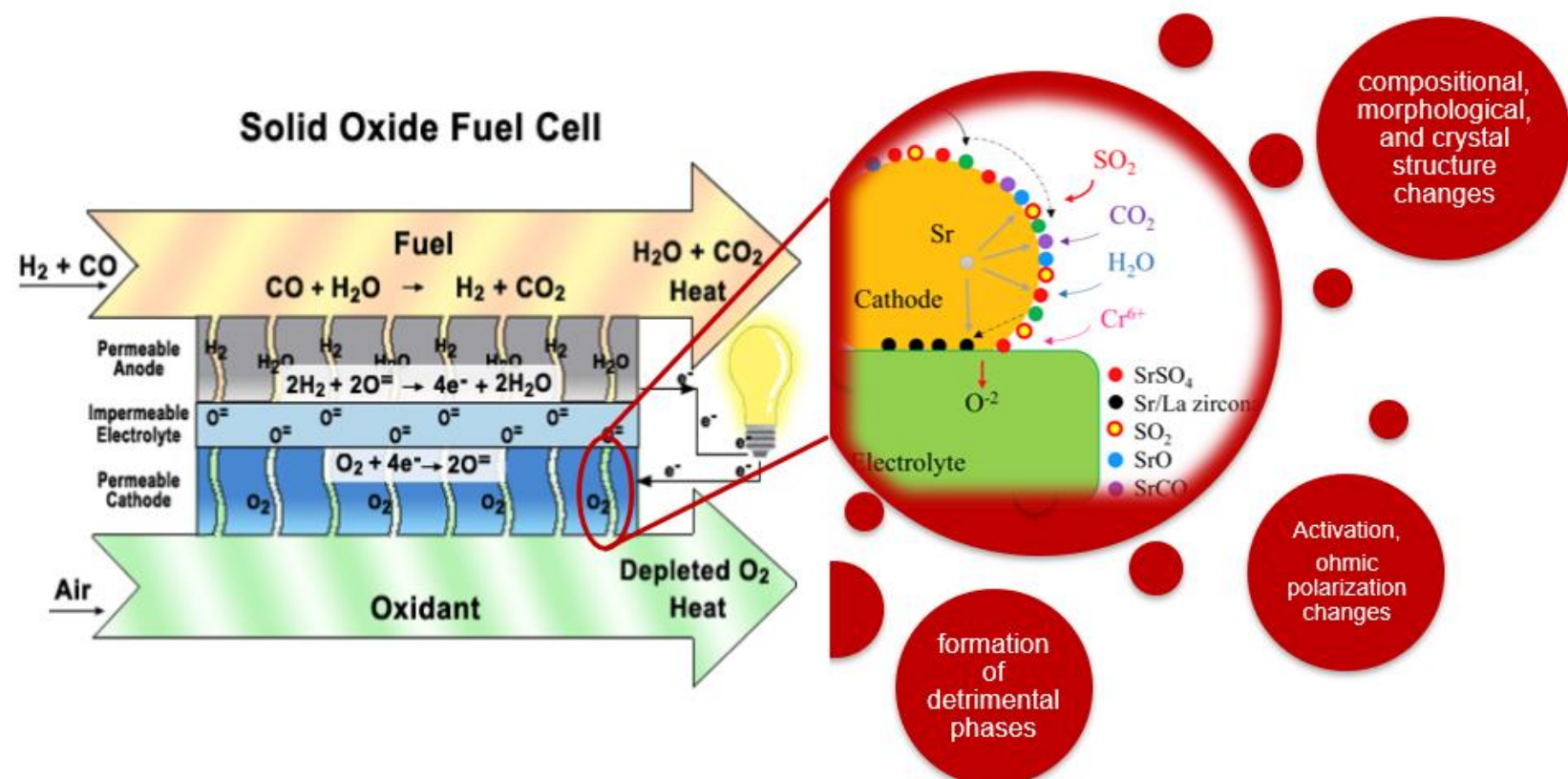
