Structural battery composites with solid-state polymer electrolyte produced by slurry coating

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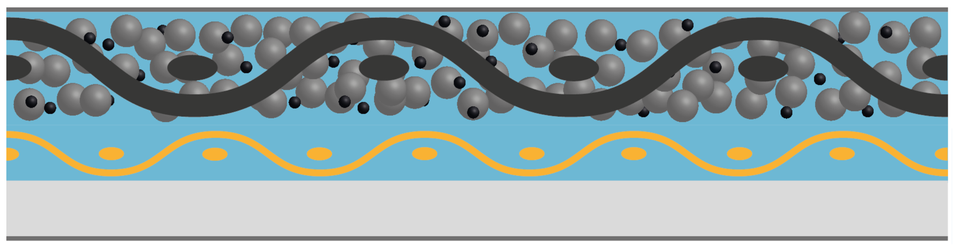
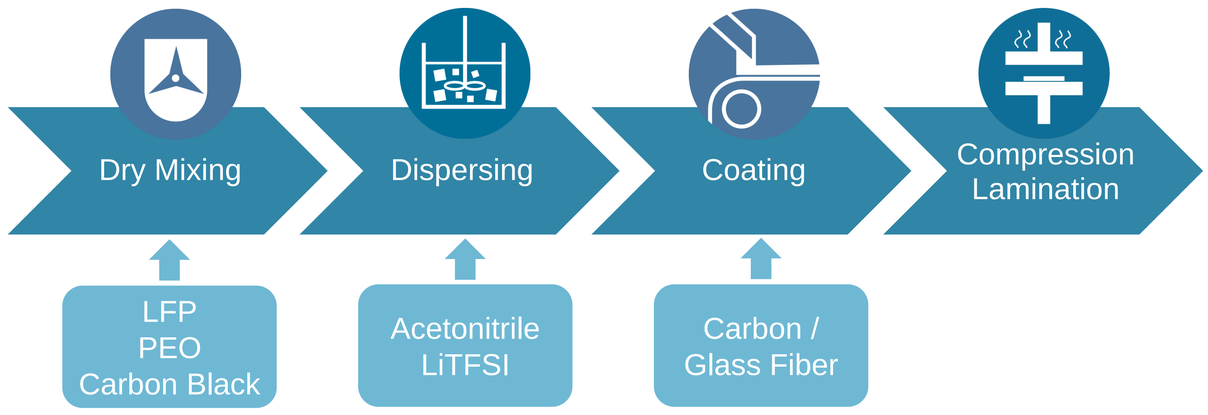
Objective



- Electrical aviation requires small and lightweight electrical energy storage devices.
- Multifunctional structure:
  - → A structural battery composite can store electrical energy while bearing mechanical loads.
  - → Reduction of parasitic mass and volume.

Process chain

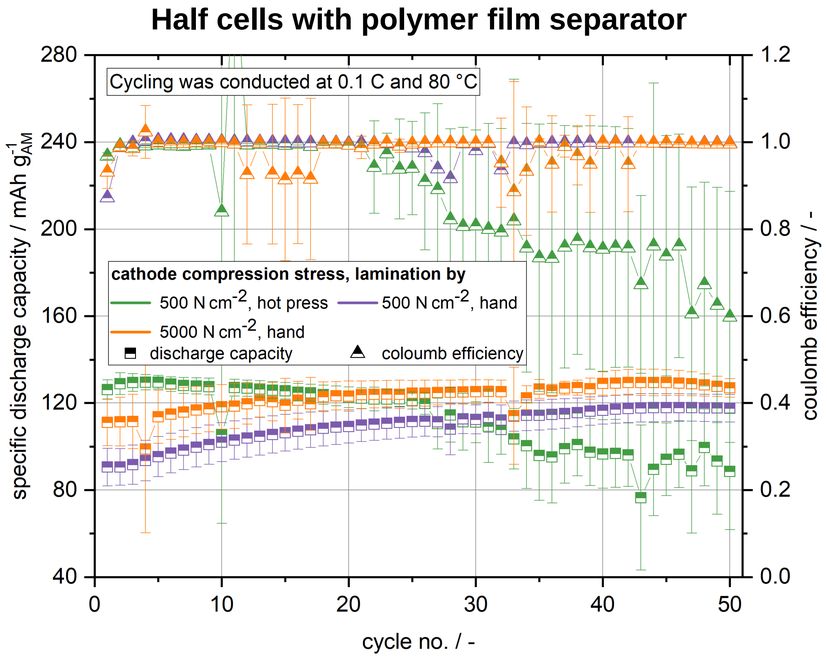


	Carbon Fiber Cathode	Glass Fiber Separator
LFP	72.3 %	-
PEO	16.4 %	68.2 %
LiTFSI	7.6 %	31.8 %
Carbon Black	3.7 %	-

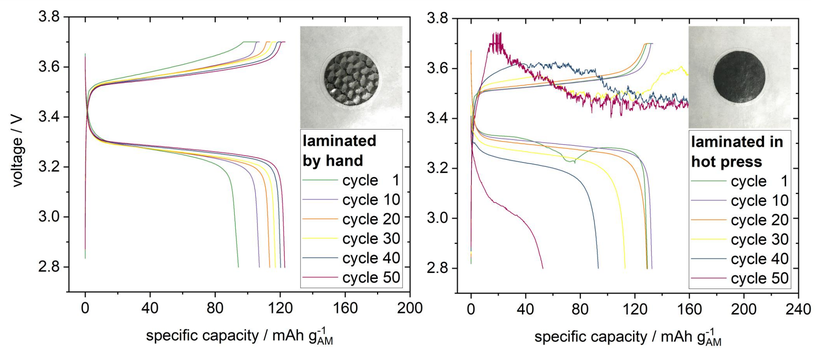
- Lamination was performed either in a hot press or manually on a hot plate.
- For half-cell tests, a polymer film separator based on a PEO block copolymer was used.

