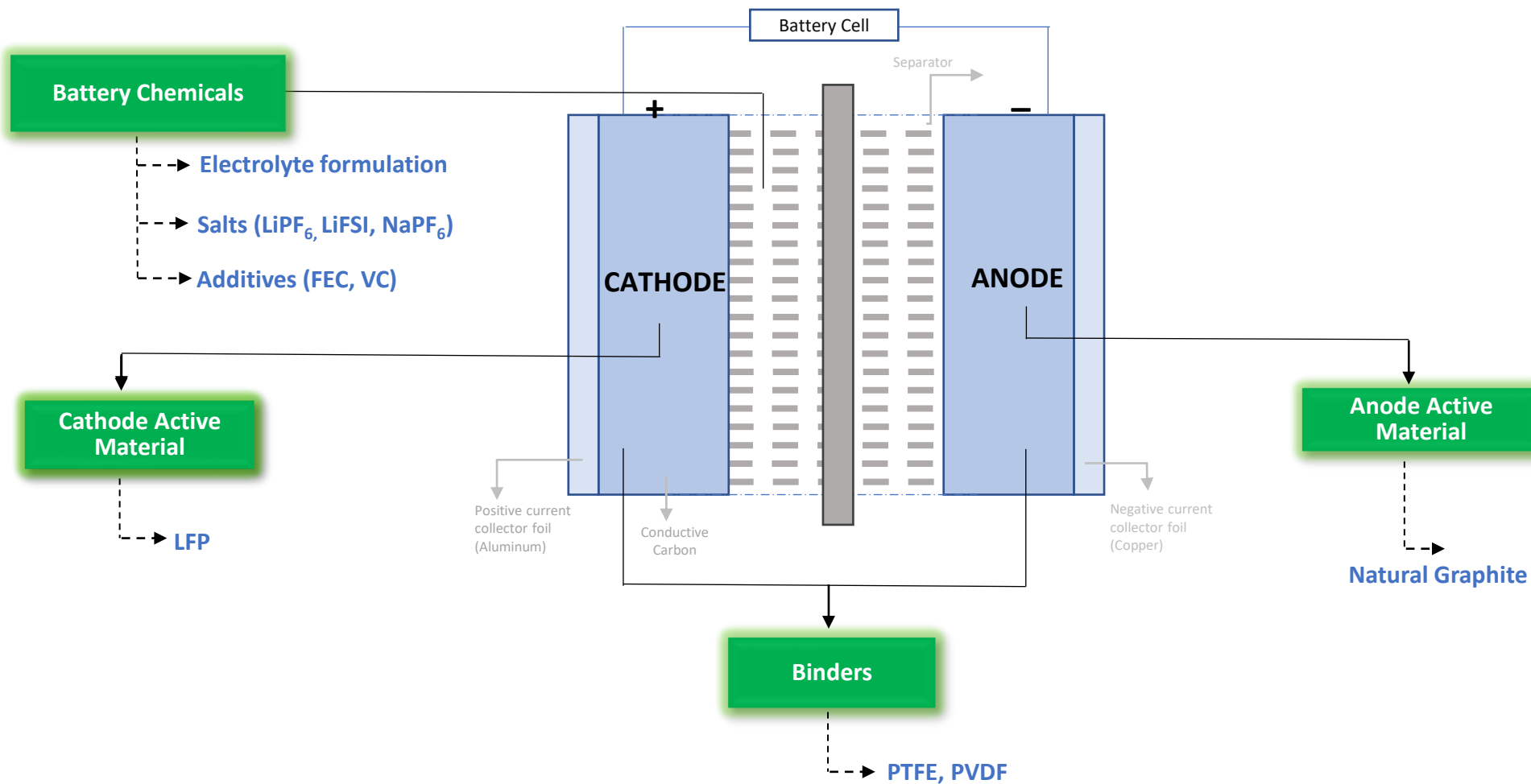


Novel Binders For Dry Coating

- ❖ Legacy over 100 years, with market capitalization of US\$ 15 Bn
- ❖ Establishing world's largest battery chemicals complex outside of China with manufacturing locations in India & Oman
- ❖ Comprehensive product portfolio – Electrolyte Salts, CAM, AAM and Binders
- ❖ Products approved with large Cell producers
- ❖ Commercial production started with strong vertical integration independent of China
- ❖ Only non-Chinese supplier to offer both PTFE and PVDF binders for dry & wet electrodes





