Electronic Supplementary Information

High performance polyurethane-polyacrylic acid polymer binders for silicon microparticle anodes in lithium-ion batteries

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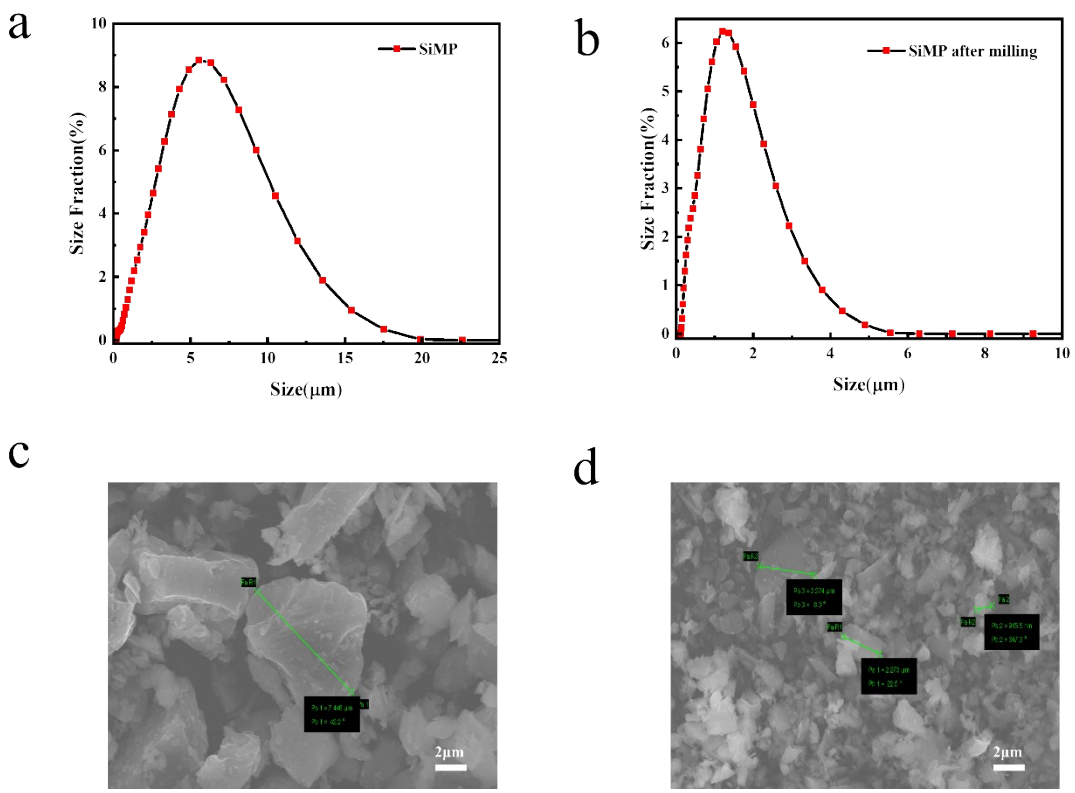

Fig. S1 The particle size distributions of (**a**) SiMP, (**b**) SiMP after milling and morphology of (**c**) SiMP, (**d**) SiMP after milling

Table S1 The cycling performances of multi-proportion PU-PAA binders

	PU-PAA-21	PU-PAA-11	PU-PAA-12
The initial discharge capacity (mAh/g)	3782	3592	3339
The coulombic efficiency of the first cycle (%)	88.2	89.6	90.2
The discharge capacity of the second cycle (mAh/g)	3486	3420	3176
The discharge capacity after 100 cycles (mAh/g)	2368	2455	2458
The discharge capacity after 200 cycles (mAh/g)	2132	2166	2251
The capacity retention after 200 cycles (%)	61.0	63.3	70.9

Table S2 The comparison of electrodes using PU-PAA-12 binder and other composite binders

Binders	Materials	Cyclability
PU-PAA-12	Si microparticles	2458 mAh/g after 100 cycles (840 mA/g) 2251 mAh/g and capacity retention of 70.9% after 200 cycles (840 mA/g) 1934 mAh/g and capacity retention of 60.9 % after 500 cycles (840 mA/g)
PAL−NaPAA (2018)[1]	Si microparticles	1914 mAh/g after 100 cycles (840 mA/g)
PAA-borax (2020)[2]	Si microparticles	2470 mAh/g after 100 cycles (500 mA/g)
CMC-NaPAA-PAM (2019)[3]	Si nanoparticles	1210 mAh/g after 150 cycles (420 mA/g)
PAA/PVB (2019)[4]		2170 mAh/g after 100 cycles (250 mA/g)
OS-PAA (2021)[5]	Si nanoparticles	1386 mAh/g and capacity retention of 40.2% after 100 cycles (200 mA/g)
PDA-PAA (2021)[6]	Si nanoparticles	1410 mAh/g and capacity retention of 56.0% after 500 cycles (840 mA/g)

