OPINCHARGE presentation

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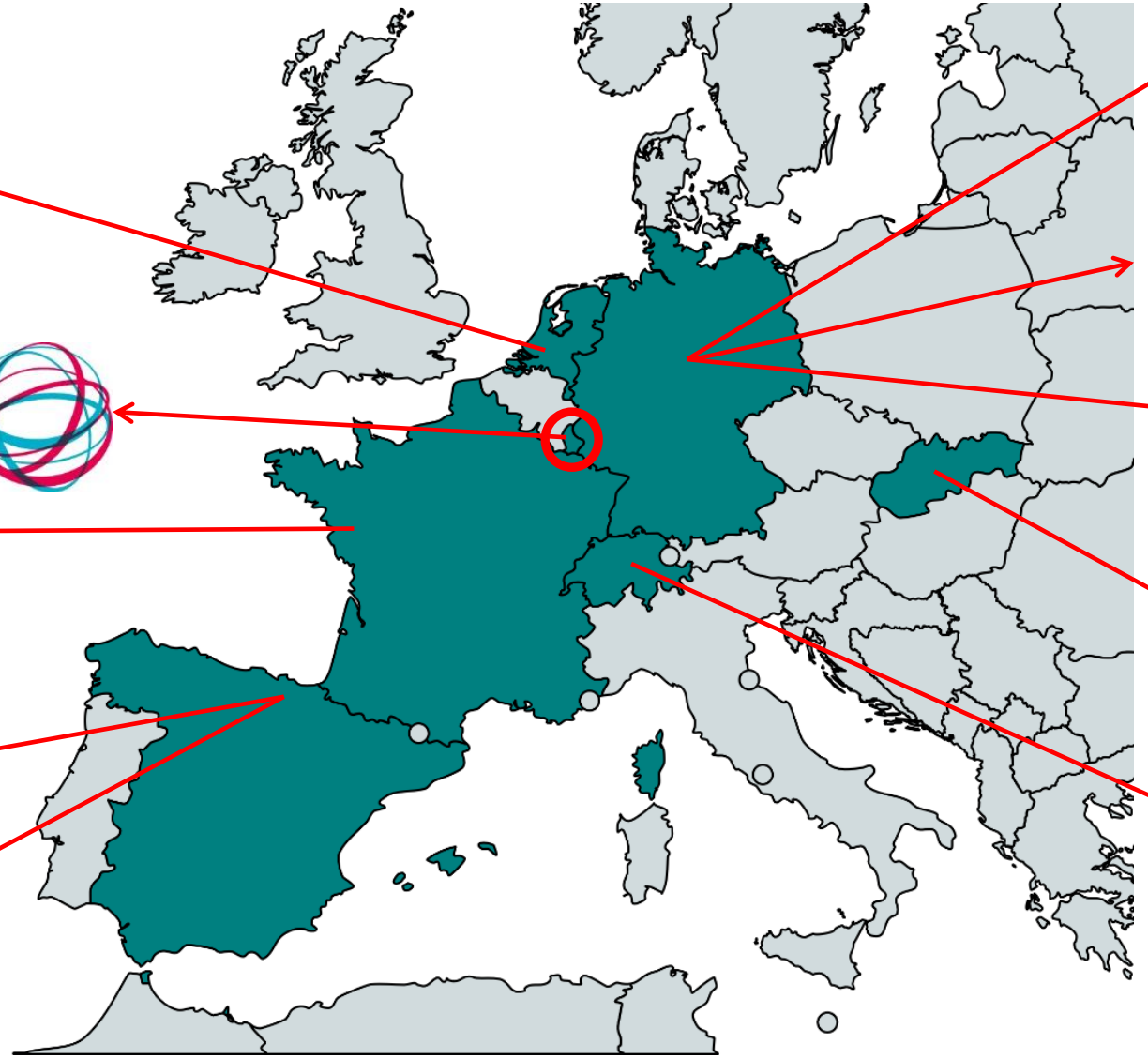
representing Santhana Eswara (LIST, project leader)