GFCL EV's Binder Portfolio

Dry Coating	Wet Coating
PTFE - FP 7040EX	PVDF - 1160
PVDF (as co-binder) - 1125, 2150	

- ❖ Single source for PVDF and PTFE Binders for both wet & dry electrode processes
- ❖ Portfolio includes Homopolymer and Copolymer grades
- ❖ Successful validation in natural and synthetic graphite anodes
- ❖ Products qualified in 4680 cells

1. Holds active material and conductive additive together thereby forming a path for the flow of electrons
2. Maintains structural integrity of electrode coating over the current collector
3. Forms an interphase between electrode and electrolyte protecting the electrode from corrosion

Challenges with PTFE

1. Inconsistent flow due to pre-fibrillation
2. Degradation at anode



Our Solution



INOFLON[®] FP 7040EX PTFE

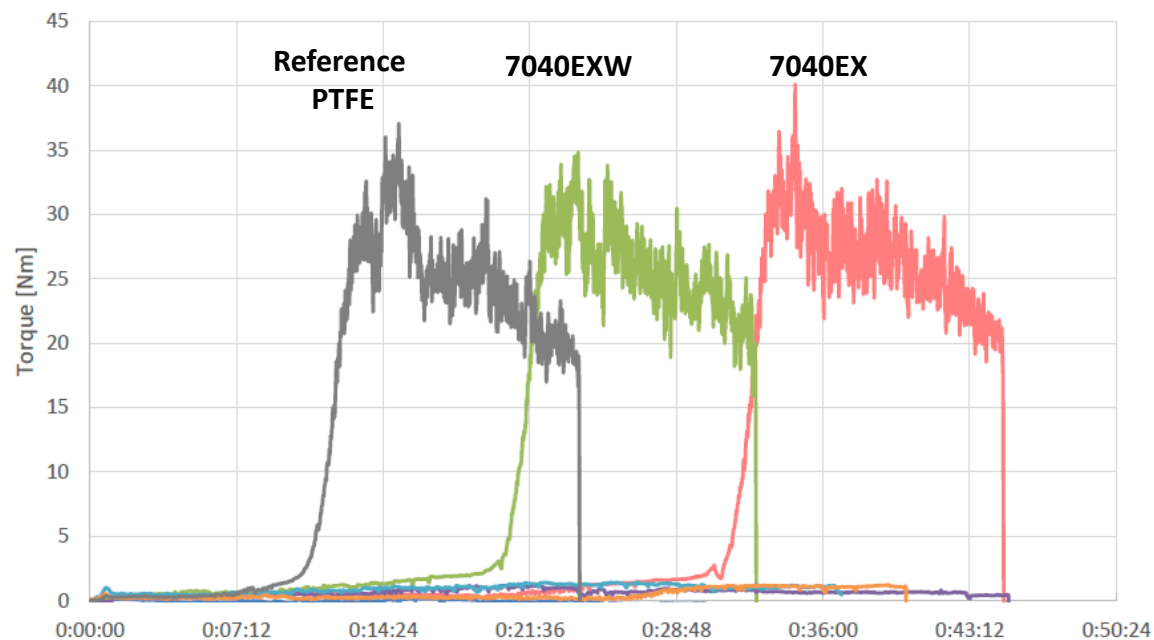
1. Conducted by Fraunhofer Institute for Material and Beam Technology IWS



