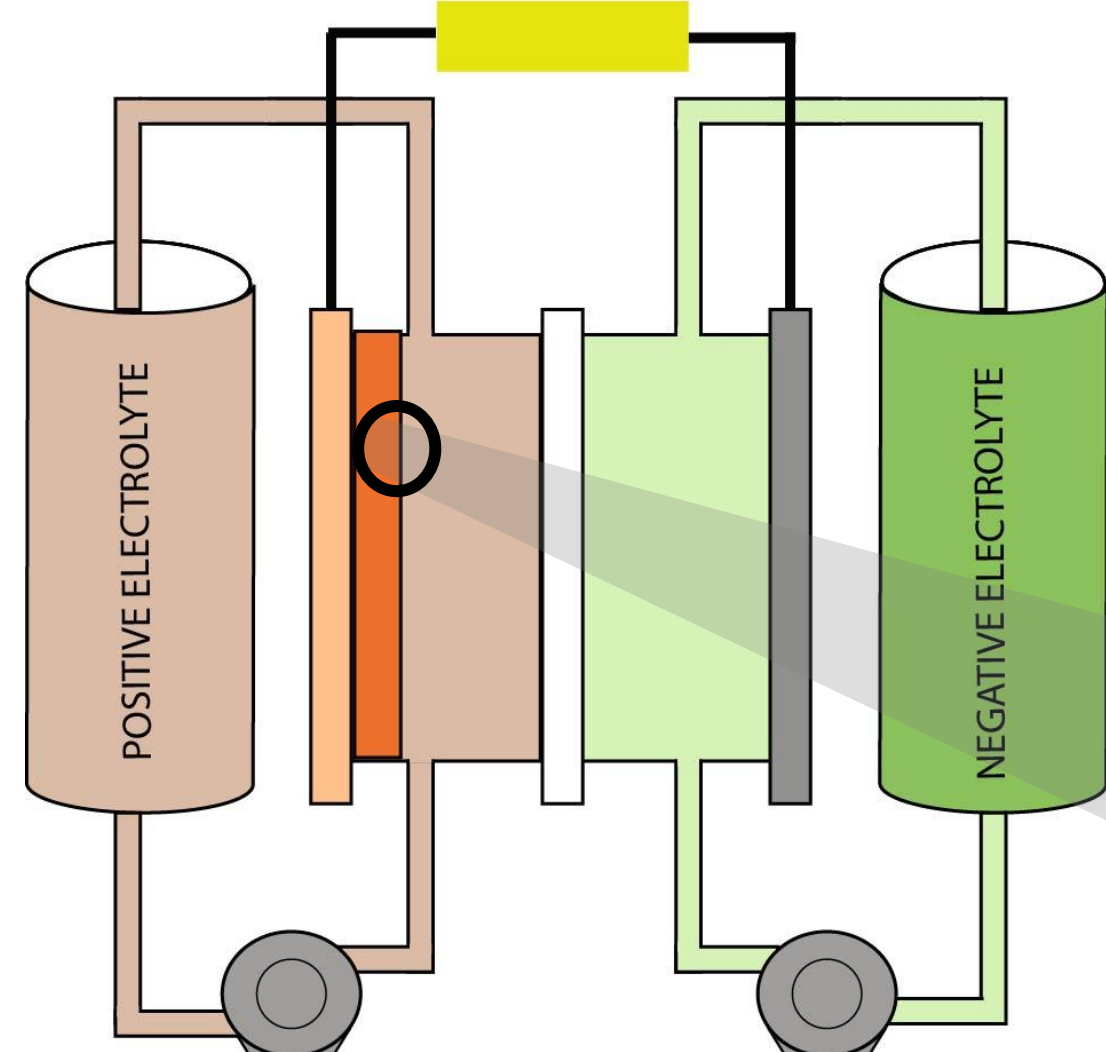


CuBER



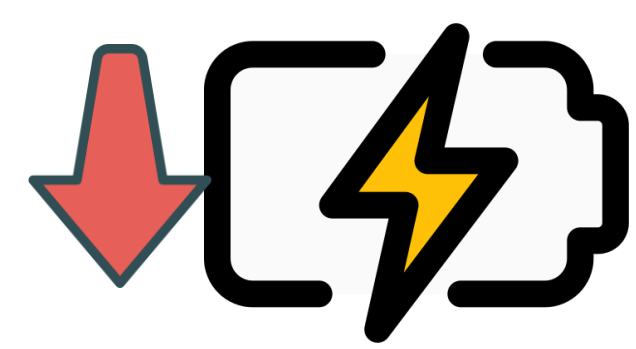
All-copper Redox Flow Battery (CuRFB) [1-3]

