

Investigating the electrochemical stability of sulfide solid electrolyte dry films for dry processed solid state batteries

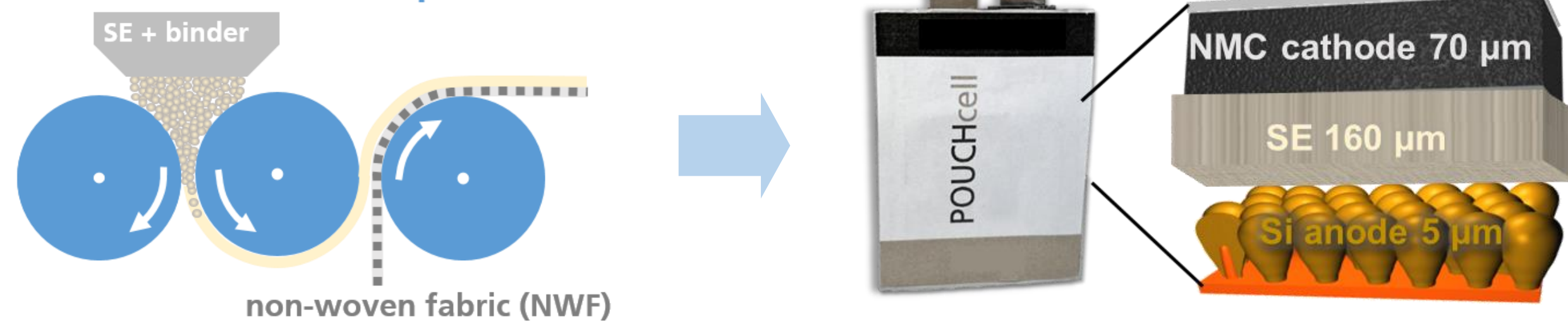
Felix.Hippauf@IWS.Fraunhofer.de

M. Rosner, S. Cangaz, F. Hippauf, S. Dörfler, T. Abendroth, H. Althues, S. Kaskel

Motivation

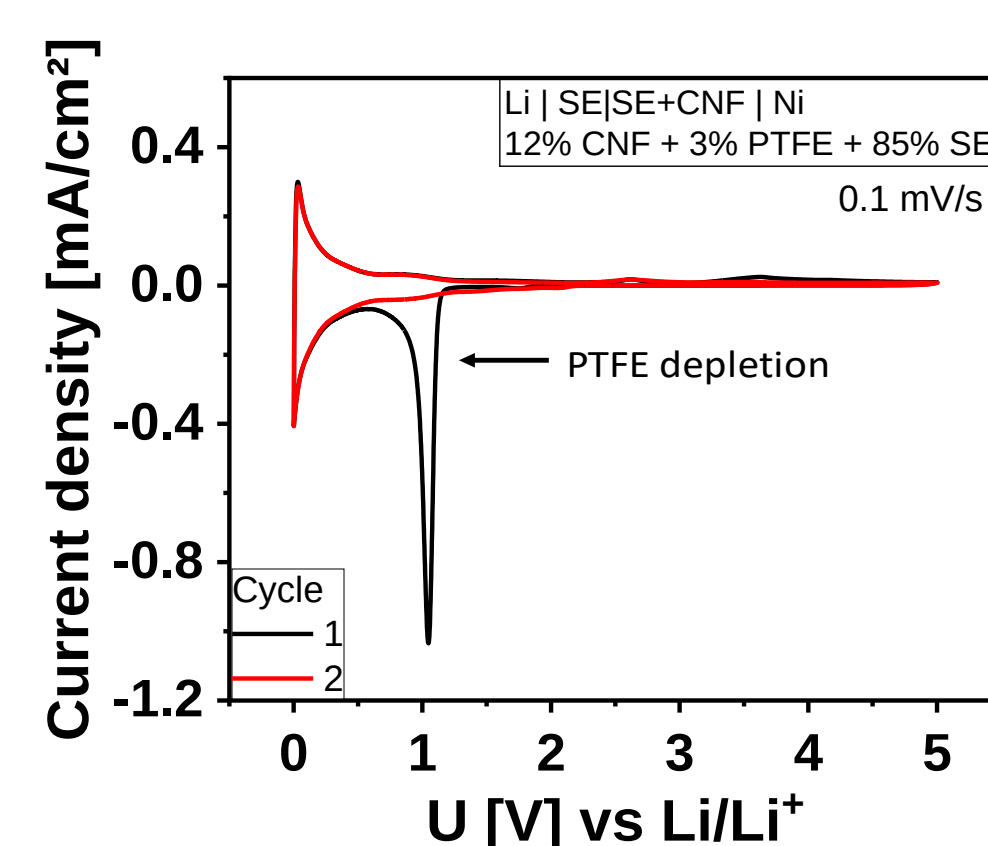
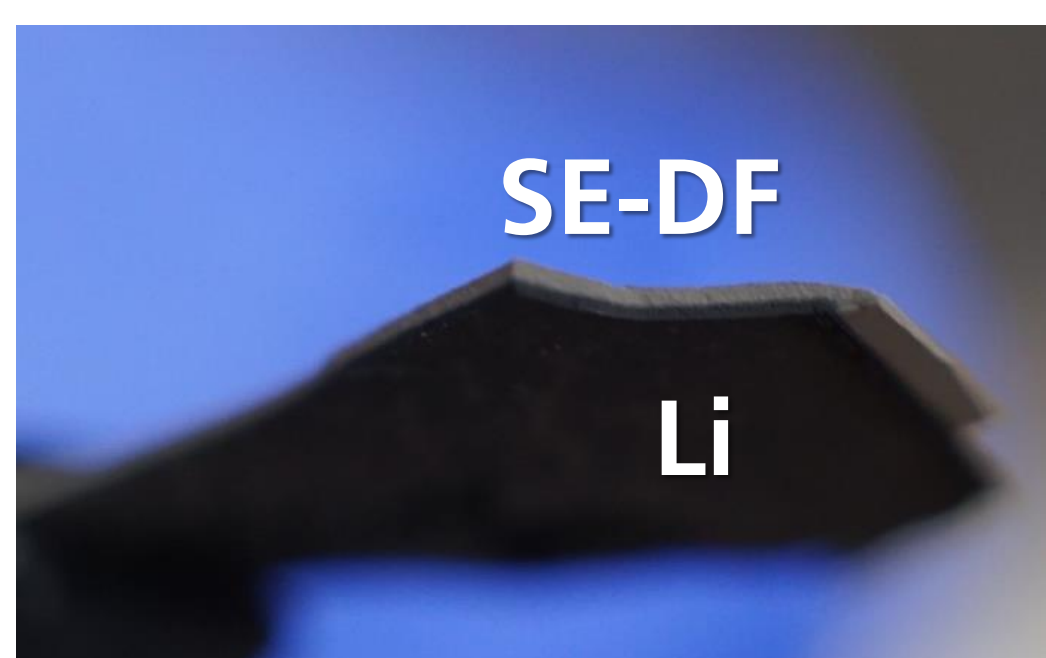
- Si anodes enable high volumetric energy densities > 900 Wh/L