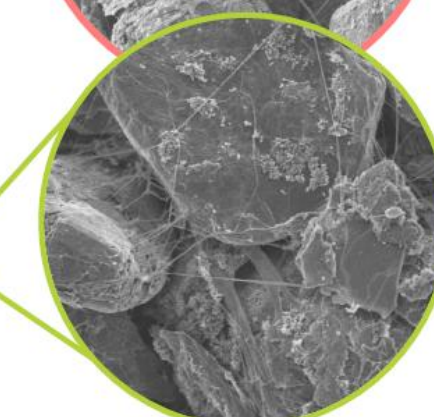
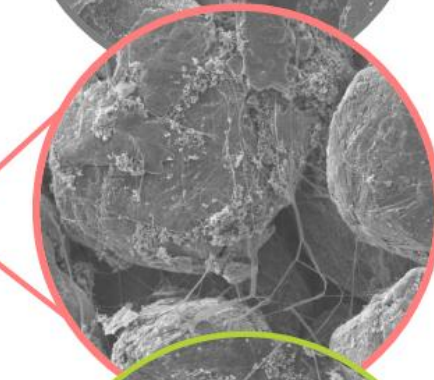
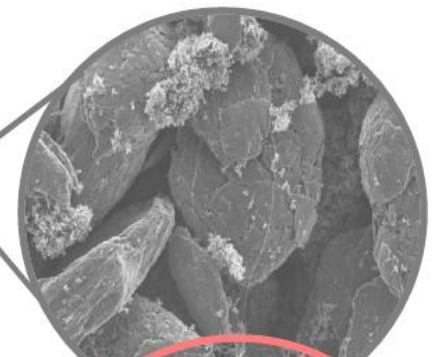
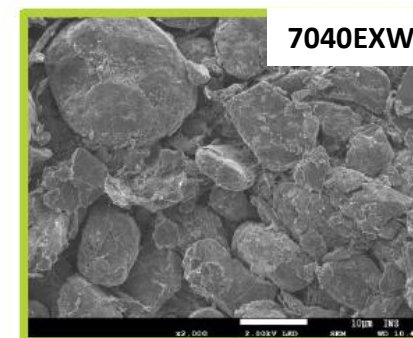
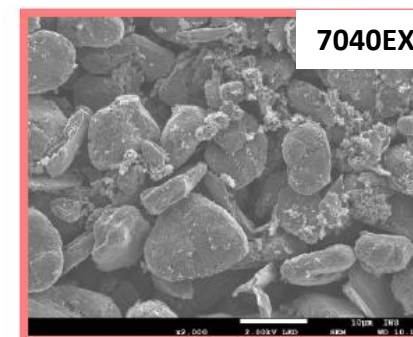
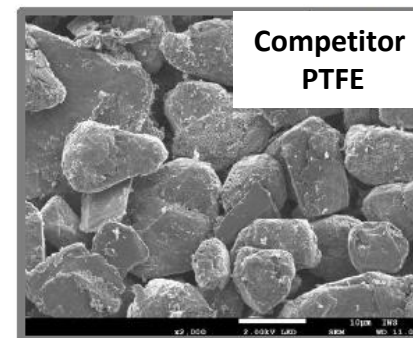
2. Customer Qualifications at multiple cell producers

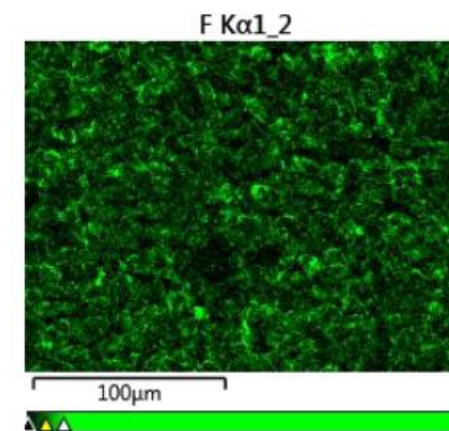
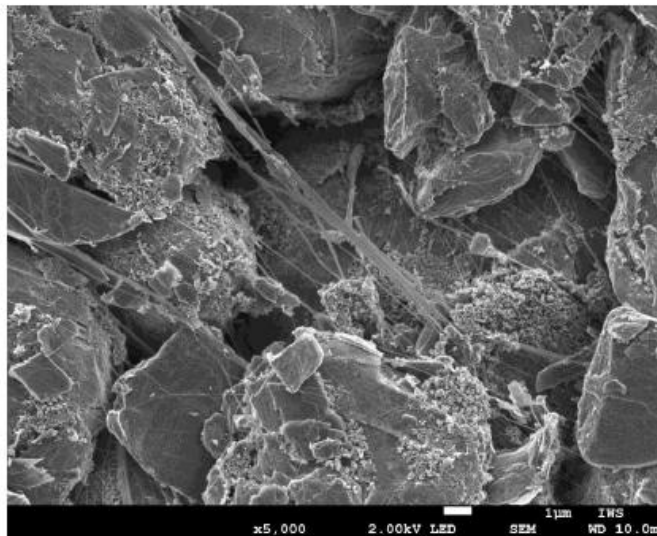
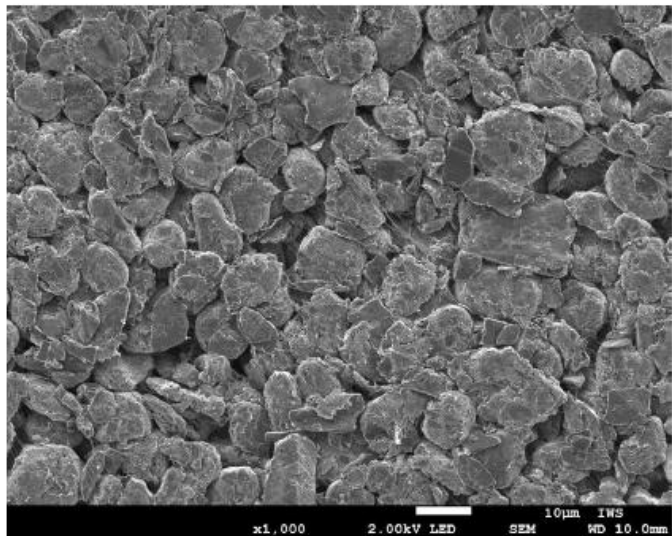
Dry Coating on Anode and Cathode

