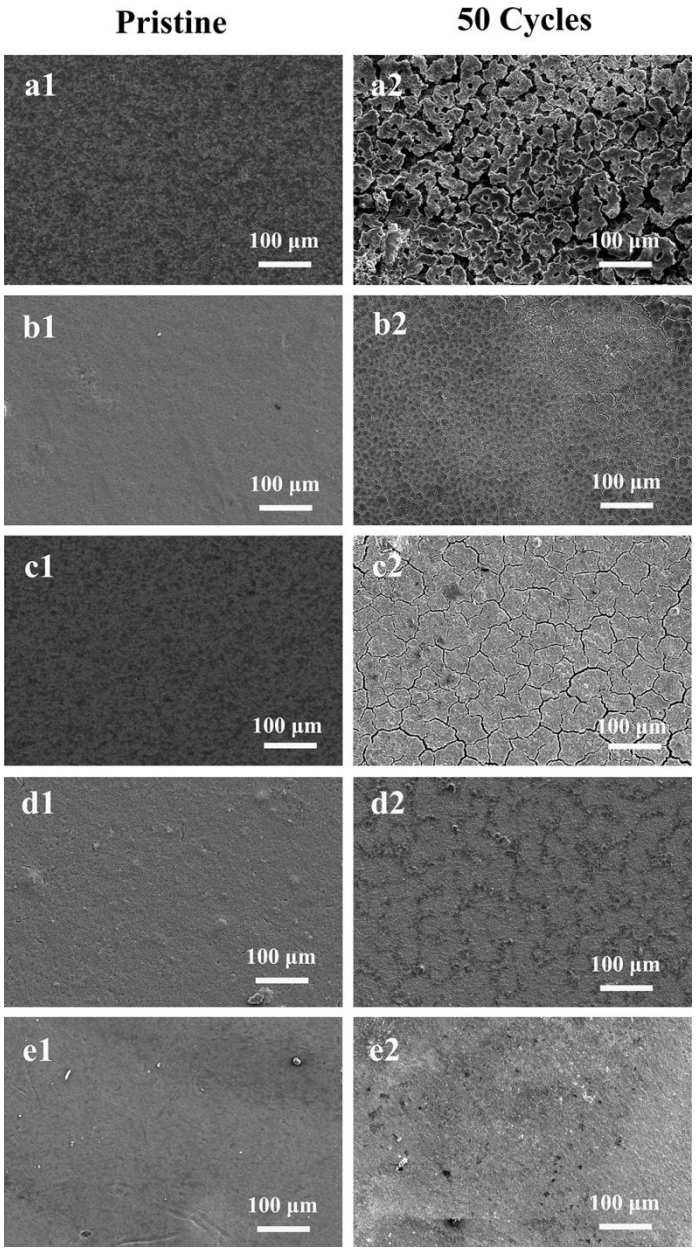


Figure S11. SEM images of (a) Si/PVDF, (b) Si/CS, (c) Si/PAA, (d) Si/CS-PAA and (e) Si/CS-PAANa electrode surfaces at low magnification.

Reference

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