- Economic dry processing of separator layers (SEL) and cathodes
- Long term cycling in pouch cells without prelithiation
- Processing possible via continuous DryTraec® process

continuous DRYTraec® process



Challenges

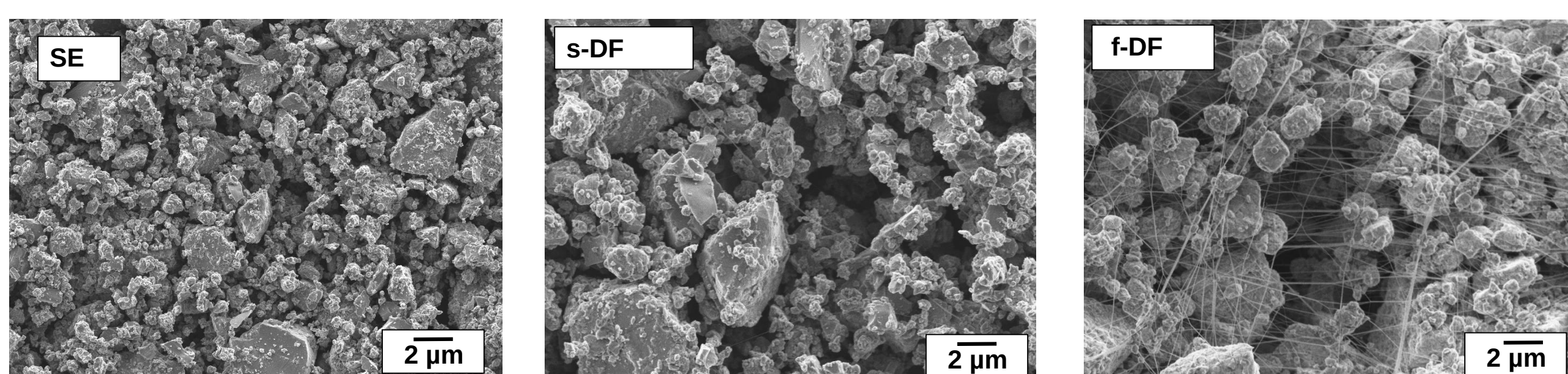
- Limited stability of PTFE at low anode potentials
- Decomposition leads to increased electronic conductivity of SEL
- Careful adaption of binder content and processing required