Electrochemical characterization of cathode half cells

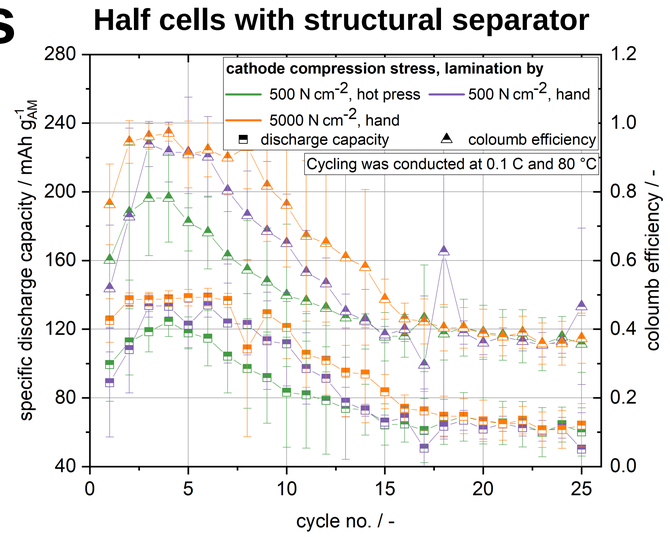
Half cells with polymer film separator



- Higher cathode compression stress improves the contact within the cathode and the capacity.
- Lamination in the hot press improves the initial capacity, but introduces significant capacity fading, because the separator is locally weakened.
- The capacity of the manually laminated cells increases, because the contact between cathode and separator improves over time.

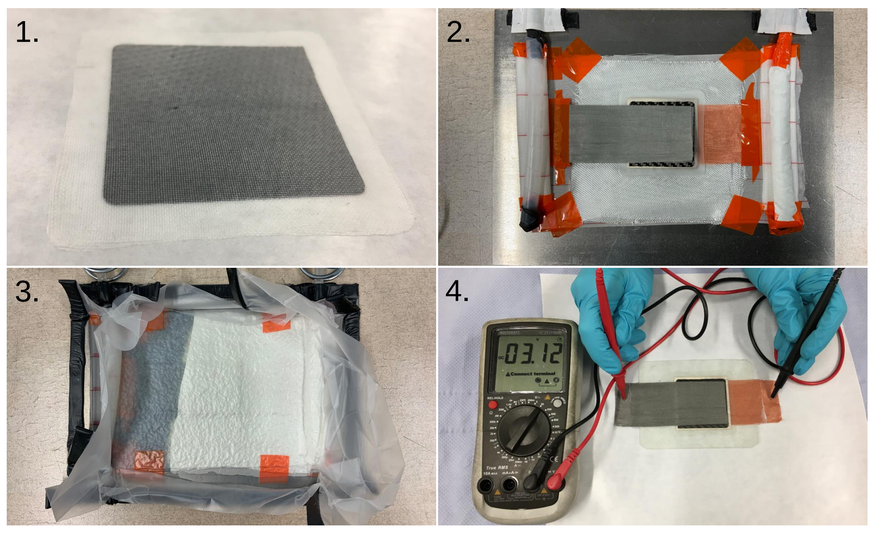


Half cells with structural separator



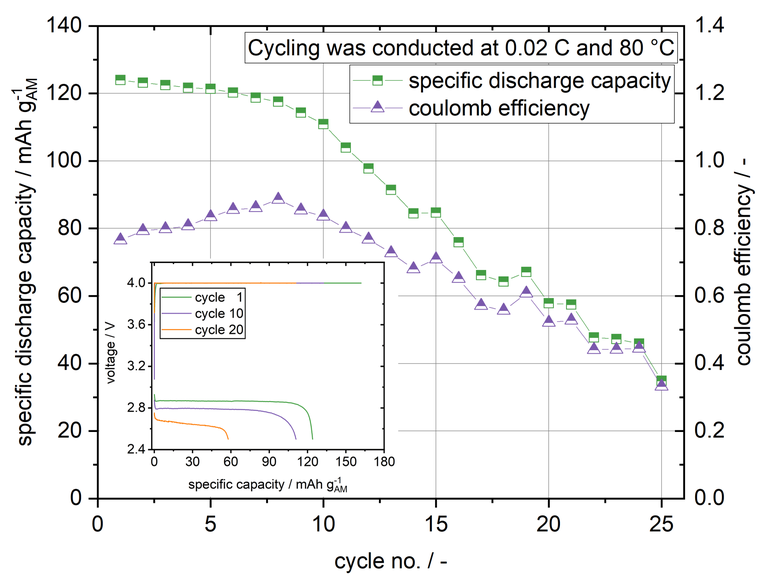
- Fast degradation of the capacity due to lithium dendrite growth.
- The structural separator is more sensitive to lithium dendrite growth than the polymer film separator.

Fabrication of a structural battery composite



1. Laminated structural cathode and structural separator
2. Cell stack prepared for infiltration
3. Infiltration with epoxy resin
4. Demolded structural battery composite

- Comparable initial capacity and capacity fading like the half cells with structural separator.
- Capacity fading and poor coulomb efficiency can be explained by lithium dendrite growth.
- The infiltration with epoxy resin introduces high overpotentials. Most probably the expoxy resin is partially increasing the electrical resistance.
- Specific energy of 64 Wh kg^{-1} with respect to electrode and separator mass.



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