Battery cell prototyping

FEV SIGNATURE SOLUTIONS

High-quality, cost-effective, and fast-track prototyping and testing

FEV offers

- **Innovative solutions:** In-house chemistry lab and holistic approach to deliver cutting-edge, customized solutions tailored to your specific needs.
- **Global supplier network:** Access to **over 250** trusted battery material suppliers for tailored solutions.
- **Global collaboration for cell prototyping:** Partnering with leading prototype centers worldwide to offer a range of options, ensuring the highest quality.
- **Comprehensive testing services:** From initial material benchmarking to full battery system testing, based on FEV's comprehensive cell database.

Why FEV

- **Efficiency and speed:** Streamlined processes and strong partnerships allow for quick results without compromising on quality. Own prototyping facilities.
- **Commitment to quality:** Dedicated to maintaining high-quality standards and reliable performance.
- **Customer-centric approach:** Prioritizing unique requirements ensures a tailored experience that meets costumer's goals and expectation.
- **Proven expertise**: Over a decade of experience in battery system development and testing, understanding the challenges of costumer projects.

Reference project FEV
Prototyping large LFP and NMC 811 cells with PFAS free binders

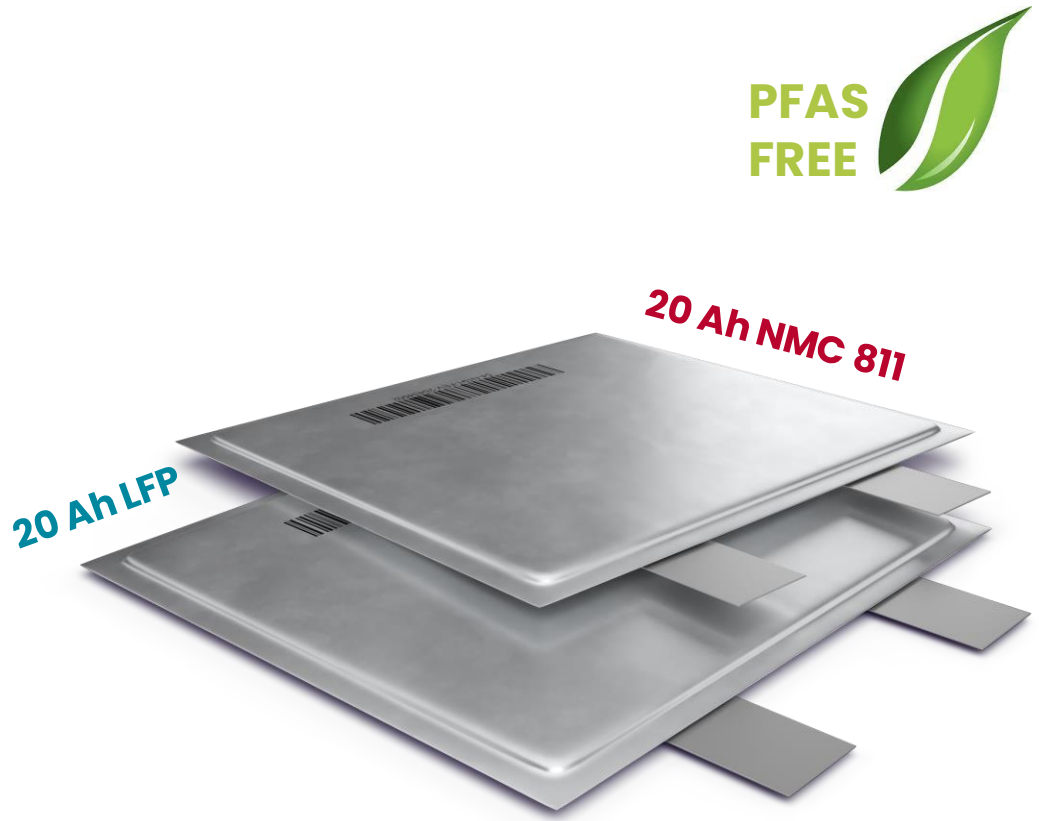
Background: A large OEM ordered LFP and NMC prototype cells with PFAS-based binders as a PVDF substitute. With tightening EU REACH restrictions, the performance of PFAS free binders are being assessed.

FEV involvement

- Selection of a suitable PFAS-free binder through market research, patent analysis, and literature review to identify the best alternative.
- Fabrication of 20 Ah LFP and NMC cells using the selected binder for further evaluation.
- Testing and performance comparison with reference cells made using PVDF binder.
- In-depth electrode analysis to assess structural and electrochemical properties against PVDF-based electrodes.

Fabrication of pouc^x^xh cells

Cell testing based on EV standards



PFAS = Per- and polyfluoroalkyl substances, REACH = Registration, Evaluation, Authorisation, and Restriction of Chemicals

Reference project FEV
Benchmarking carbon additives for NMC811 electrodes

Background: Carbon additives significantly influence cathode electrode performance. This project investigates the impact of small amounts of CNT as carbon additive on cell performance.