INTRODUCTION

Deal with **Copper Deposition** on the cathode



Safety issue [2-3]

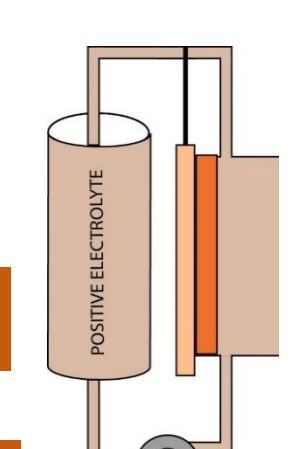


Lower efficiency



OBJECTIVE

To simulate a 2D Half-cell Copper Deposition Model

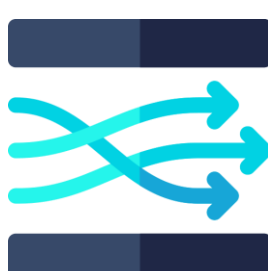


METHODOLOGY

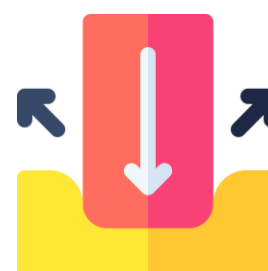
1. Defining the physical problem



Electrochemistry



Fluid dynamics



Deforming geometry

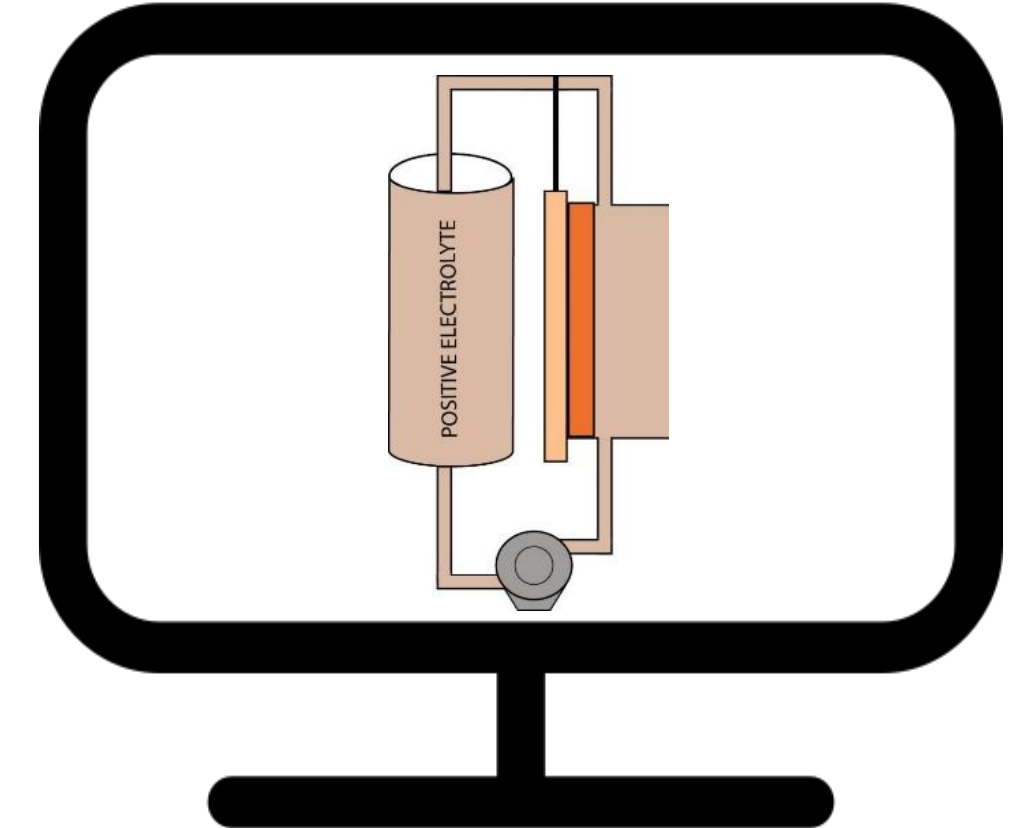
Charge Conservation
Electroneutrality