- ✓ INOFLON PTFE exhibits good fibrillation
- ✓ Better process control – Optimum (delayed) fibrillation



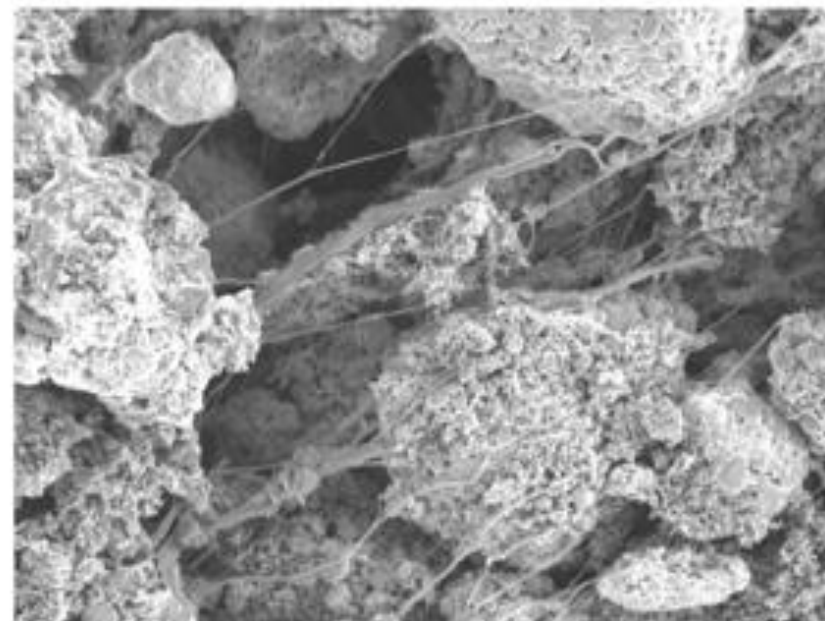
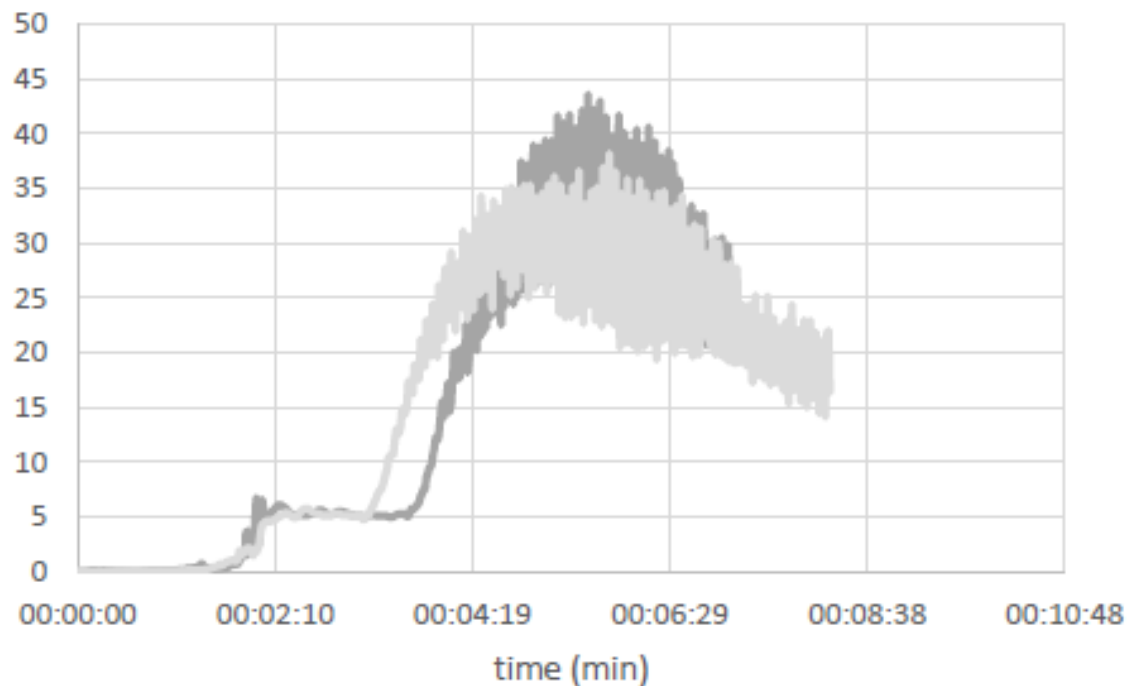
7040EXW : Post-treated version of 7040EX