Table S3 The mass loading of the Si anodes

Si anodes	mass loading (mg/cm^2)
PU-PAA-21 electrode for 0.2 C (840 mAh/g)	0.27
PU-PAA-11 electrode for 0.2 C (840 mAh/g)	0.42
PU-PAA-12 electrode for 0.2 C (840 mAh/g)	0.41
PU electrode for 0.2 C (840 mAh/g)	0.34
PAA electrode for 0.2 C (840 mAh/g)	0.39
PU-PAA-12 electrode for rate performance	0.35
PAA electrode for rate performance	0.40
PU-PAA-12 electrode with constant capacity conditions	0.37
PU-PAA-12 electrode with high load	0.98

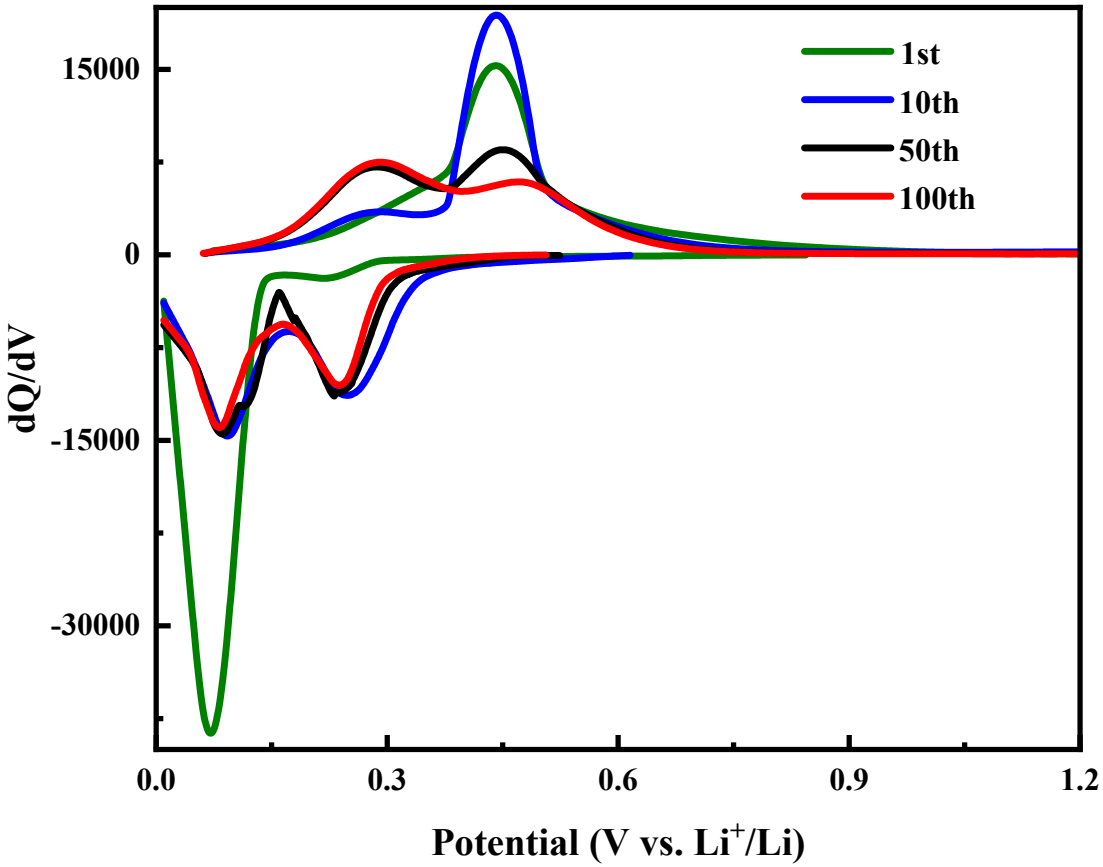

Fig. S2 The dQ/dV derivatives at cycle 1, 10, 50, 100 of PU-PAA electrode

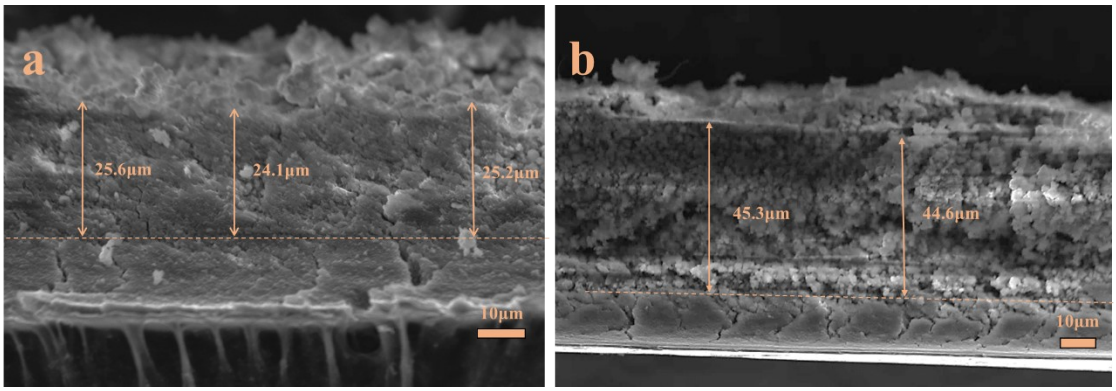

Fig. S3 Cross-sectional SEM images of PAA electrode (a) before cycling and (b) after 30 cycles

References

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