OPINCHARGE

Oslo, 25-26/06/2024

Opincharge consortium



ThermoFisher SCIENTIFIC

LIST

cnrs

cidetec energy storage

CIC energiGUNE energy storage research centre

JÜLICH Forschungszentrum

German Research Center for Artificial Intelligence

DLR

PEDAL CONSULTING

PAUL SCHERRER INSTITUT PSI

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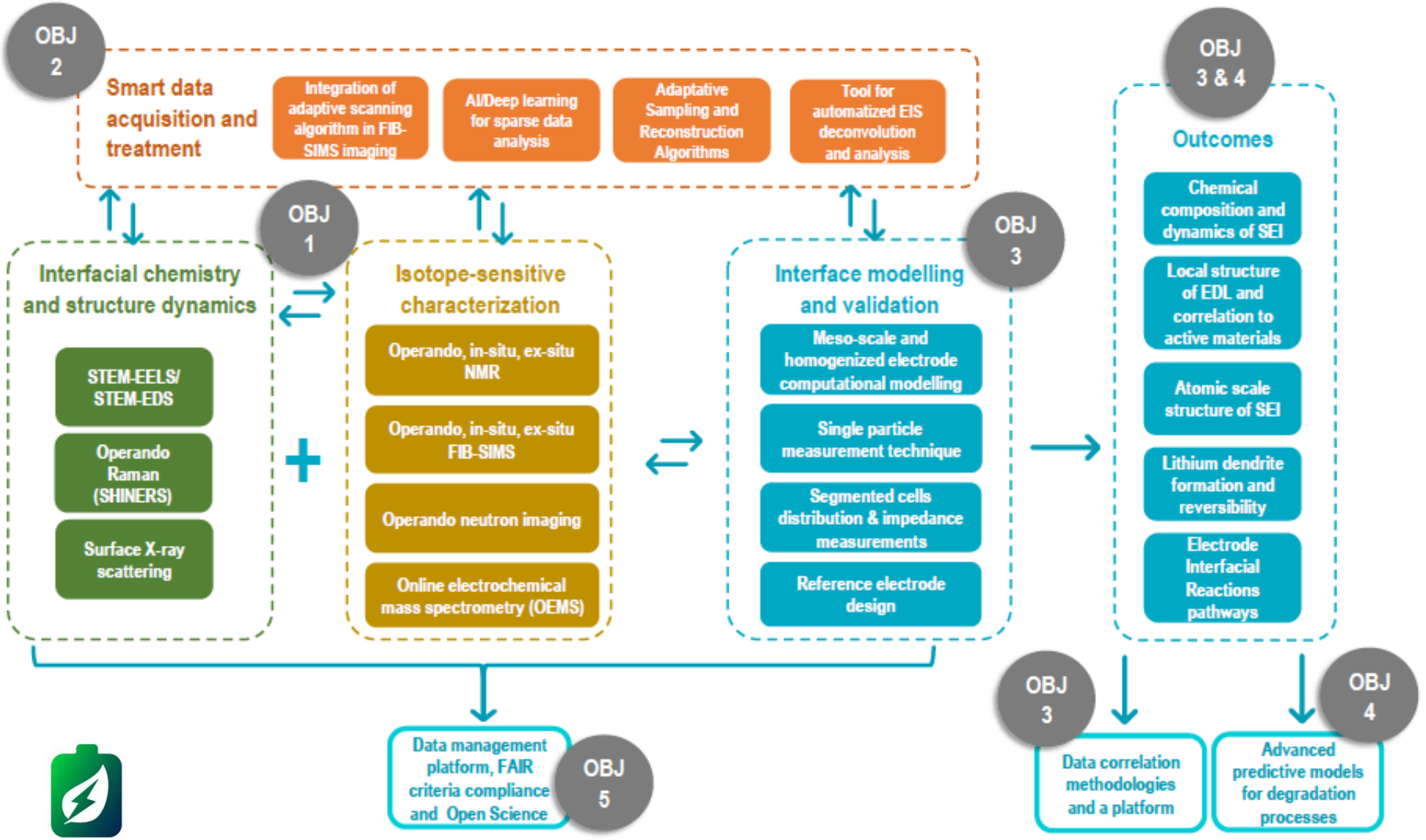
Project Overview