FEV involvement

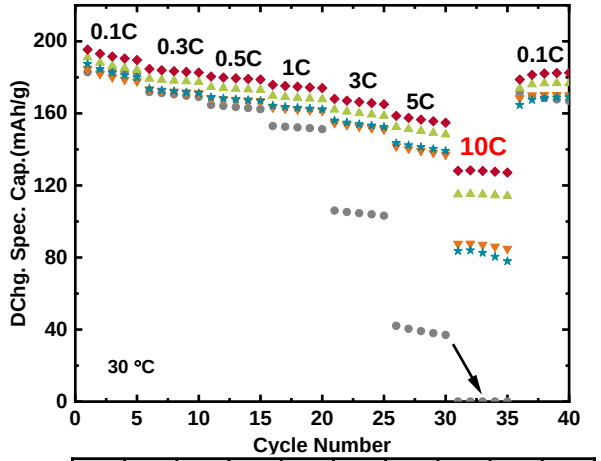
- Benchmarking the effect of carbon additives on performance of NMC811 electrodes including: MWCNT, SWCNT and graphene from 5 companies.
- Electrode and coin cell fabrication with graphene and lithium metal anode were performed at FEV cell lab.
- Electrochemical testing of fabricated cells and SEM analysis of fabricated electrodes.
- Exploring the impact of carbon additives on electrode homogeneity and electrical resistance.
- Cost estimation on the effect of CNT additive on cell material cost.

Electrode and coin cell fabrication

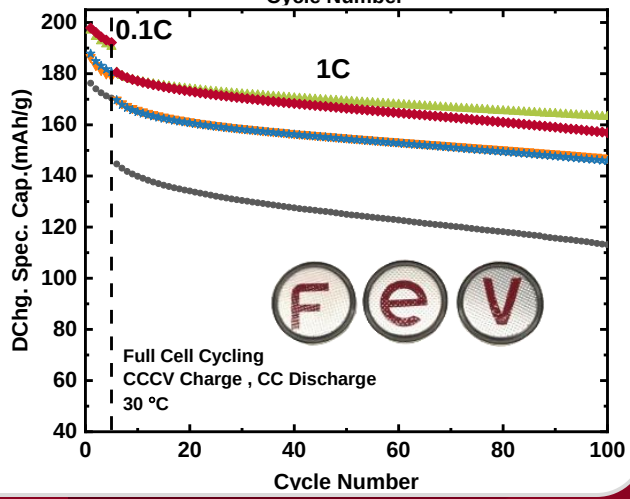
Cell testing and electrode analysis

- **Remarkable <u>discharge</u> rate at <u>5 and 10C</u>**

3wt% CB (Reference)
2wt% CB + 1wt% MWCNT A
2wt% CB + 1wt% MWCNT B
2wt% CB + 1wt% MWCNT C
2wt% CB + 1wt% Graphene

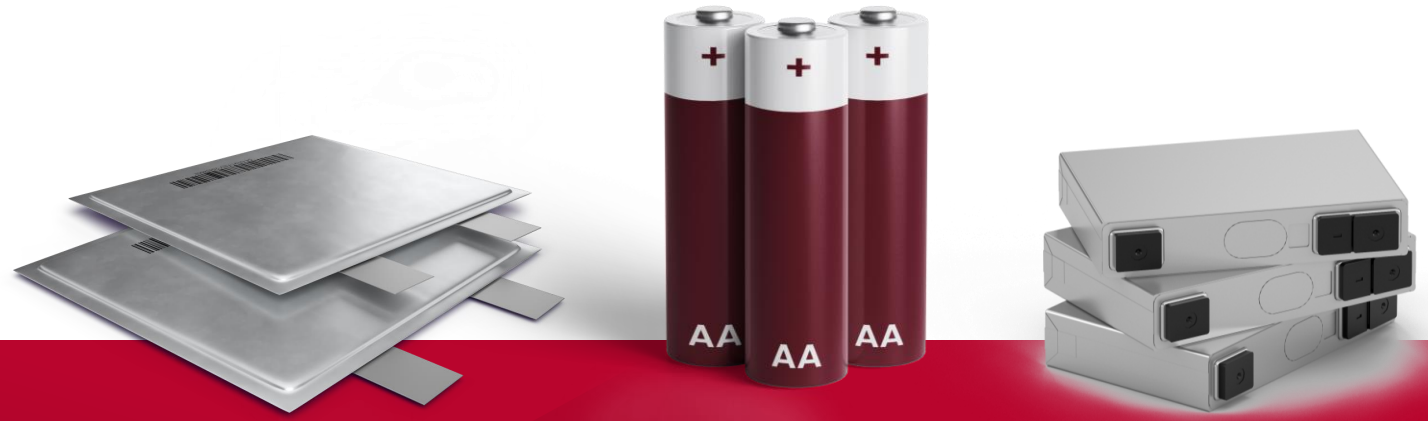


- **20% increase in retention**



MWCNT = multiwall carbon nanotube, SWCNT = single wall carbon nanotube

FEV covers all activities in cell prototyping, from material selection to final testing



Material selection
In the first step, battery materials are carefully selected from FEV's extensive database to meet the specific requirements of the customer.
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Initial benchmarking
Next, coin or monolayer pouch cells are produced and tested in FEV's laboratories to evaluate and narrow down the most promising material candidates.

