

Supporting Information

A Pyrene–Poly(acrylic acid)–Polyrotaxane Supramolecular Binder Network for High-Performance Silicon Negative Electrodes

Yunshik Cho, Jaemin Kim, Ahmed Elabd, Sunghun Choi, Kiho Park, Tae-woo Kwon, Jungmin Lee, Kookheon Char, Ali Coskun,* and Jang Wook Choi**

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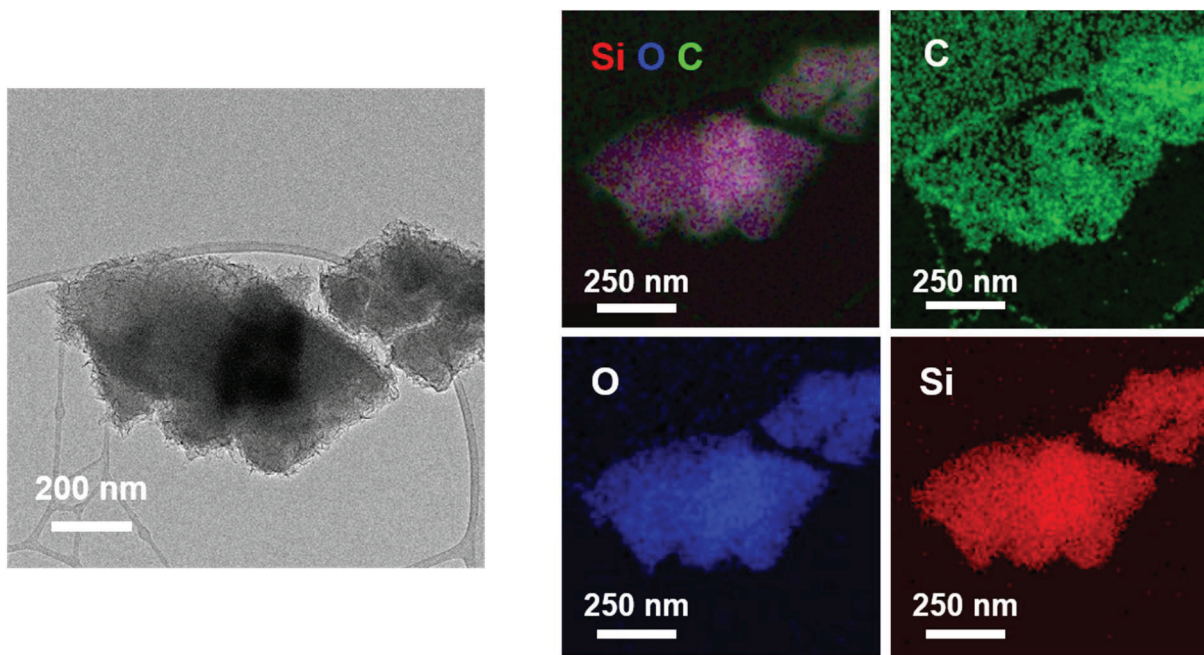


Figure S1. Elemental mapping of c-SiO using EDS.