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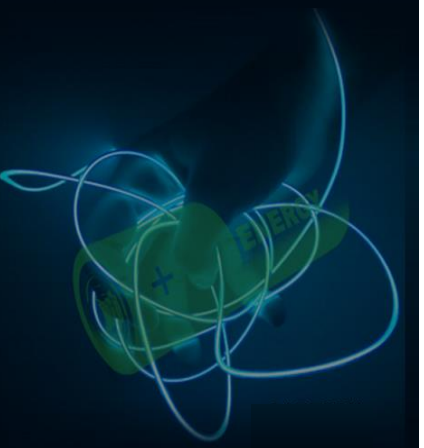
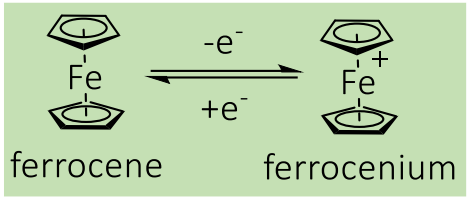
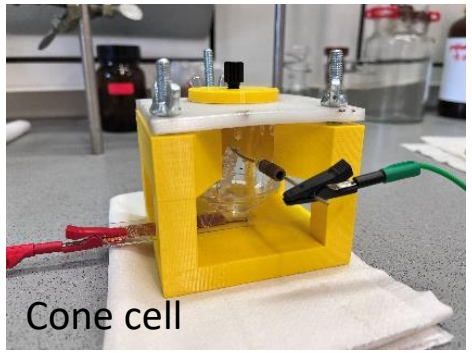
WP5/Top challenges

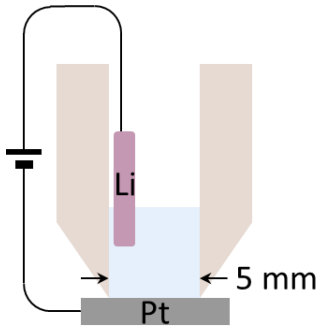
1. Meso-scale modelling of interphases
   - SEI transport, reaction processes, and structure
   - Continuum Models and kinetic Monte Carlo models (KMC)
2. Homogenized degradation modelling
   - Automated analysis of EIS spectra with ML algorithms
3. Correlation of interface properties with electronic/ionic transport
   - Redox-Probe experiments (see next slide)
4. Electrochemical validation at full cell level
   - Polarization, EIS, cycling and CV to validate models
5. Reference electrode design and continuous electrode monitoring
   - Integrate a 3D porous reference electrode in pouch cell



