

## MONTHLY REPORT

PROJECT: Determination of Electrochemical Performance and Thermo-Mechanical-Chemical Stability of SOFCs from Defect Modeling (# DE-FC26-02NT41562)

PERIOD: July/August

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For July/August we have continued our impedance testing of symmetric cells with lanthanum strontium manganate (LSM) electrodes and yttria-stabilized zirconia (YSZ) electrolyte. Current work is focused on the effects of ageing with respect to the formation of secondary phases such as lanthanum zirconate and their impact on impedance and associated time constants for the mass transport processes.

Early results show, as expected that the formation of lanthanum zirconate at the YSZ-LSM (electrolyte-electrode) interface increases the total impedance of the cell. To gain more insight into the role of the secondary phase we are also working on accurately resolving the components (i.e., the semi-circles) of the impedance spectra. Towards this end we have begun collaborating with an expert in the field (Dr. M. Orazem) to reliably resolve the impedance components of the spectra by separating the effects of stochastic errors and selecting appropriate equivalent circuit models.

Also in this period, we have maintained steady progress in packaging the various parts of the continuum-level electrochemical model into software modules (written in C++). Of note, we have completed modules for the generation of defects (defect thermodynamics) as a function of oxygen partial pressure, dopant concentration and mass-action constants. Current work is focused on completing the module for defect transport. When this is completed we anticipate even more rapid development of the remaining modules.