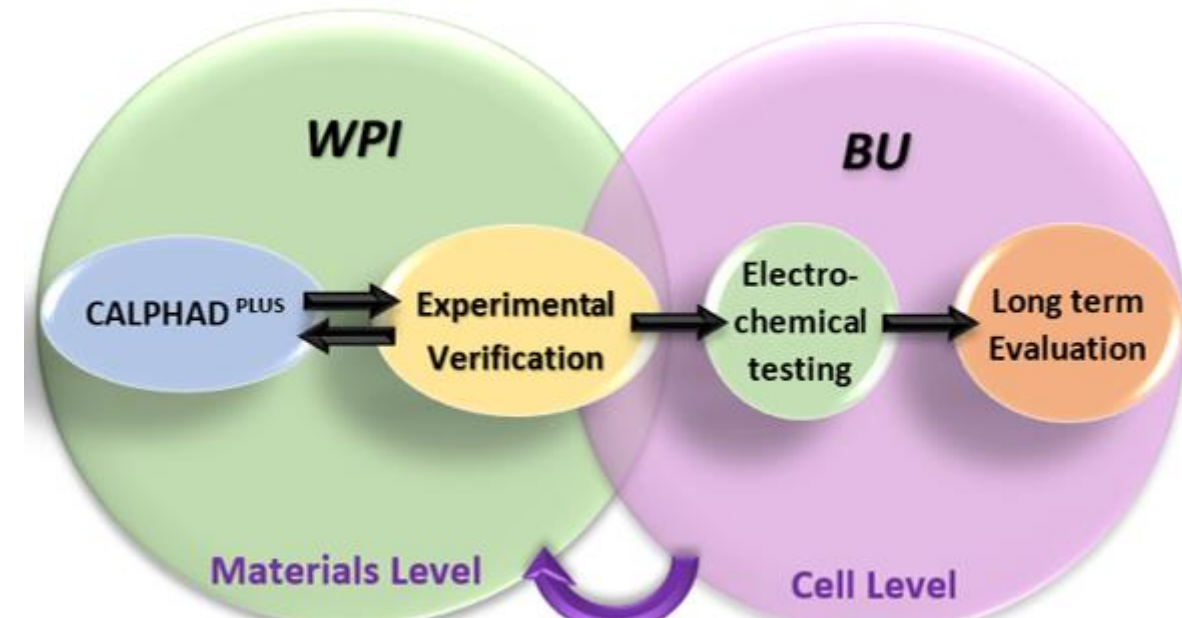


