**LSM-20/YSZ Cathode Response to Elevated Steam Content in 500-1000 h Tests**

**Pacific Northwest National Laboratory**

J.S. Hardy1, J.W. Templeton1, N.R. Overman1, and J.W. Stevenson1

G.A. Hackett2, S. Lee2, and K. Gerdes2

1Pacific Northwest National Laboratory 2National Energy Technology Laboratory

e-mail: [jeff.stevenson@pnnl.gov](mailto:jeff.stevenson@pnnl.gov) Phone: (509) 372-4697

Cells with LSM-20/YSZ cathodes were tested at 800, 850, 900, and 950°C in dry and humid cathode air. At each temperature, six cells were operated at a constant current approximating an operating condition voltage of 800 mV. Of the six cells, two were tested in dry cathode air during the entire test, two were tested in humid cathode air during the entire test, and two were tested in cathode air in which the humidity level was alternated between dry and humid air every ~250 hours. The dry air had a dew point of -80°C and the moist (~3% water) condition was achieved by bubbling the dry air through water at room temperature. Triple exponential decay equations were fit to the operating voltage as a function of time over each continuous segment of the data. This made it possible to calculate the instantaneous degradation rate as a function of time over the entire test duration based on the best curve fits to the data. Degradation rates were generally higher in humid cathode air and the degradation experienced during exposure to humidity was at least partially reversible when cells were subsequently exposed to dry air, especially at lower temperatures.

Additional cells were operated at 800°C with higher cathode air humidity (10 and 20%) with operating potentials of 800 and 900 mV. In this case, humidity was supplied continuously for 500 h through a controlled flow steam injection system. At 10% humidity and 900 mV operating potential, no degradation was observed, while significant degradation was observed at 20% humidity and 10% humidity with 800 mV operating potential. SEM results show rounding of the cathode microstructure and substantial delamination from the electrolyte surface.