Mass Conservation
Laminar Flow
Incompressible Fluid

3. Data Clustering

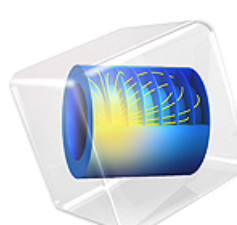


4. Data Modelling



2. Physical modelling using

COMSOL MULTIPHYSICS



Inflow



2D GEOMETRY

2D mesh

58240 elements

9 boundaries

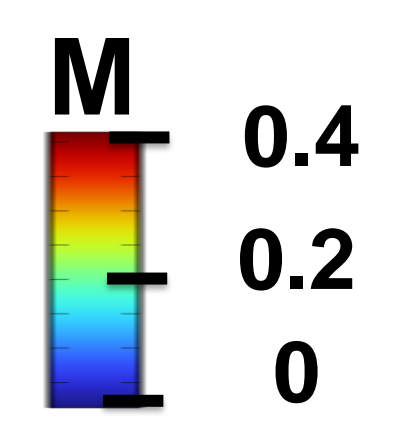
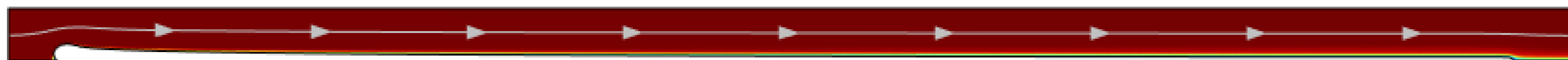
Outflow



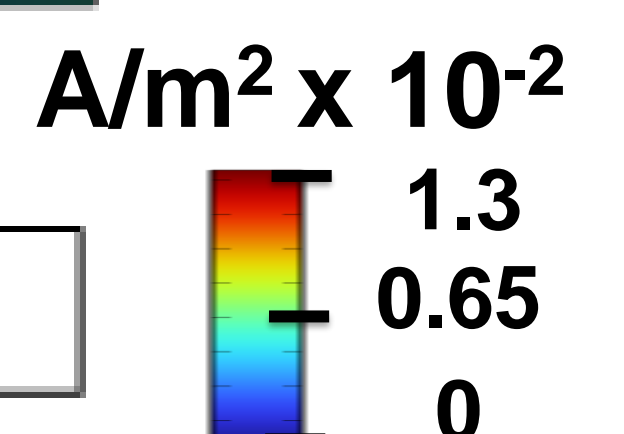
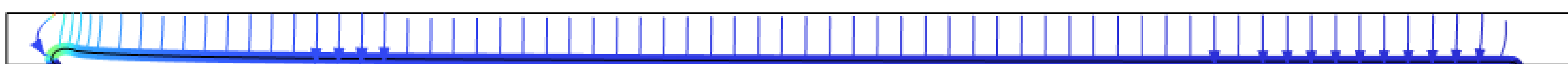
Electrode Surface - Deforming geometry