Method

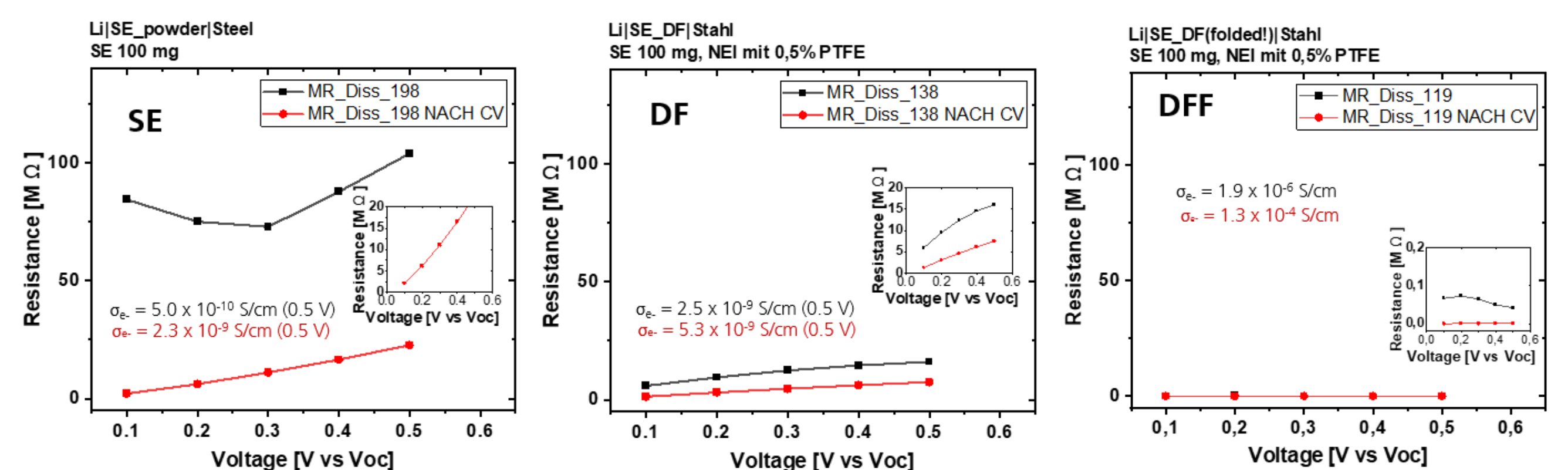
- Solvent-free preparation of cathode and separator layer
- Increasing binder content% and fibrillation degree

Sample	SE-Pellet	pc-DF	s-DF	f-DF
PTFE wt. %	0 %	0.25 %	0.5 %	0.5 %
Folding	None	Standard	Standard	Extensive
SE				
PTFE fibril				