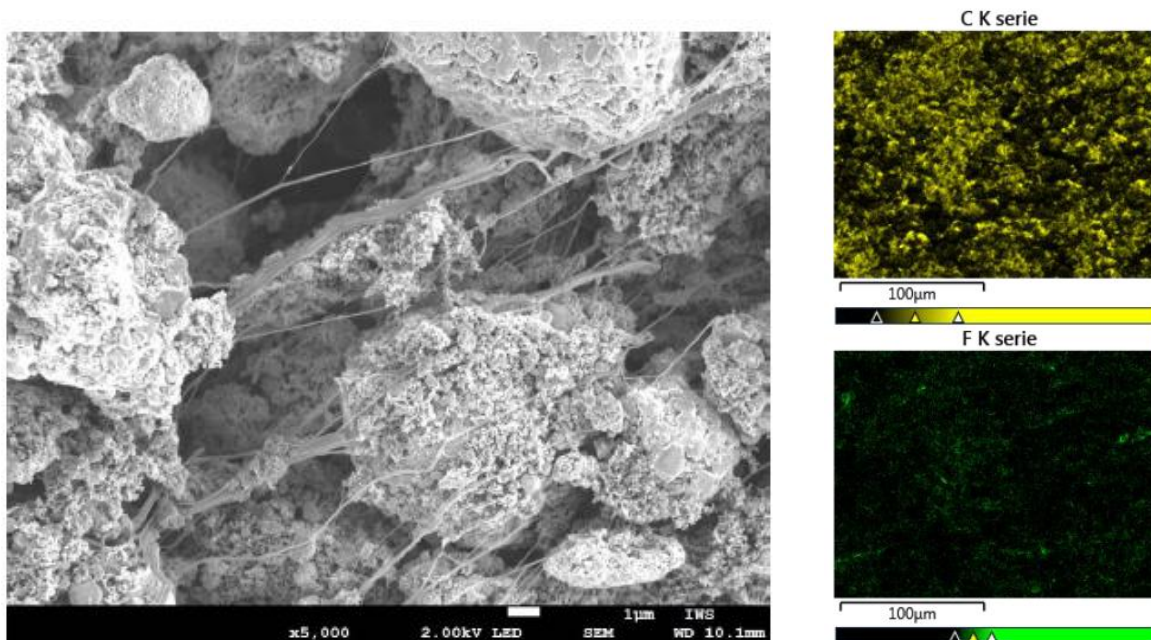




- Fibrils are distinct & clearly visible - provide necessary cohesion
- Fluorine distribution is homogeneous - good dispersion of active material

