

IMPACT OF MIXING DEVICE SELECTION ON THE ELECTROCHEMICAL PERFORMANCE OF DRY-PROCESSED LITHIUM IRON PHOSPHATE CATHODES FOR LITHIUM-ION BATTERIES

Laurenz Rößmann^a, Markus Börner^a, Martin Winter^{a,b}

^a University of Münster, MEET Battery Research Center, Corrensstr. 46, 48149 Münster, Germany

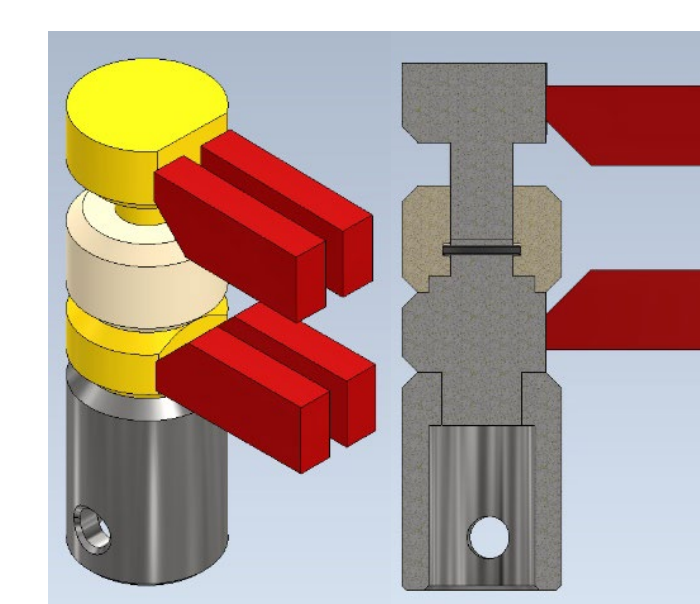
^b Helmholtz-Institute Münster, IMD-4, Forschungszentrum Jülich GmbH, Corrensstr. 46, 48149 Münster, Germany

MOTIVATION

- Dry-processed cathodes attract growing interest due to their potential for enhanced energy density, reduced cost and eco-friendliness
- Unique binder structure provides excellent ionic conductivity
- Electric conductivity becomes the more critical factor in LIB
- Goal:
 - Comparing 4 different mixing device via powder conductivity to evaluate the deagglomeration and distribution of the carbon conductive agent

METHODS

- Measurement of powder conductivity conducted between gold stamps at constant pressure