Introduction and Background

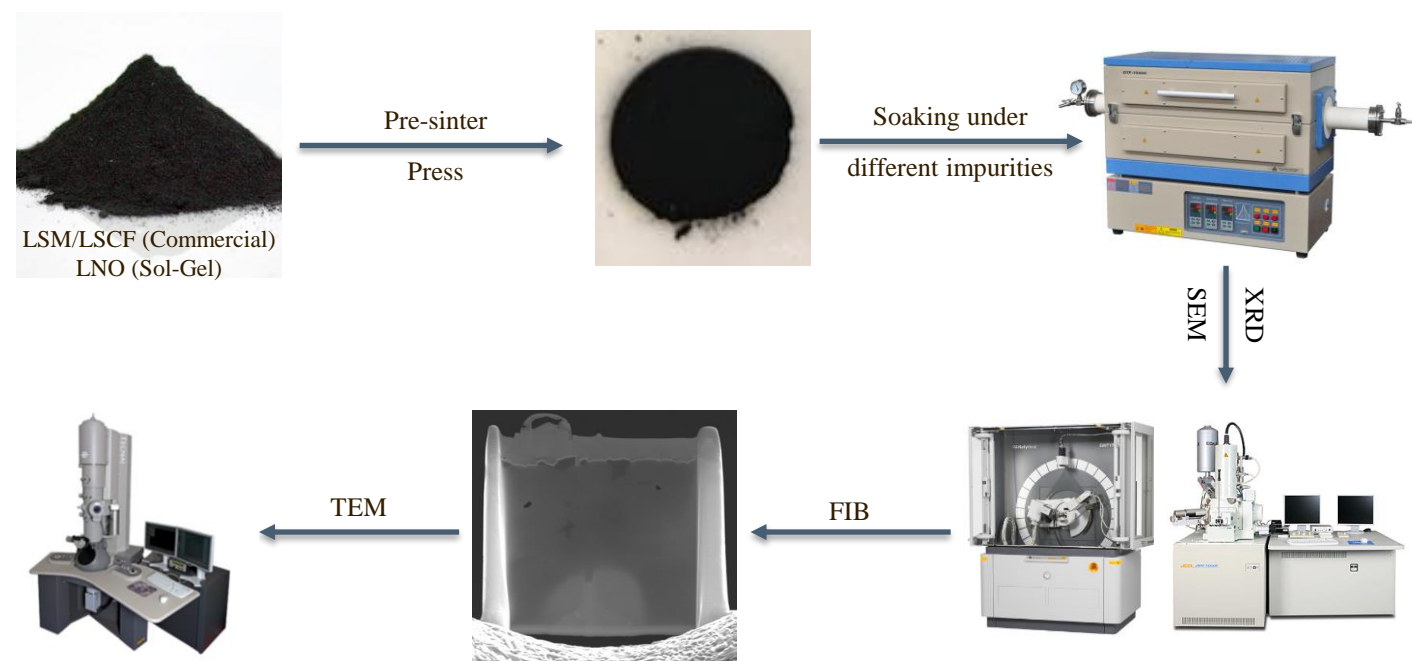


Approach and Objectives

- Investigate the degradation mechanisms of different impurities to the cathode materials.
- Propose tolerant electrodes under different conditions.



Experimental Procedure



Computational Procedure

Thermodynamic Databases

- Database Focusing on Perovskite/R-P phases[1-3]
- Database Expanded to Consider Gas Impurities(SSUB)

Thermodynamic Predictions

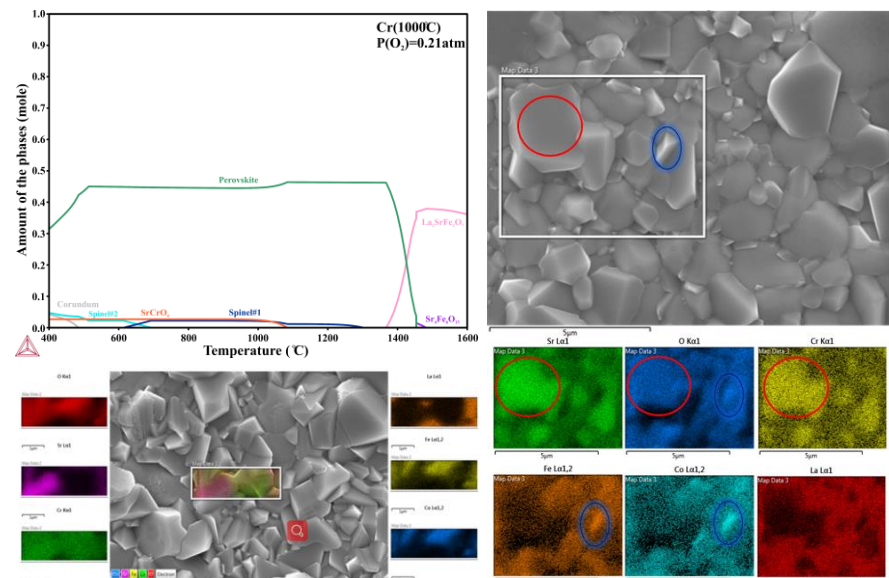
- Predictions based on the same experimental conditions for both sintering as well as operation conditions.
- Predictions expanded to consider other conditions or even more extreme conditions.

[1] A.N. Grundy, Swiss Institute of Technology Zurich, 2004.

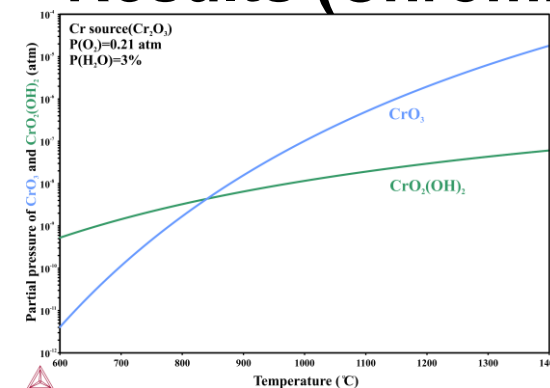
[2] W. Zhang, R. Barfod, Department of Energy Conversion and Storage, Technical University of Denmark, 2012.