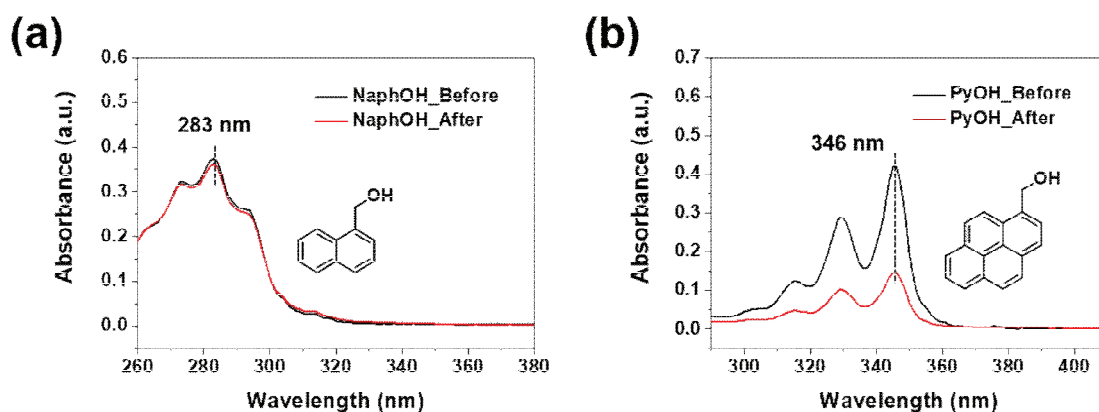


Figure S2. UV-Vis spectra before and after the interaction of aromatic compounds with c-SiO. (a) NaphOH. (b) PyOH. For this experiment, each aromatic compound was dissolved in 4 mL of DMSO to make 1 mM solution, and 2 g of c-SiO was then added, followed by stirring of the solution for 1 day. Next, each solution was centrifuged (13,000 rpm, 10 min), and its supernatant was diluted and analyzed by UV-Vis analysis.

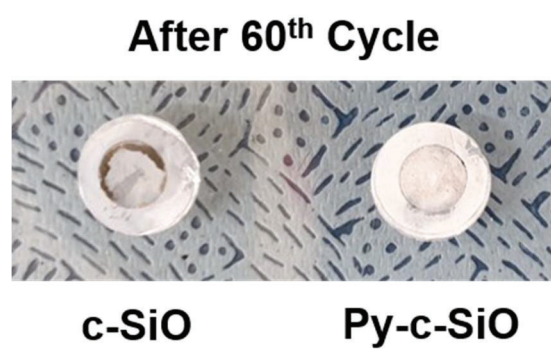


Figure S3. PE separators after 60 cycles of Li half-cell operation. (Left) From c-SiO-PAA and (right) from Py-c-SiO-PAA.

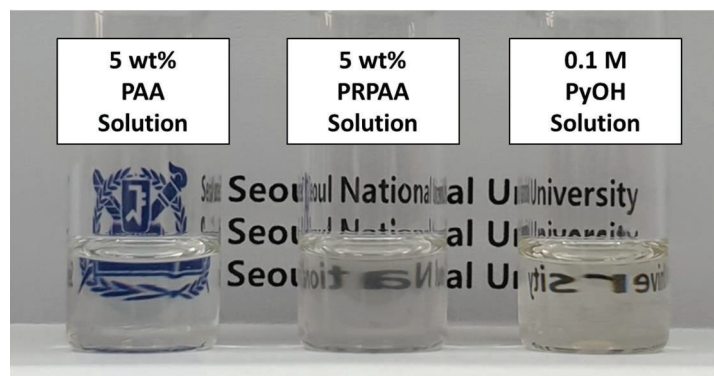


Figure S4. Solubility test of PAA, PRPAA, and PyOH in DMSO. The concentrations are consistent with those in the cell fabrication.

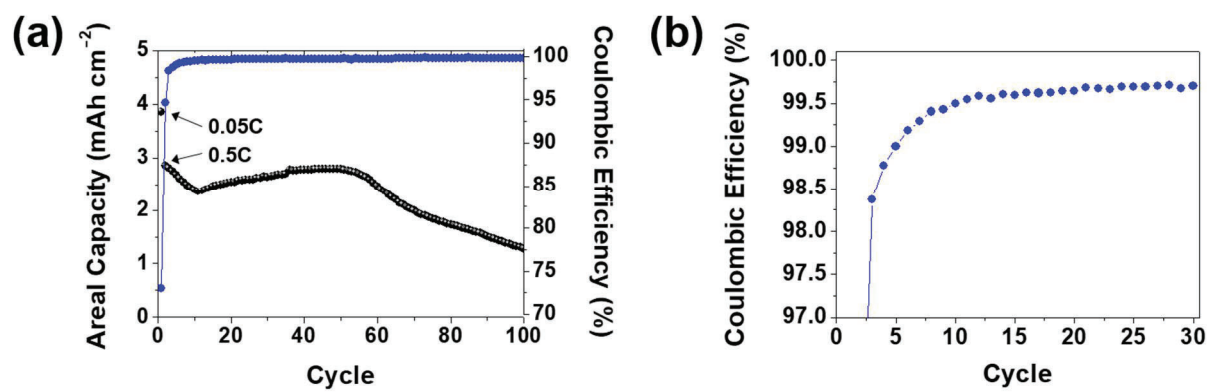


Figure S5. (a) Cycling performance of the c-SiO-PRPAA electrode measured at 0.5C and (b) its corresponding Coulombic efficiencies in the first 30 cycles.