Electrode Calendaring

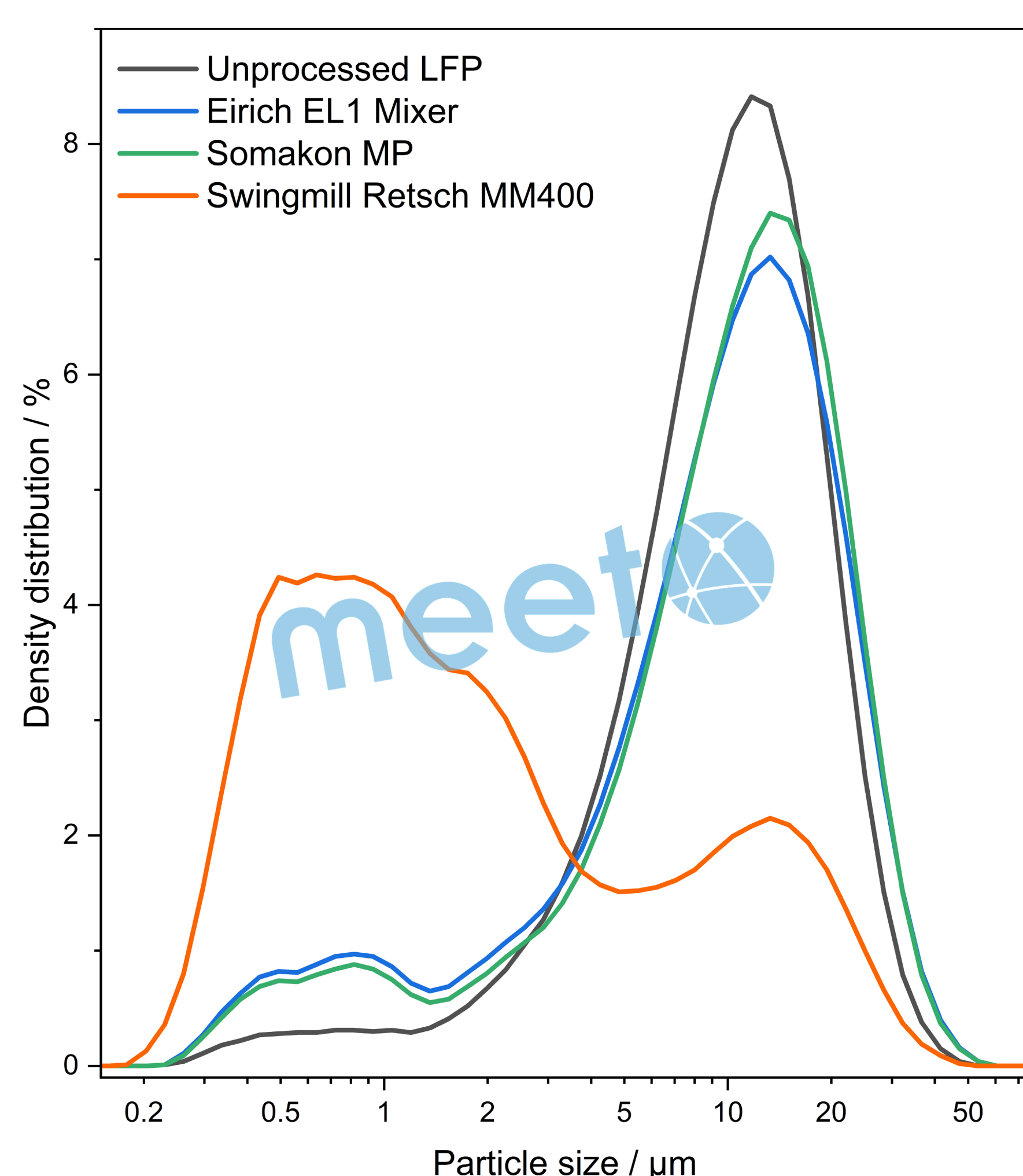
Step	Gap width / μm	Rot. Speed / rpm	Friction / %
1	300	1.0	0
2	225	1.0	60
3	150	1.0	60
4	80	1.0	60
5	50 / Lamination	1.0	0