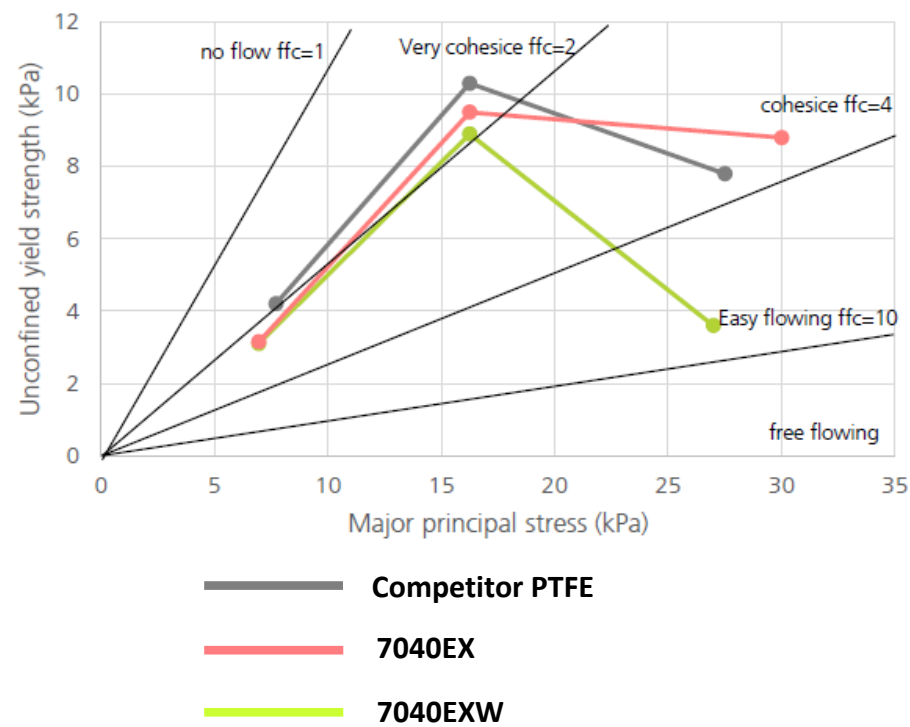
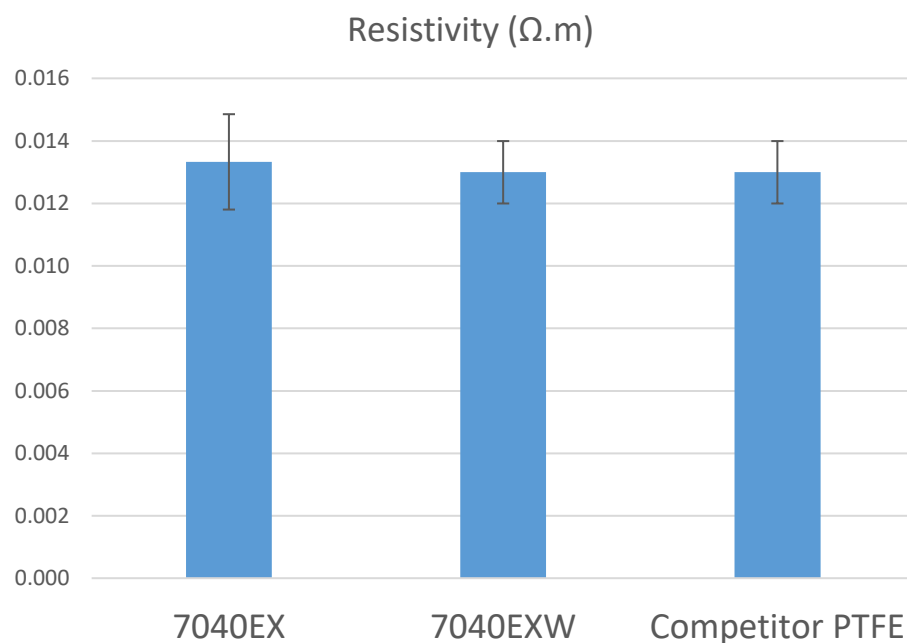
- Optimal fibrillation of FP7040EX is observed at comparatively lower torque as desired