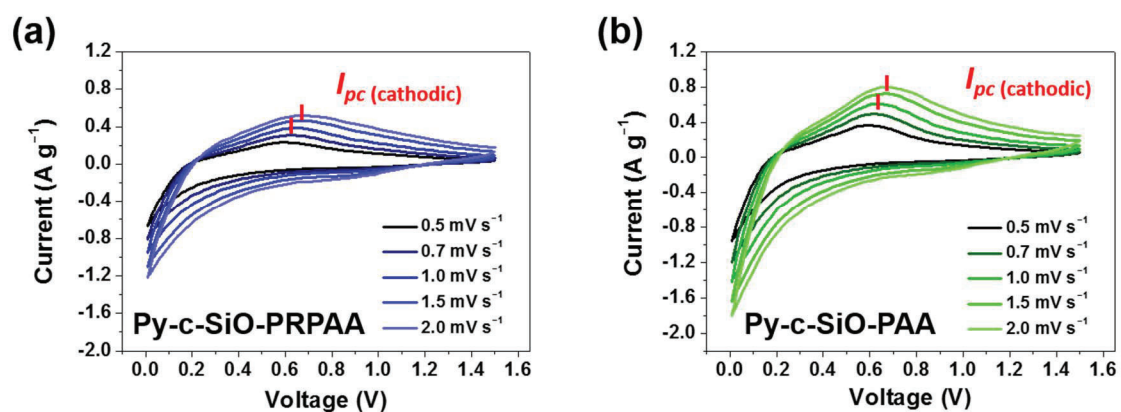


Figure S6. CV profiles of (a) Py-c-SiO-PRPAA and (b) Py-c-SiO-PAA electrodes at various scanning rates in the potential range of 0.01–1.5 V vs Li/Li⁺.

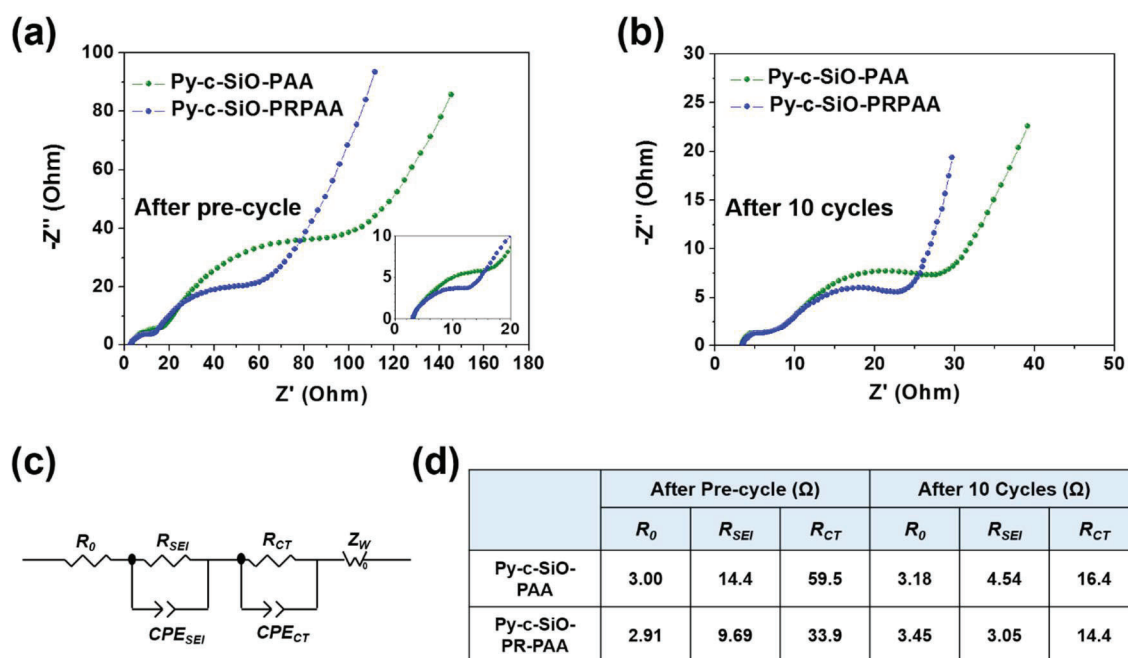


Figure S7. EIS plots of electrodes (a) after single pre-cycle at 0.05C and (b) after additional 10 cycles at 0.5C. (c) Equivalent circuit for EIS analysis and (d) the resulting resistance values by fitting to the equivalent circuit.