Tested devices

1. Eirich EL1 Mixer
2. Somakon MP
3. Retsch Swingmill MM400

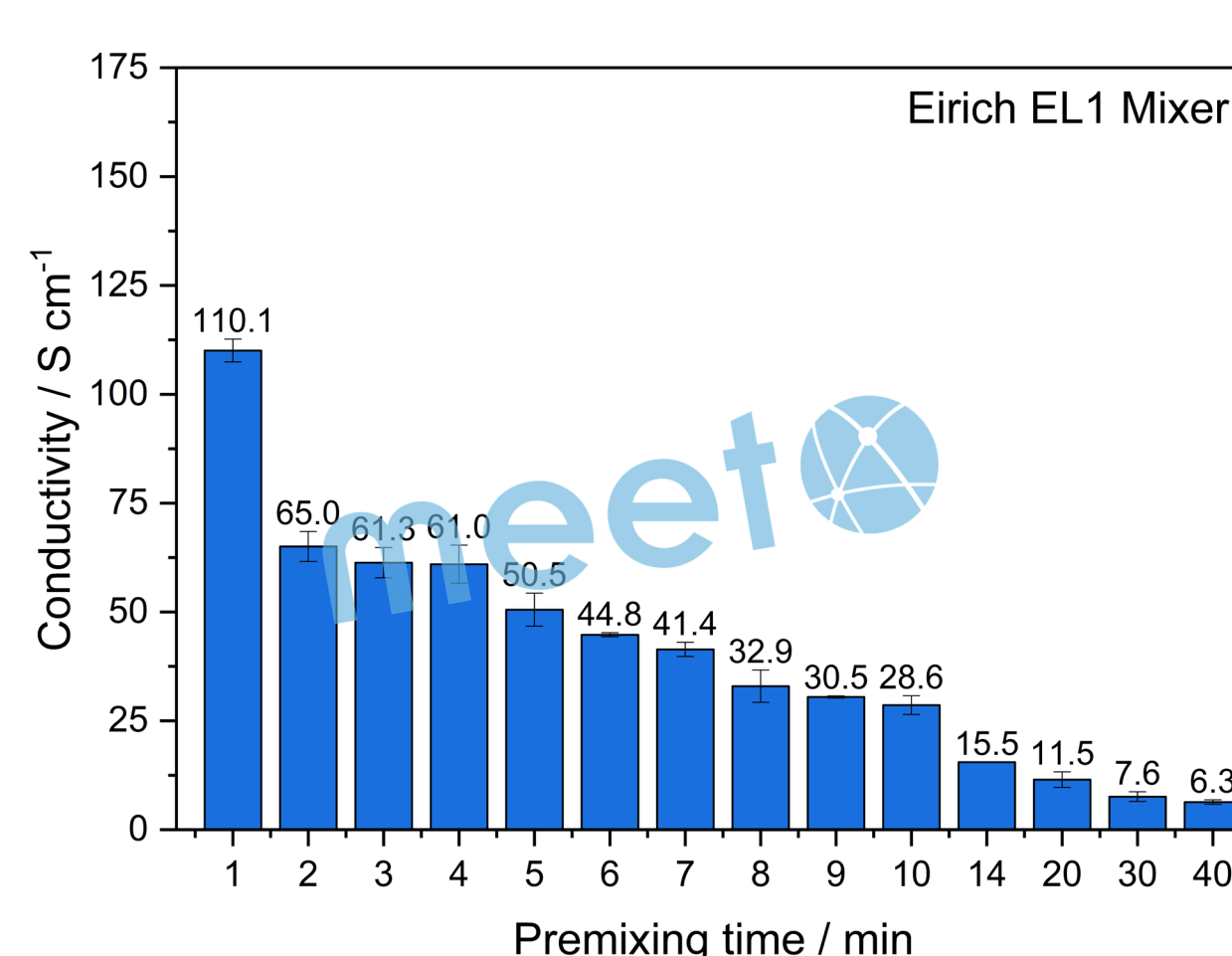
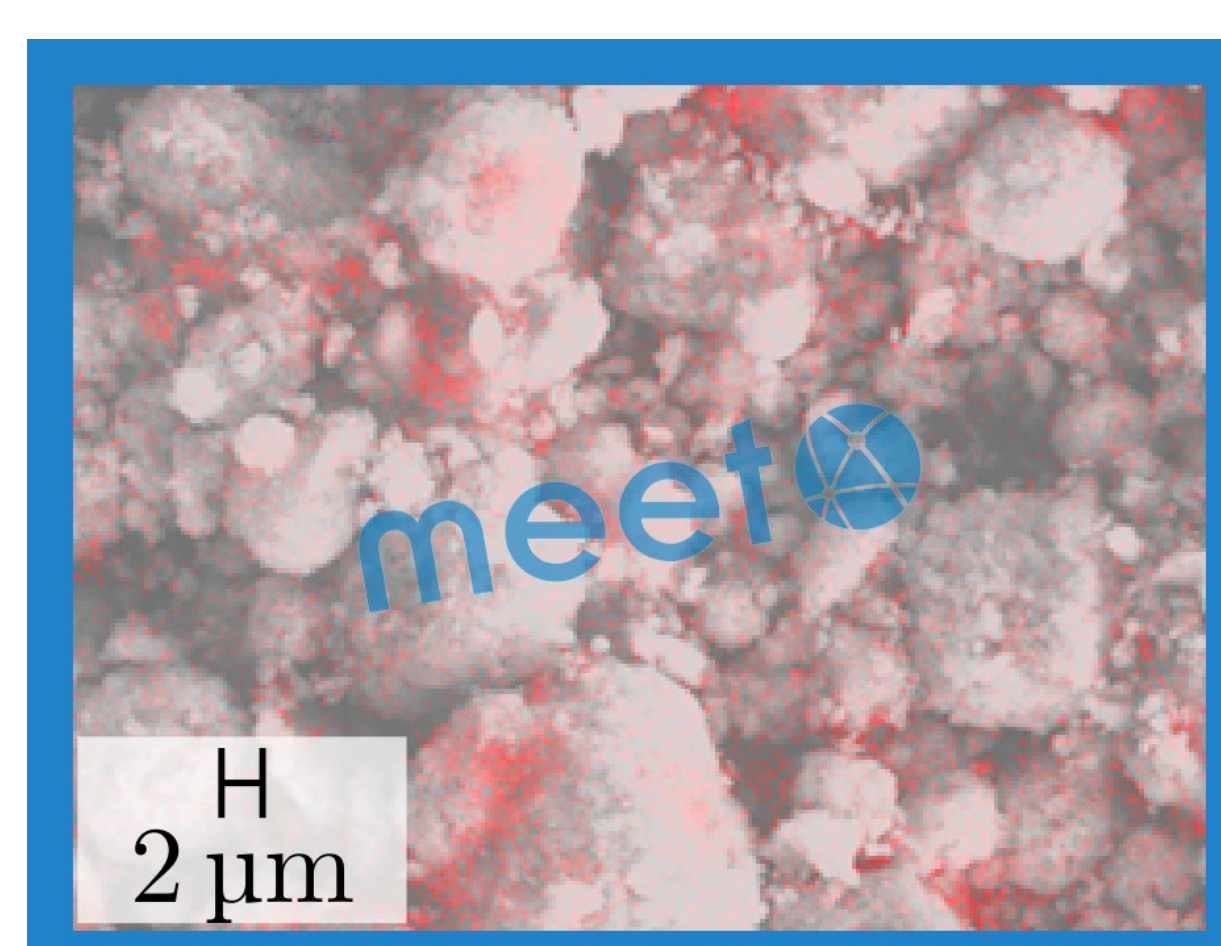
POWDER CHARACTERIZATION