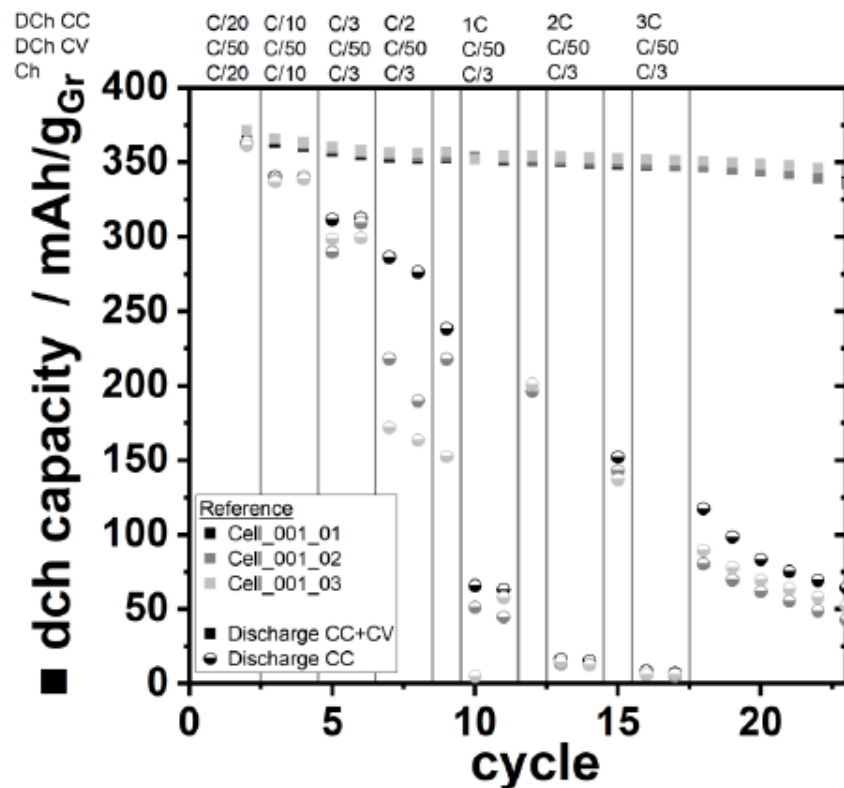


- Fibrils are distinct & clearly visible in SEM analysis - provide necessary cohesion
- Carbon & Fluorine distribution is homogeneous - good dispersion with CAM

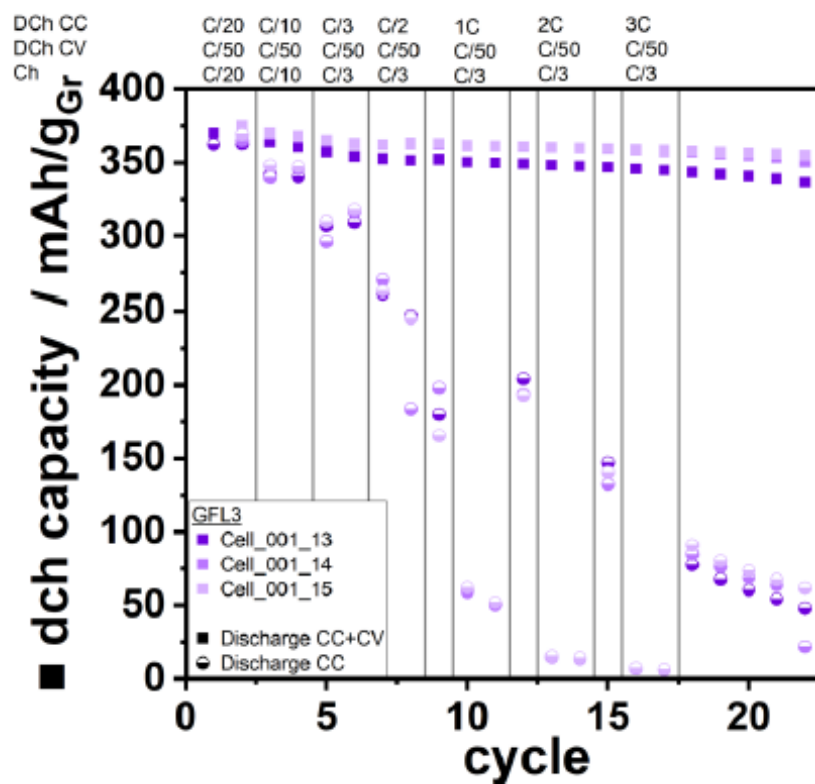
- INOFLON PTFE FP 7040EX and 7040EXW show low resistivity as desired
- 7040EXW exhibits better flowability characteristics