[3] M. Zinkevich, F. Aldinger, Journal of Alloys and Compounds, 375 (2004) 147-161.

Results (Chromium+Humidity)

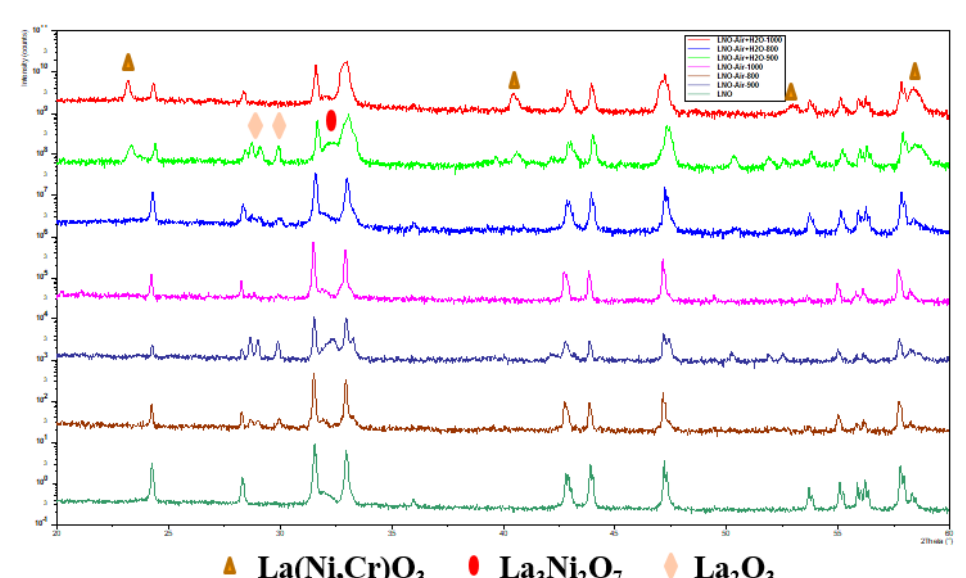
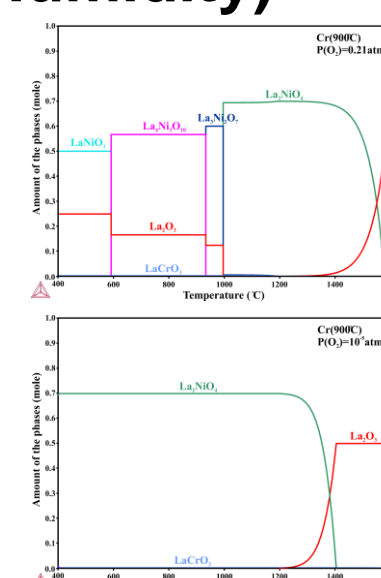