PREMIX STABILITY



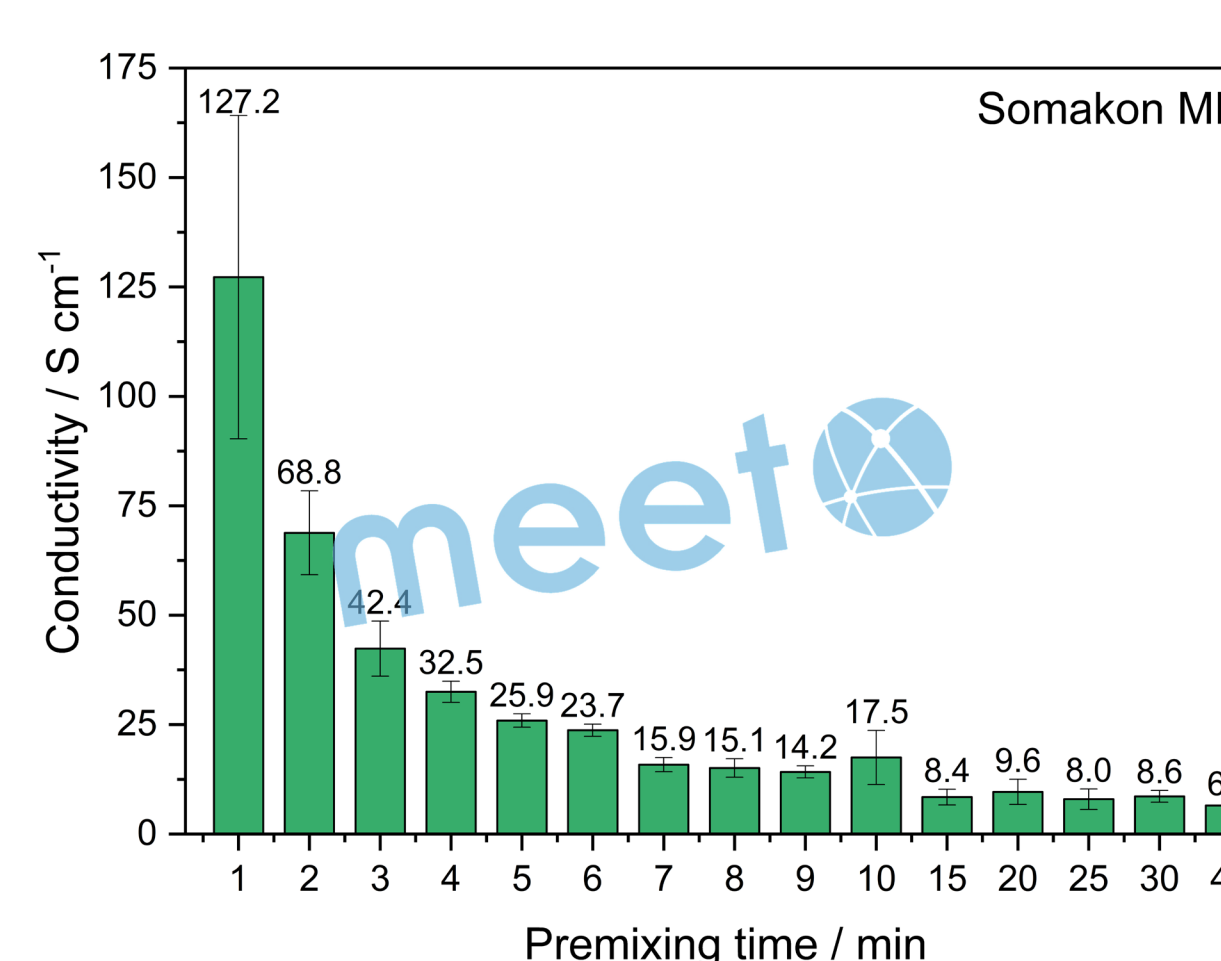
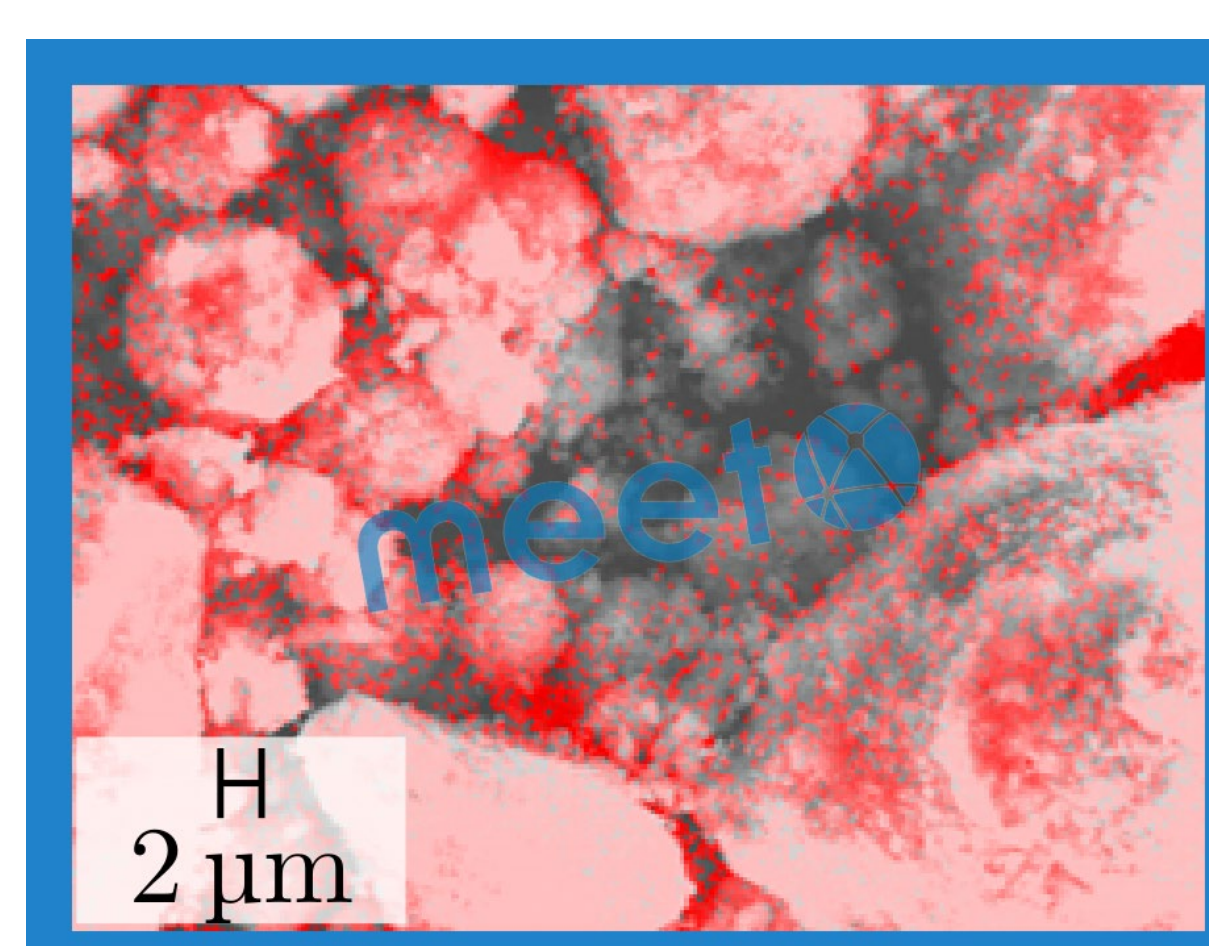
- EL1 and MP → good deagglomeration and distribution of CB
→ prediction: proper CB coating
- MM400 significant shift of main LFP peak
→ destruction of secondary LFP particles

