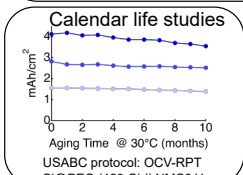
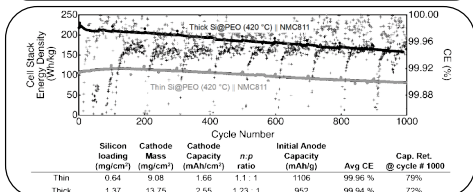
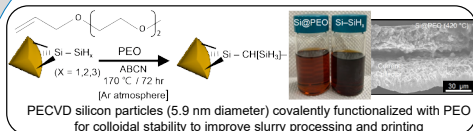


Oligomer/SiO_x Passivation



Electrode and cycling details:

- 8:1:1 Si@PEO:P84:C45
- Cured at 420 °C for 4 hrs under N₂
- Electrolyte: 1.2M LiPF₆ in 3:7 EC:EMC with 3 wt.% FEC (GenF)
- Full cells were electrochemically prelithiated to 18% SOC
- C/3 cycling with intermittent C/10
- Voltage window 3.0-4.2 V
- All measurements at 30 °C

Conclusions

- High silicon content electrodes with intermediate loading show stable cycling (CE > 99.9%) in standard carbonate electrolyte.
- Calendar life > 10 months

Carroll et al. 2023, J. Mat. Chem A. DOI: 10.1039/D2TA08935A

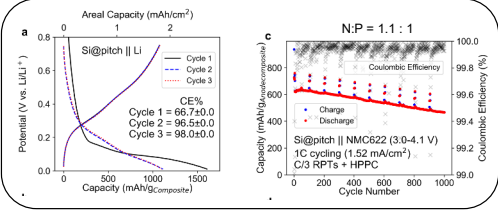
sp² Amorphous Carbon Passivation

50 wt% Si@SiH₄ NP
50 wt% pitch

1. Balance mixture
2. Vacuum dry
3. Formulate slurry: 80% Si@pitch, 20% H₂O, 100% Tensil C45
4. Ball mill
5. 325 mesh sieve
6. Filter/press
7. Bake-coat
8. Dry 150 °C (vacuum)
9. Anneal at 300 °C

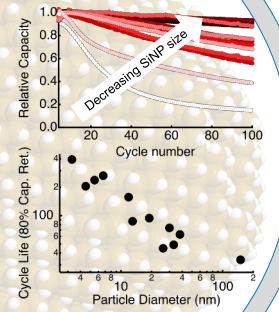
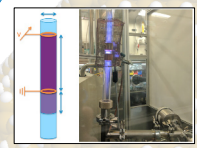
Electrode and cycling details:

- 8:1:1 Si@Pitch:P84:C45
- Cured at 350 °C for 4 hrs under N₂
- Prelithiated to 8% SOC
- All cycling data collected under same conditions as Si@PEO



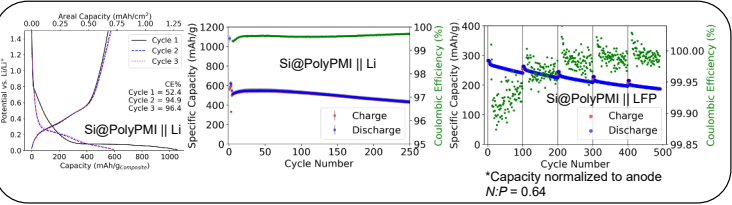
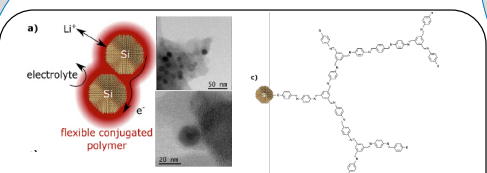
Schulze et al. manuscript in preparation

Plasma Enhanced Chemical Vapor Deposition (PECVD) Silicon Nanoparticles



- Highly controllable synthesis with surface termination (-SiH₃) for easy covalent or ionic functionalization
- In Li-ion batteries, particle sizes dictate the cycle stability of silicon anodes

Conducting Polymer Passivation



Electrode and cycling details:

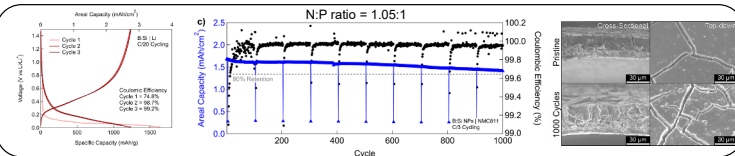
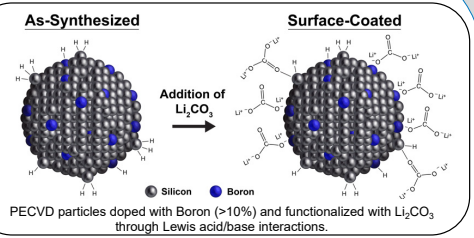
- 6:2:2 Si@PolyPMI:P84:C65
- Cured at 350 °C for 4 hrs under N₂
- Cycling data collected at 1C
- No electrochemical prelithiation
- All electrolyte is GenF

Conclusions:

- Silicon embedded and covalently attached to hyperbranched PolyPMI
- CE reaches values > 99.99%
- SEI remains unchanged between 1 and cycle 200
- Calendar life measurements are on going

Martin et al. 2023, Adv. Ener. Mat. DOI: 10.1002/aem.20203921

Ionic Passivation



Electrode and cycling details:

- 8:1:1 B:Si:P84:C45
- Cured at 400 °C for 4 hrs under N₂
- Cycling data collected at C/3 in GenF electrolyte
- Full cells assembled from electrochemically prelithiated anodes (1% < SOC)

Conclusions:

- Boron-doped PECVD silicon particles are functionalized with Li₂CO₃ through strong acid/base interactions
- Highly compact electrode morphology
- Electrochemical cycling against NMC 811 displays capacity retention > 84% through 1000 cycles
- Calendar life measurements are on going

Pach et al. Manuscript in Preparation