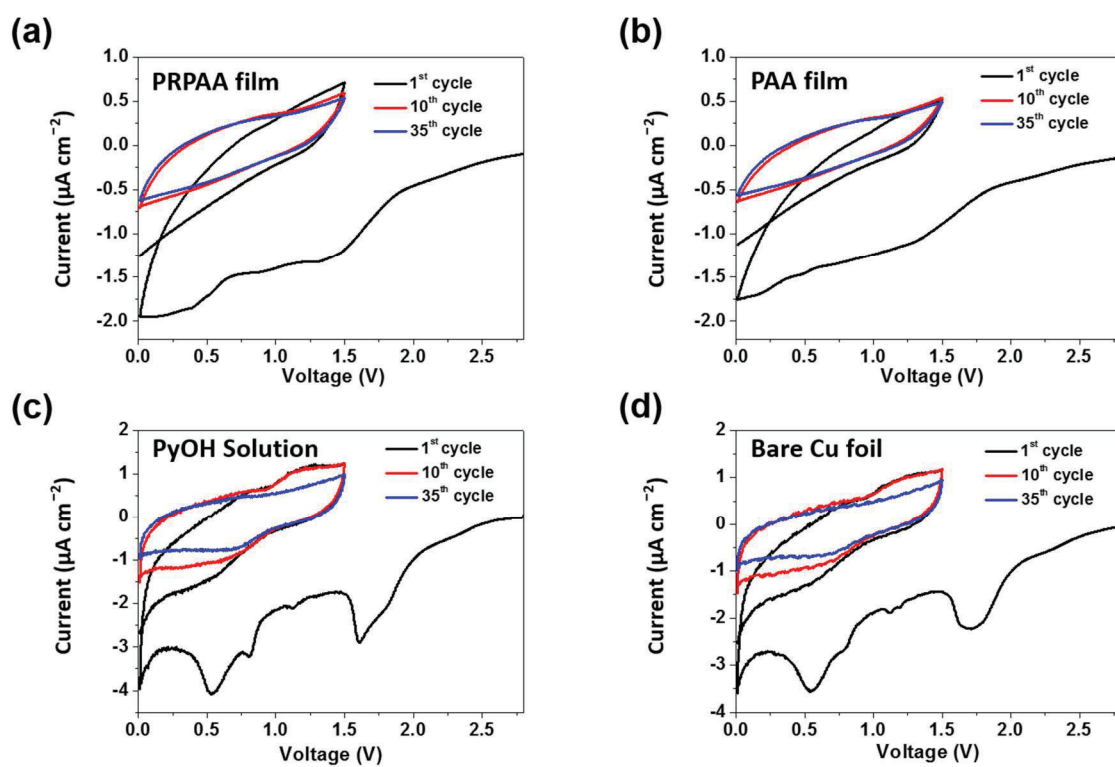


Figure S8. CV profiles of (a) PRPAA, (b) PAA, (c) PyOH, and (d) bare Cu foil at 0.2 mV s^{-1} in the potential range of $0.01\text{--}1.5 \text{ V vs Li/Li}^+$.