EIRICH EL 1



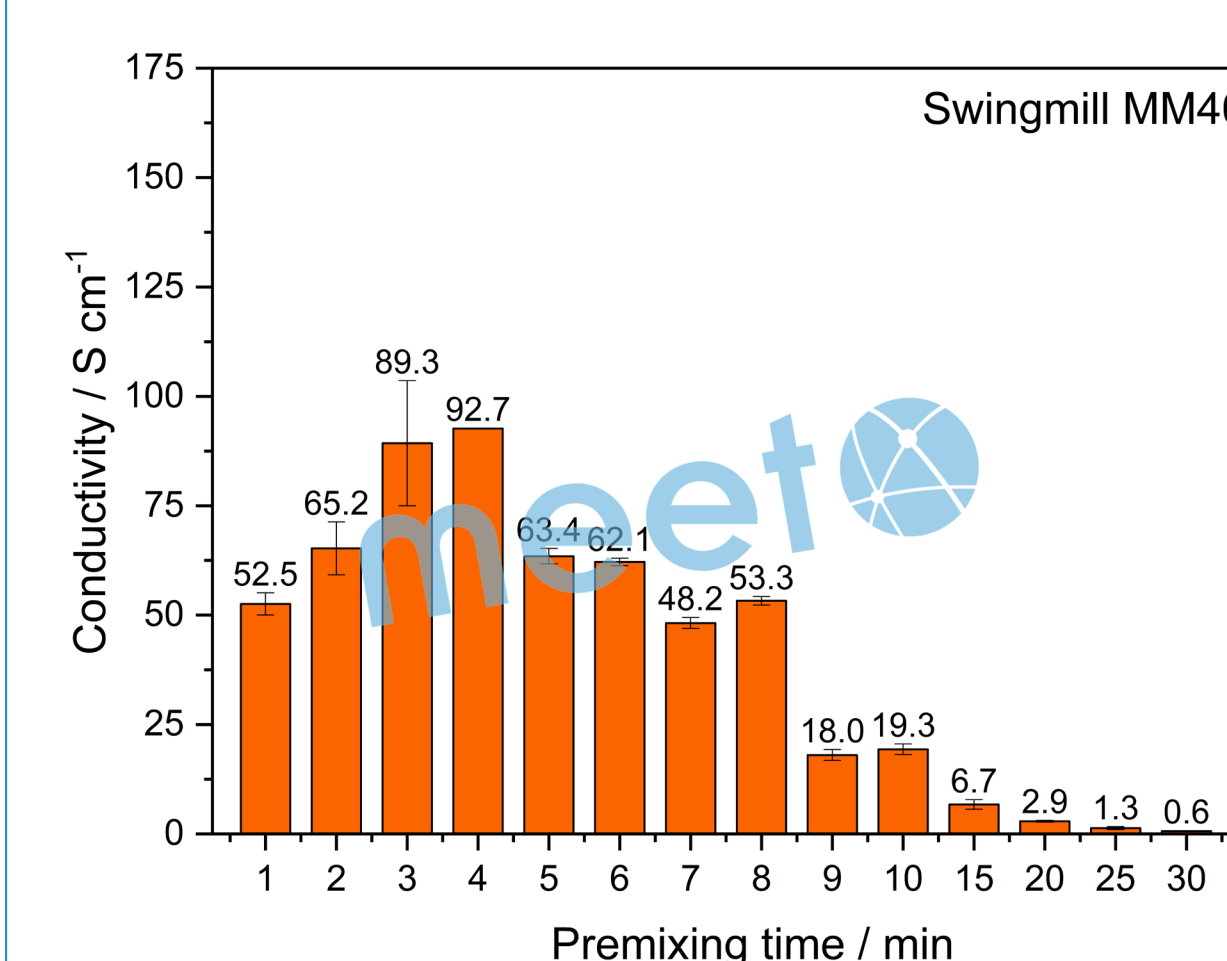
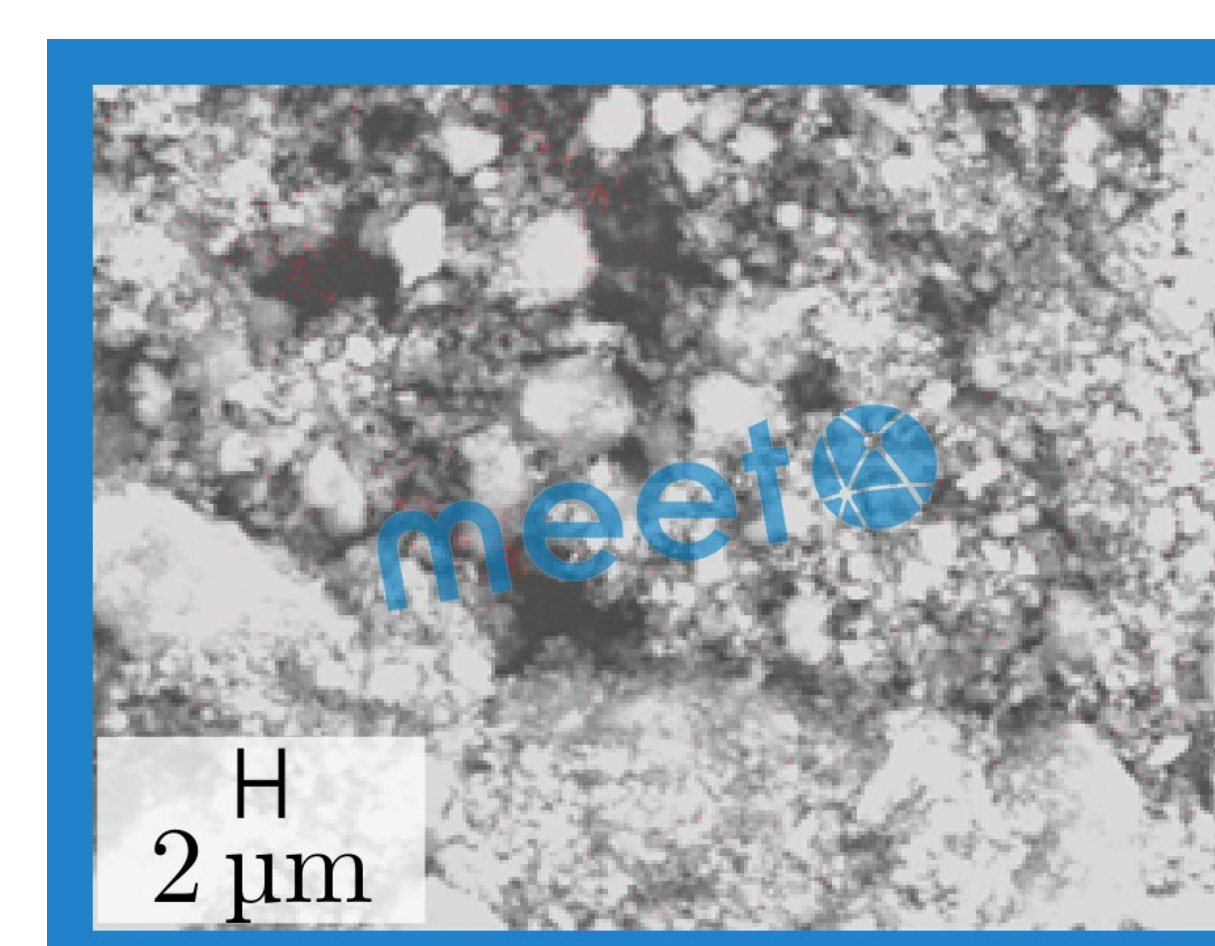
- Powder conductivity decreases with increased mixing time
- Homogenous CB coating of the LFP particles
- No major agglomerates