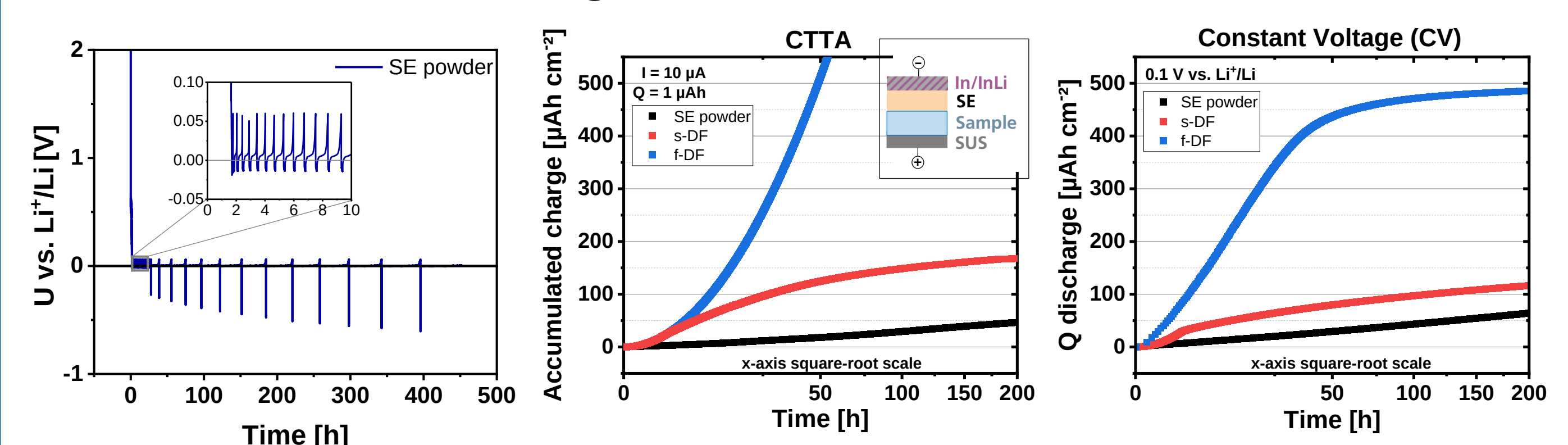
Results

Electric Conductivities after Electrochem. Decomposition

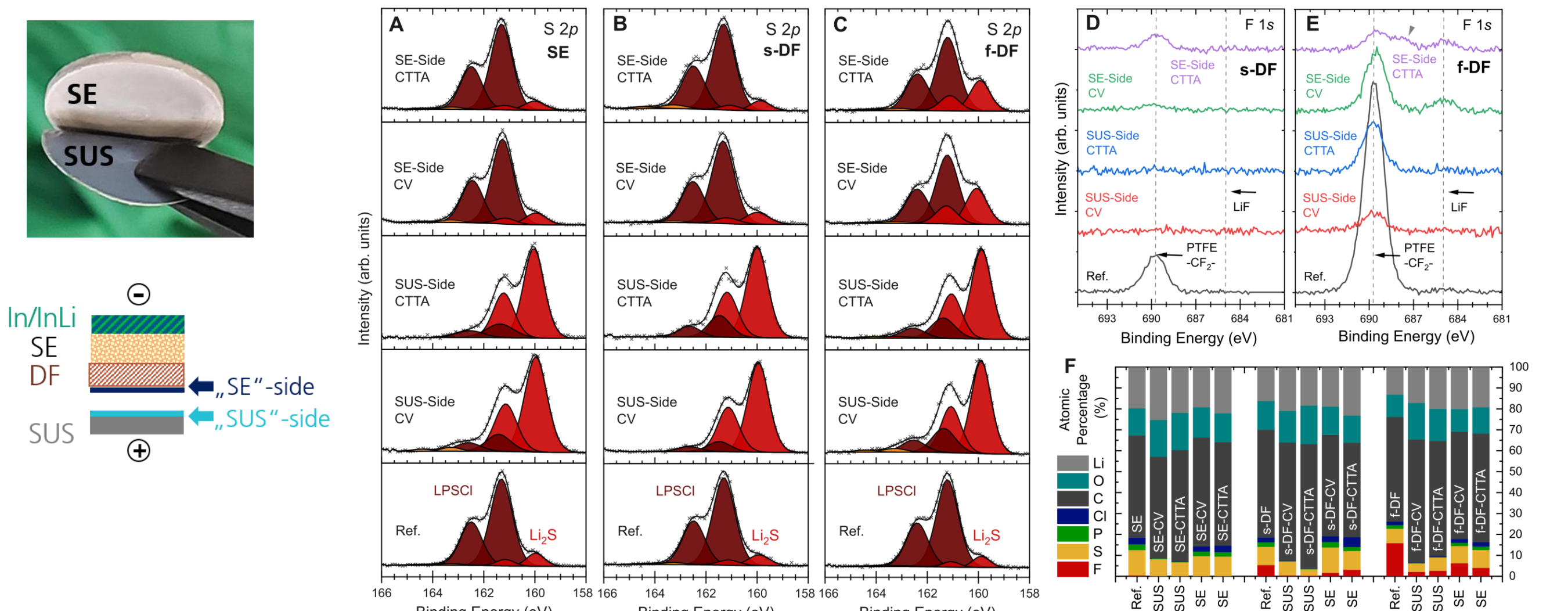


Sample	initial [S/cm]	After CV [S/cm]
SE powder	5×10^{-10}	2.3×10^{-9}
DF	2.5×10^{-9}	5.3×10^{-9}
DFF (folded)	1.9×10^{-6}	1.3×10^{-4}