LSCF+Cr+H2O

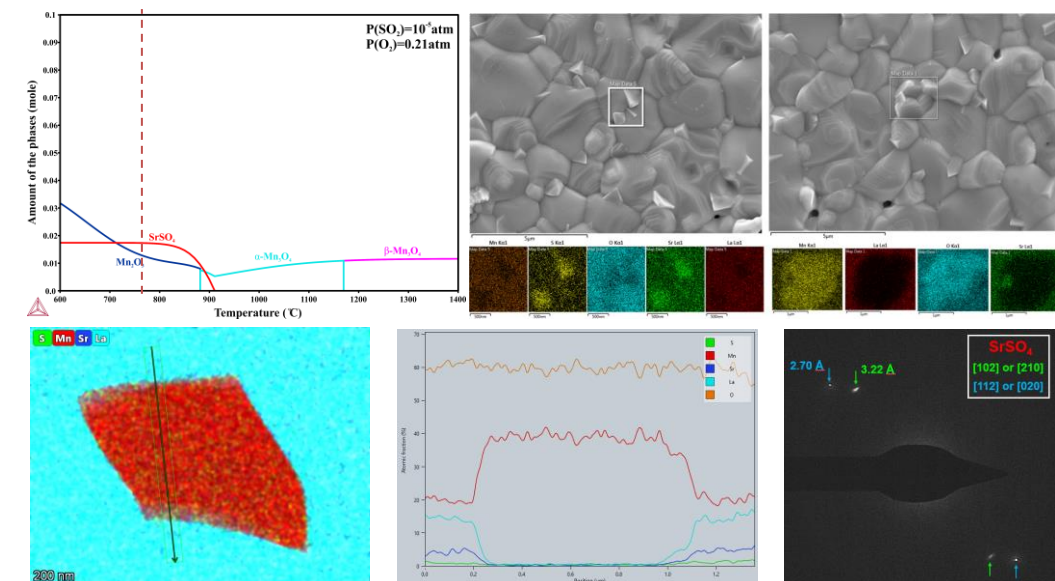


Cr+H2O poisoning: H₂O will **GREATLY** increase the "Cr-containing" gas species concentration in gas.

LNO+Cr+H2O



Results (Sulfur)

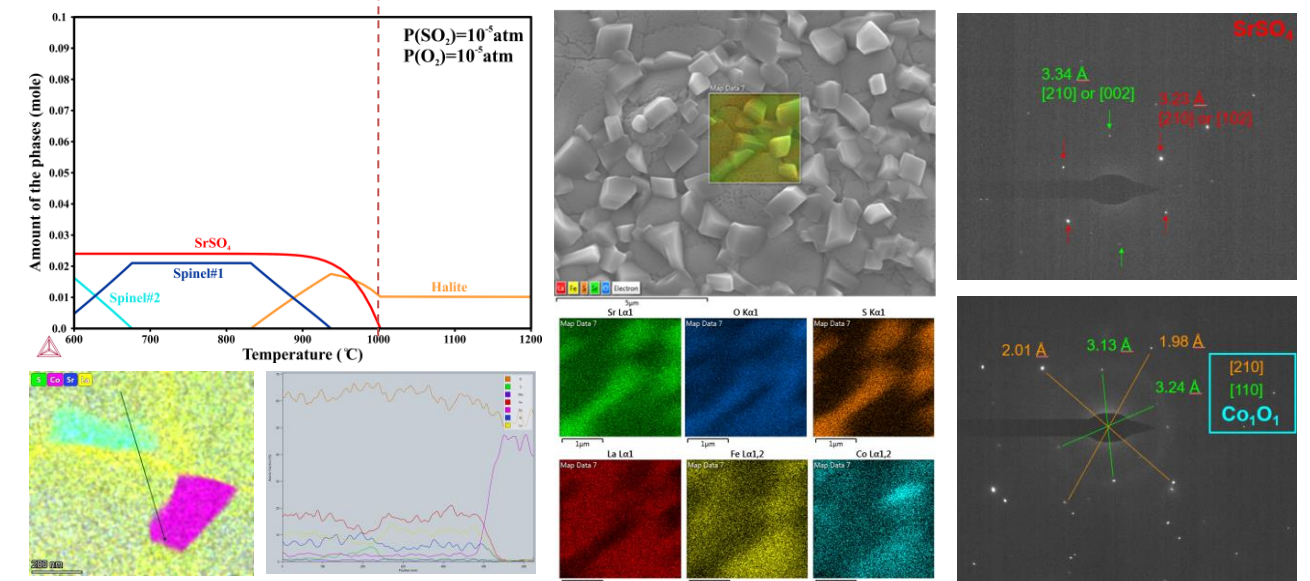


LSM under sintering conditions:

LSM pellets soak in 10ppm SO₂ balanced with dry air at **800 °C** for 2 days.

LSCF under operation conditions:

LSCF pellets soak in 10ppm SO₂ balanced with dry argon at **1000 °C** for 2 days.



Conclusions

- LSM is pretty stable based on the experiments we have done so far under its general operation conditions.
- R-P phase, LNO can be a very promising cathode compared to LSCF since both of them are MIECs and will be used under intermediate conditions.

Summary

- The Thermodynamic simulations were carried out to understand the effect of various impurities to the SOFC cathode materials:
LSM/LSCF/LNO
- Specific experiments have been designed and showed good agreement with simulation results.

Acknowledgement

Department of Energy (DOE)

- This material is based upon work supported by the Department of Energy under Award Number DE-FE0031652.
- Program managers, Jason Montgomery and Venkat K. Venkataraman.