SOMAKON MP



- Powder conductivity decreases with increased mixing time
- Pronounced CB coating of the LFP particles with visible agglomerates

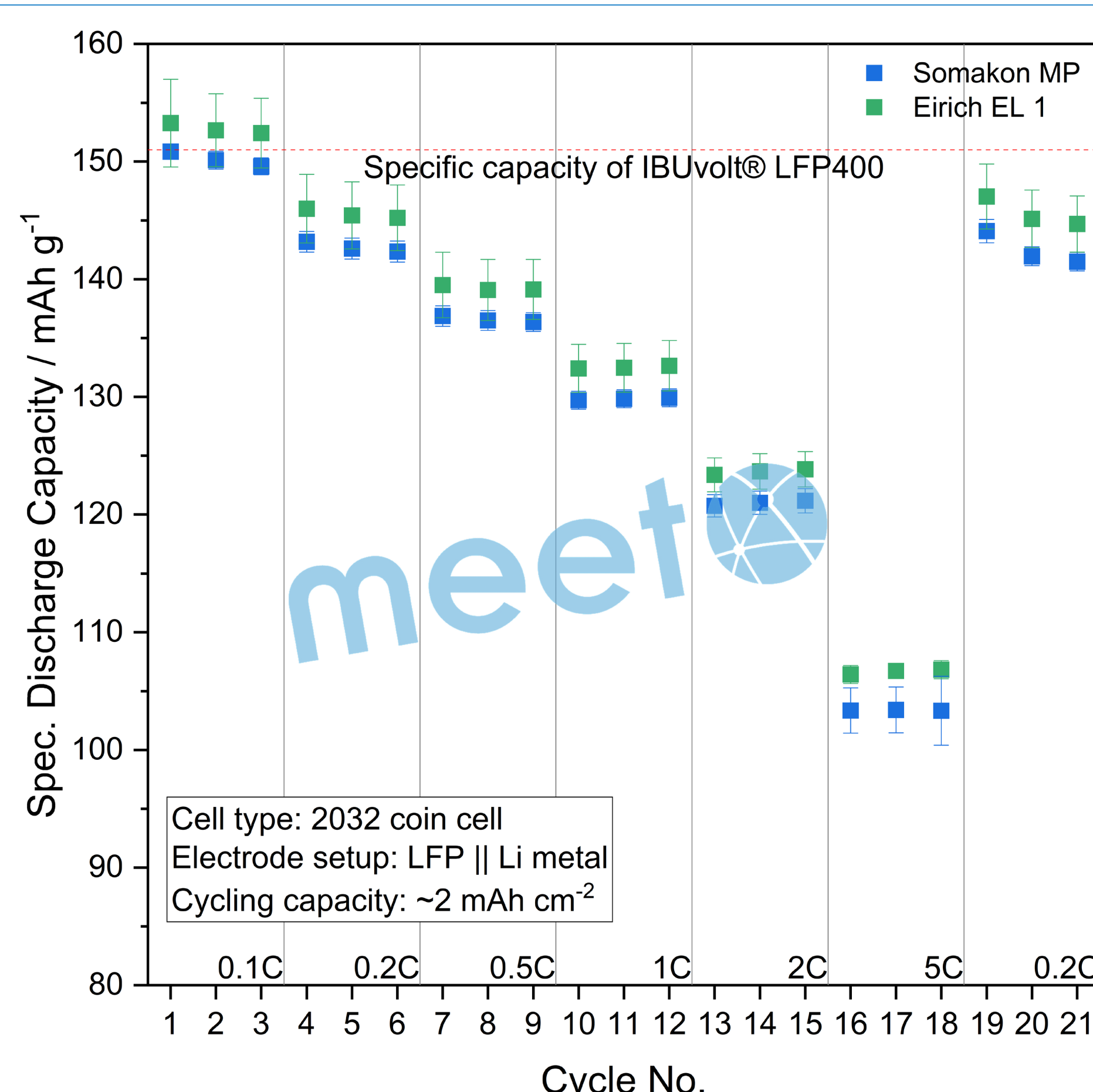
SWINGMILL MM400



- Short mixing times → CB de-agglomeration and distribution
- Longer mixing times → Destruction of secondary LFP particles

CELL PERFORMANCE

- Film formation using MM400 granulate was not successful
- PTFE fibrillation was hindered due to insufficient shear force during mixing
- Cells premixed with EL1 and MP exhibited comparable electrochemical performance between 0.1C and 2C.
- At 5C, EL1 premixed cells showed slightly improved performance
- Insufficient mixing leave residual CB agglomerates, potentially affecting electrode uniformity and performance



CONCLUSIONS

- MM400 exhibits significant process limitations in dry-premixing and insufficient PTFE fibrillation
→ LFP degrades with prolonged mixing time
- Eirich EL1 and Somakon MP show comparable results in dry-premixing
- Still remaining CB agglomerates while mixing with Somakon MP
- EL1 enables slightly improved CB deagglomeration, resulting in a more homogeneous coating.
→ Potential performance variations during long-term cycling warrant further investigation
- Distinction in cell performance only above 5C

REFERENCES

- [1] A. Gyulai et al, ACS Applied Energy Materials 6(10) 2023, 5122–5134.
- [2] K. Huber et al, Journal of Energy Storage 124 2025, 116850.
- [3] Montes, J. M. et al., Journal of Materials Science 2015, 51 (2), 822–835.

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laurenz.roessmann@uni-muenster.de