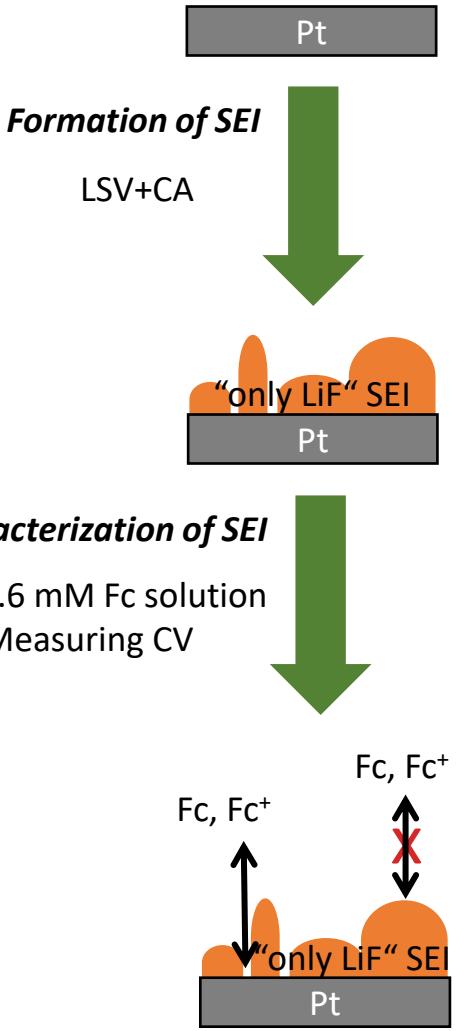
WP5/Preliminary experimental results

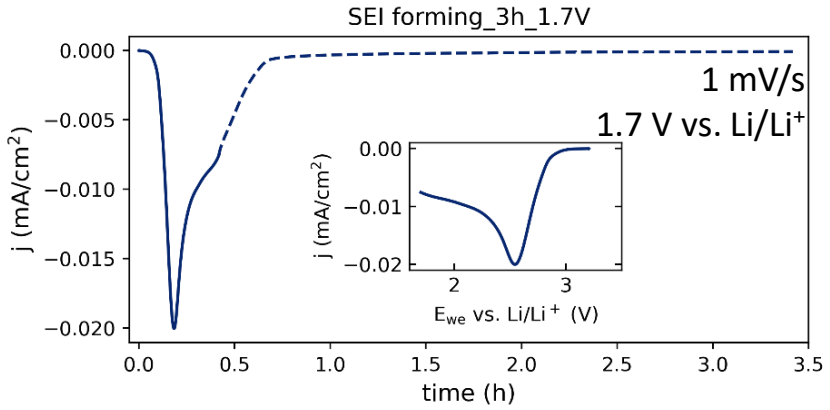


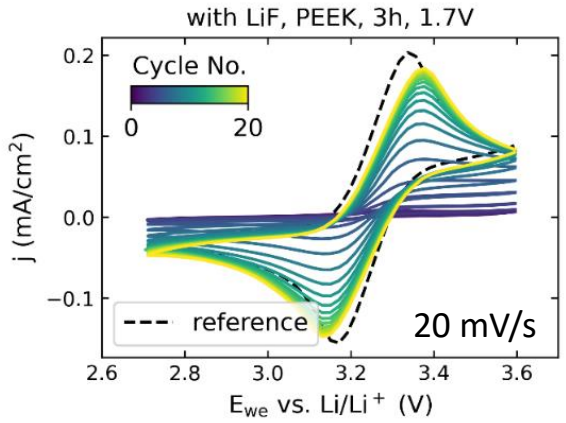




WE: Pt (200 nm Pt coat on Si <100>)
CE/RE: Li metal
Electrolyte: LP40 with saturated LiF





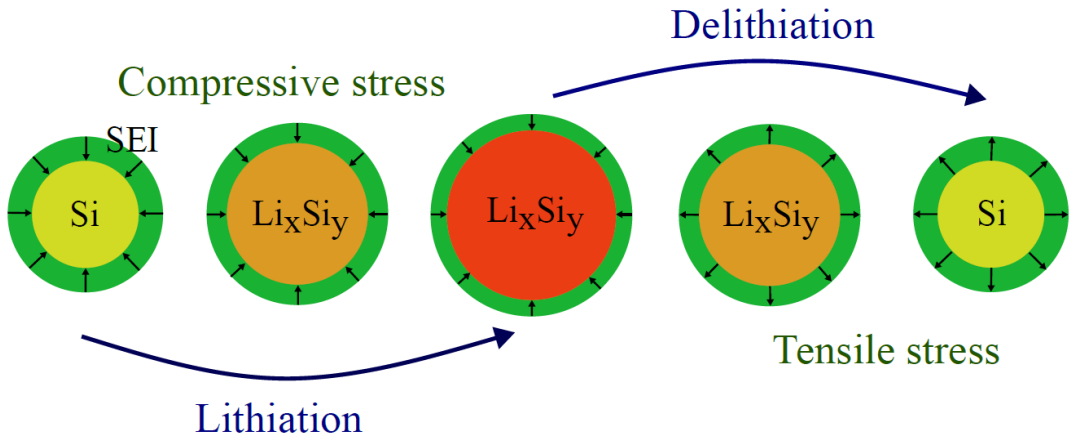


[1] Steinrück, Chem. Phys. 154, 174703 (2021)
[2] Strmcnik et al., Nat Catal 1, 255 (2018).