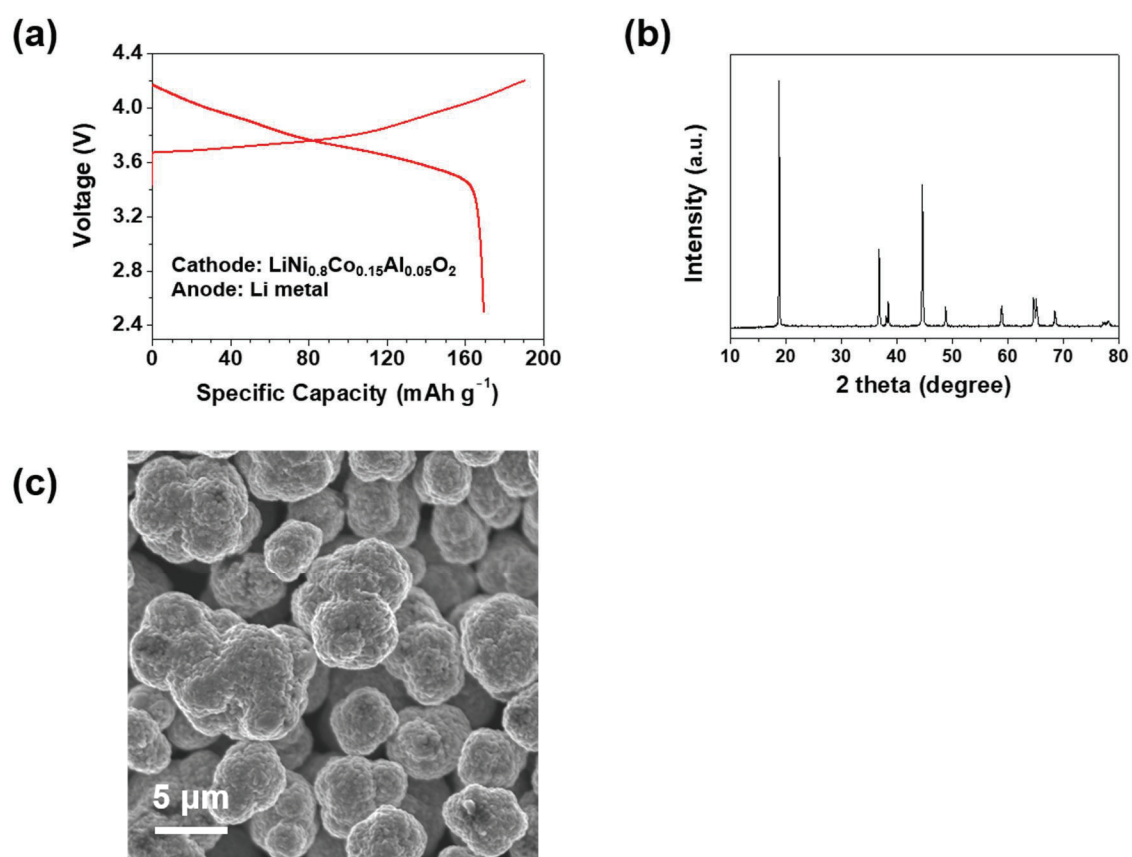


Figure S9. (a) Charge-discharge profiles of NCA half-cell at 0.05C during pre-cycling. (b) XRD spectrum and (c) SEM image of the NCA powder used.