Fabrication of large prototypes
The selected materials are then used to fabricate larger prototype cells at leading prototype centers (ranging from 1 to 30 Ah), simulating real-world applications.

Electrochemical testing
The performance of these materials is thoroughly evaluated in larger cells using industry-standard procedures for EV applications.

Thermal testing
Thermal stability tests are conducted to assess the safety and material behavior under various conditions, ensuring reliability and performance.

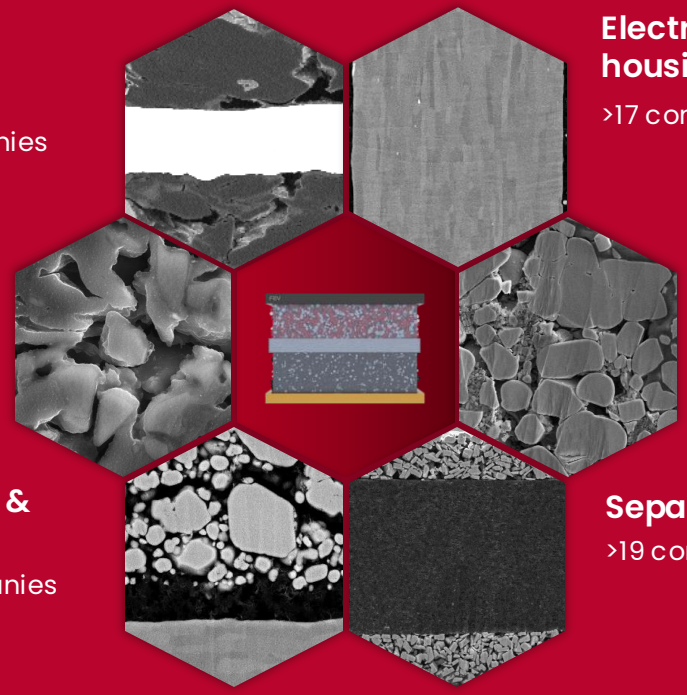
Extensive network of battery material suppliers

> 250 companies
and growing every day

Current collector
>33 companies

Electrolytes & housings
>17 companies

Anode
>40 companies



Cathode
>23 companies

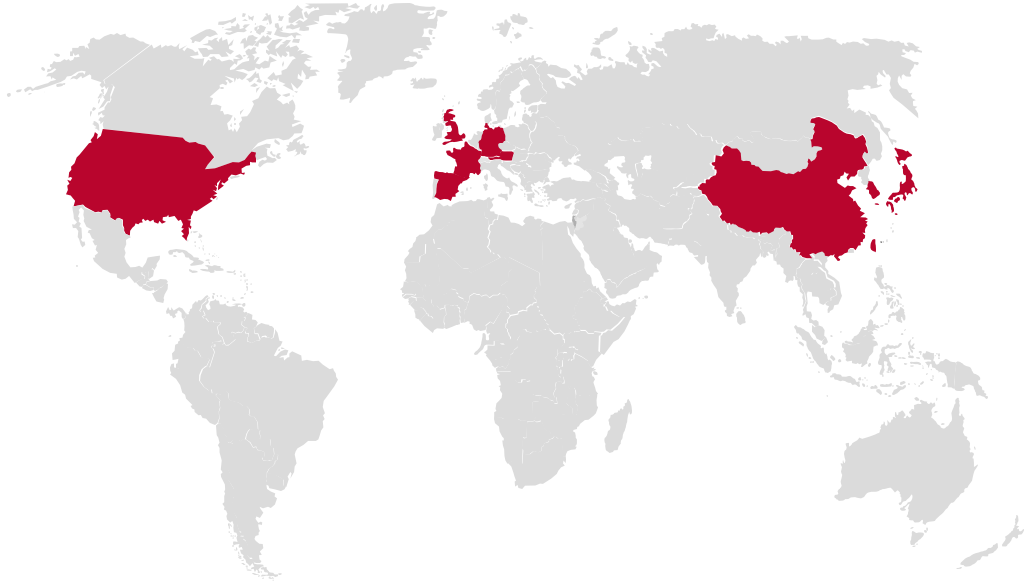
Coatings & additives
>54 companies

Separator
>19 companies

SOUR
CE:
FEV

Collaboration with leading prototype centers worldwide

- Different cell formats
- Cell size of 1 Ah up to 30 Ah
- Partnering with leading prototype centers worldwide
  - **Asia**: Korea, Taiwan, Japan, China
  - **Europe**: Germany, Spain, Austria
  - **North America**



Get in touch with us for further information

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