WP5/Preliminary modelling results

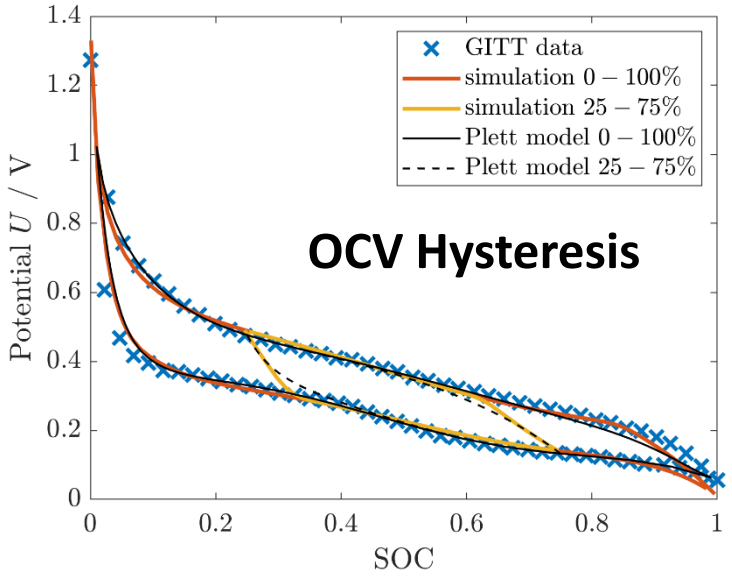
Silicon Voltage Hysteresis

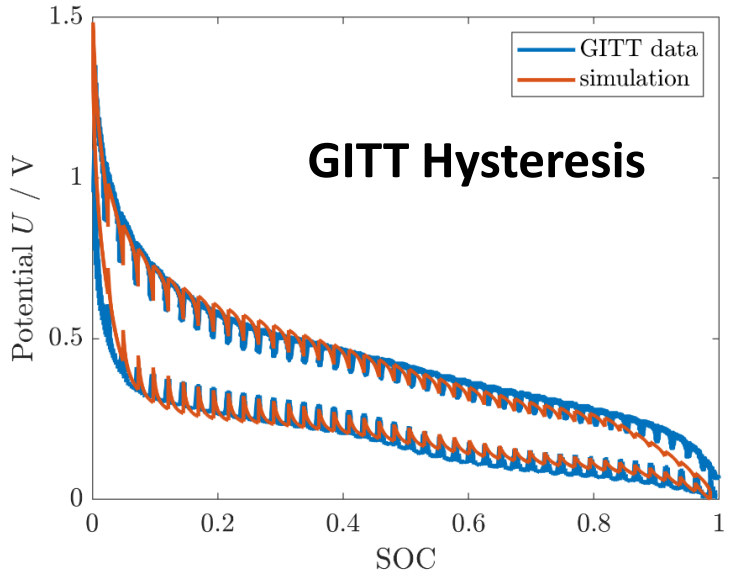
Chemo-Mechanical Continuum Model
in core-shell geometry



Voltage: $U = -\frac{\mu_{\mathrm{Li}}}{F} = U_0 + \frac{v_{\mathrm{Li}}}{3F\lambda_{\mathrm{ch}}^3}\mathbf{P}:\mathbf{F}$

Visco-elastoplastic shell behavior explains OCV and GITT Hysteresis





[1] Köbbing et al., Adv. Funct. Mater. 34, 2308818 (2024)

Conclusions/Perspectives

- **Tools are being developed: other “Battery 2030+” projects interested in using them/collaborating?**

- **Links on our project webpage https://www.opincharge.eu/project/ ; interested in doing the same? + social media?**