Electrochemical performance – Anode

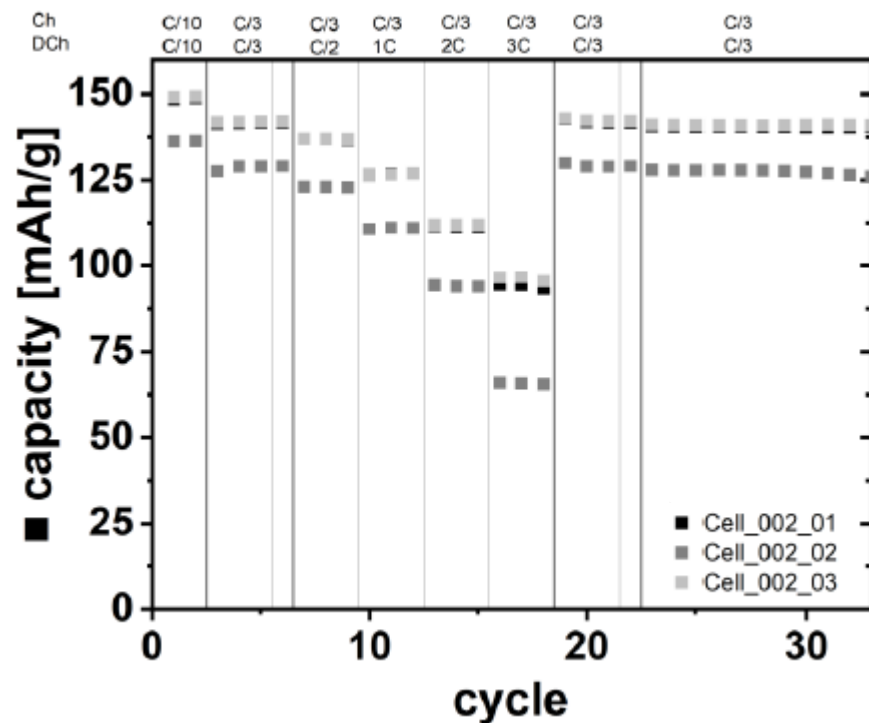


Competitor PTFE

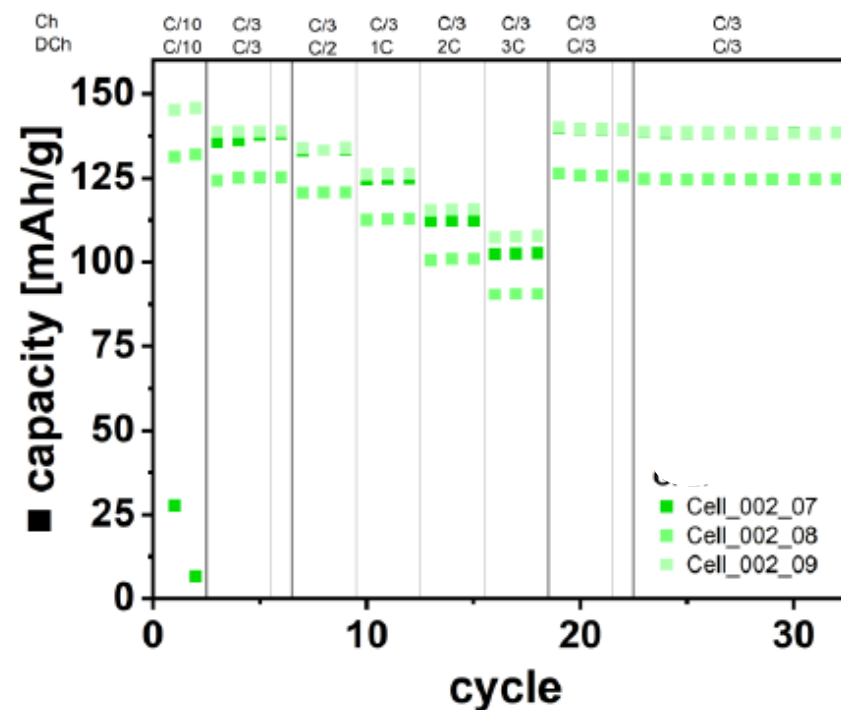


INOFLOX 7040EX

Cell capacity of anodes processed with FP 7040EX is promising



Competitor PTFE



INOFLON 7040 EX

Rate test results indicate that cathodes processed using FP7040EX exhibits comparable electrochemical performance Vs competitor PTFE



Electrochemical performance – Cathode

Binder	Peel strength (N/25 mm)	Resistance (ohm)	Discharge capacity (mAh/g) [0.1C/0.1C]	ICE (%)	2C discharge capacity (mAh/g)	Capacity retention (%) [50 cycles]
Competitor PTFE	4.48	0.35	210.33	91.87	154.07	98.92
FP7040EX	5.12	0.33	213.02	91.97	167.00	99.22

7040EX exhibits superior performance

FP7040EX PTFE binder for Dry Coating

- ❖ Patented product
- ❖ Environmentally sustainable manufacturing
- ❖ Better processability

INOFLON FP7040EX offer enhanced performance among standard PTFE choices

THANK YOU

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