Deposition at 60% State of Charge(SoC) RESULTS

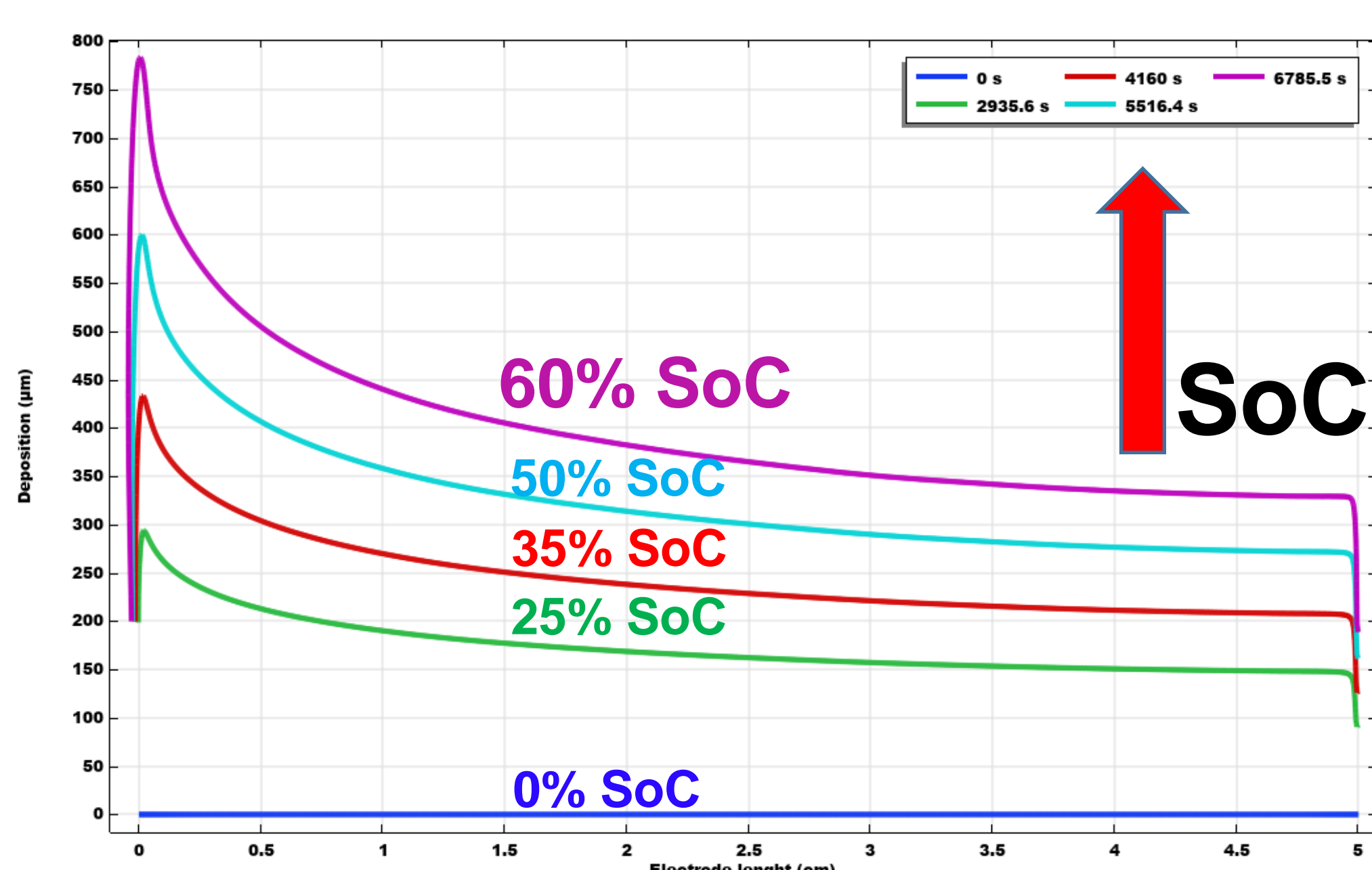
Cu⁺ Concentration at 60% SoC



Electrolyte Current Density Vector at 60% SoC



Deposition along the electrode [μm]



CONCLUSIONS

Results reflect lab experiments, ~ 10% error

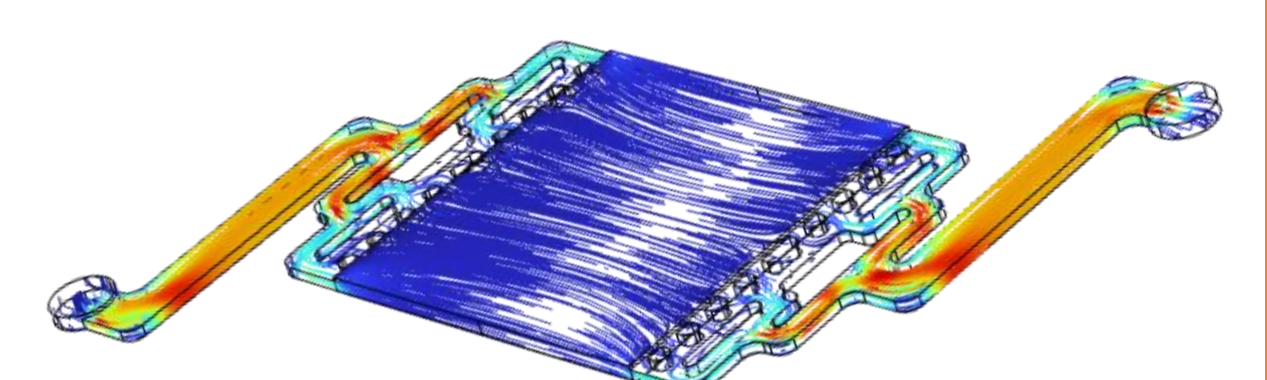
Higher deposition close to the inlet

FUTURE WORK

A 3D Half-cell Model

Laboratory Data to validate the model

Reduced Order Cloud-based Model to support the local BMS (Battery Management Systems)



ACKNOWLEDGMENTS

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- Sanz, Laura, et al. "Description and performance of a novel aqueous all-copper redox flow battery." Journal of Power Sources 268 (2014): 121-128
- Badenhorst, Wouter Dirk, et al. "Performance improvements for the all-copper redox flow battery: Membranes, electrodes, and electrolytes." Energy Reports 8 (2022): 8690-8700

ADD ME



ADD ME & CONTACT ME