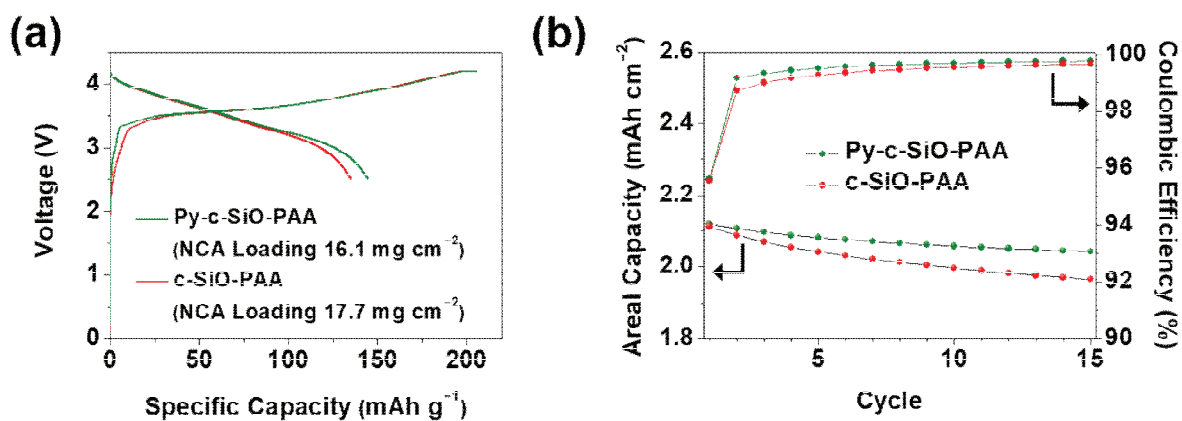


Figure S10. (a) Initial voltage profiles of the Py-c-SiO-PAA and c-SiO-PAA cells paired with NCA cathodes when measured during pre-cycling at 0.05C. (b) Cycling performance and Coulombic efficiencies of the same two cells when measured at 0.5C.

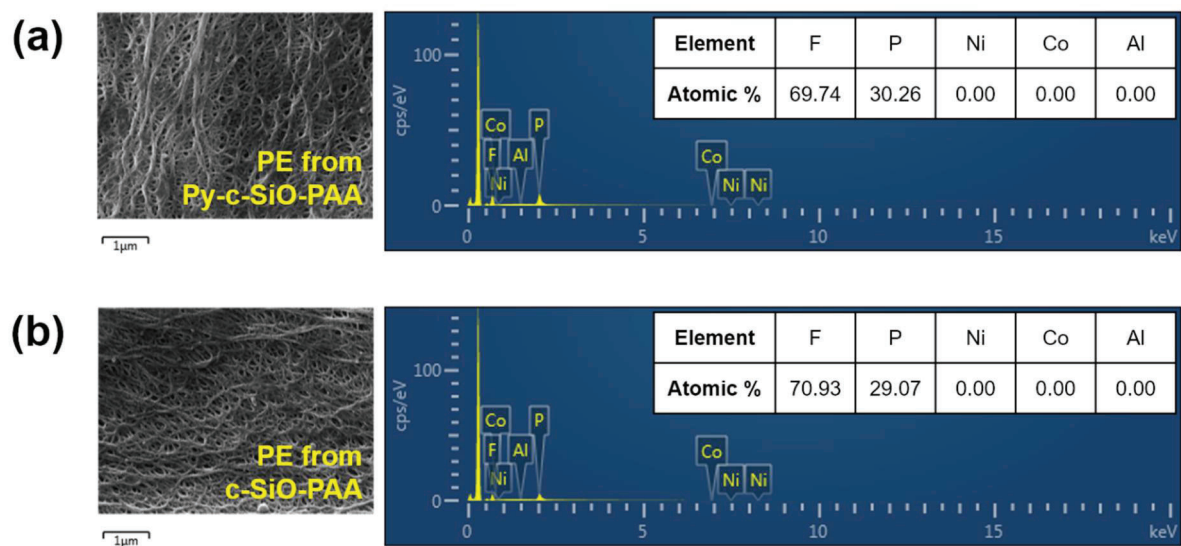


Figure S11. SEM images and elemental analyses of the separators from (a) Py-c-SiO-PAA and (b) c-SiO-PAA full-cells after 15 cycles.

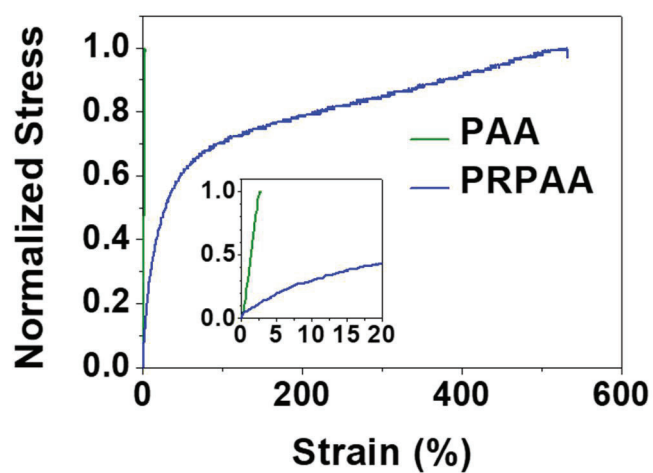


Figure S12. Stress-strain curves of PAA and PRPAA films.