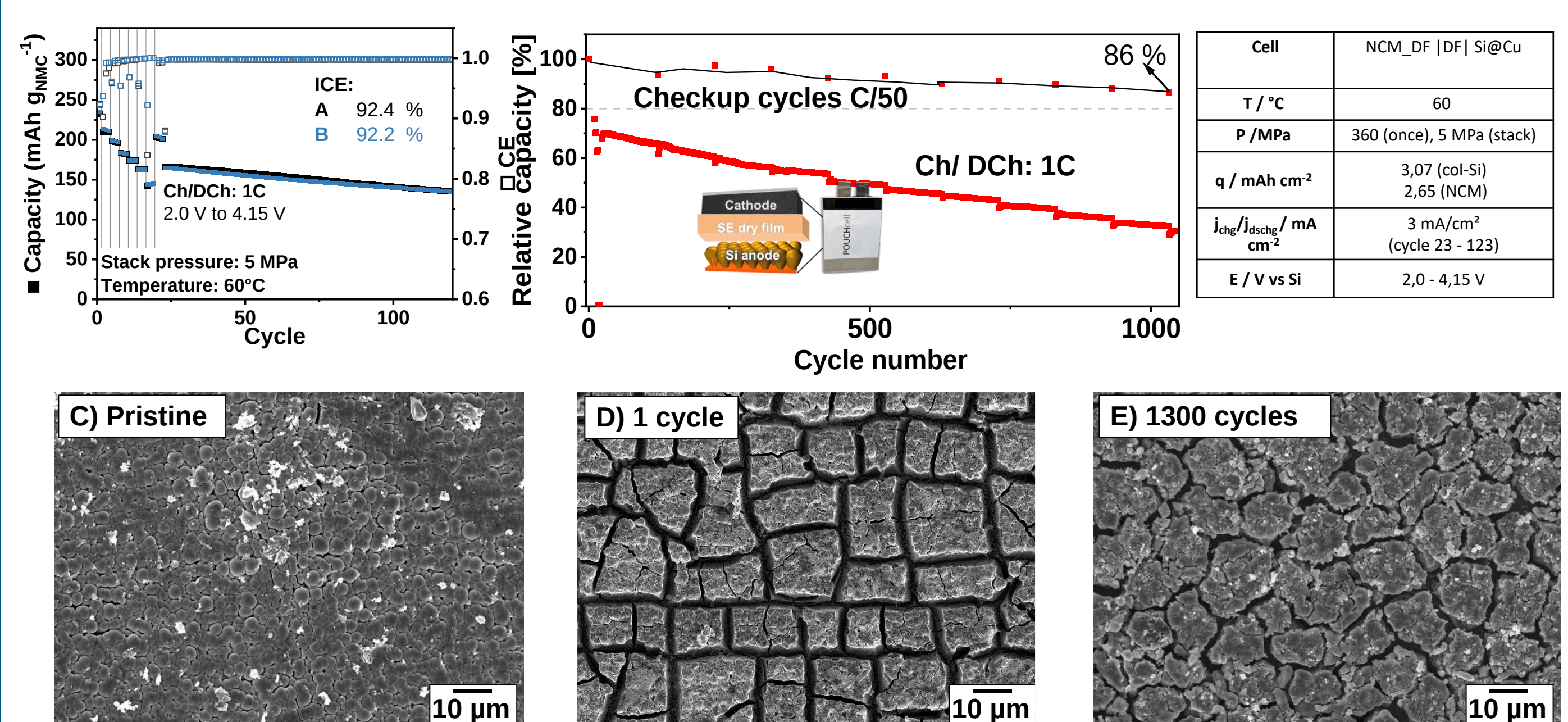
CTTA and Constant Voltage Measurements



Post-Mortem XPS Analysis of SE Interface after CTTA



Dry-Processed Single Layer Pouch Cells



Conclusion

- PTFE degradation depends strongly on the morphology of the PTFE fibrils within the SEL
- Increased electric conductivity and lithium consumption due to decomposition
- Adapted processing leads to stable cycling of single layer pouch cells with SOH > 80% after 1000 cycles

SPONSORED BY THE

This work has received funding from the Federal Ministry of Education and Research (BMFTR), support FestBatt II – FB2-Thio“ (03XP0430D)