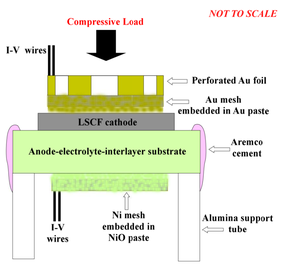
SECA CTP Stack Fixture Testing

Y-S Matt Chou, E. Thomsen, J-P Choi, J. F. Bonnett, W. E. Voldrich, and J. W. Stevenson, Pacific Northwest National Laboratory, Richland, WA 99354, Presented at the 11th Annual SECA Workshop, Pittsburgh, PA, July 27-29, 2010

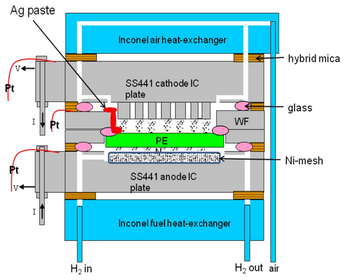
Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Objectives: to develop a "standard" stack test fixture to validate SOFC materials, and processing development

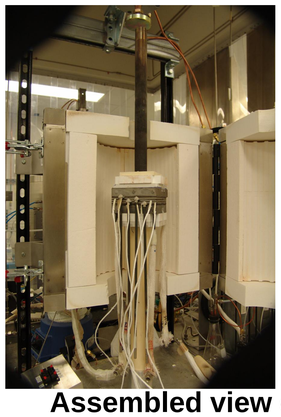
"Button" cells offer a quick tool to assess basic SOFC materials processing and behavior; however, the cell geometry/size, gas flow, sealing systems, contact materials, current collectors etc are far from the real cells in a stack.

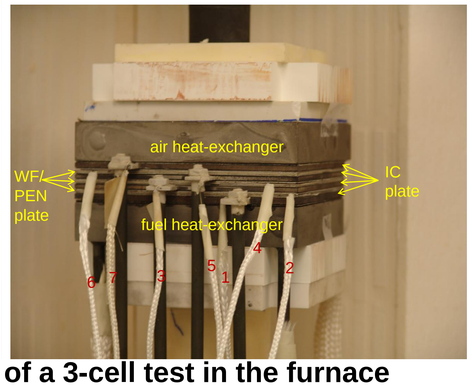


Button cell



Cell in "stack" assembly

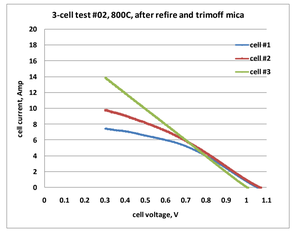


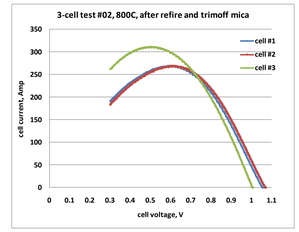


Assembled view of a 3-cell test in the furnace

Materials for stack testing

1. commercial 2"x2" NiO/YSZ supported YSZ cell with LSM cathode of 16 cm^2 active area
2. LSM20 and Ni paste +Ni mesh as contact
3. (Mn,Co) spinel coating and aluminization
4. AISI441 interconnect and window frame
5. Refractory glass seal for WF and double seal (composite glass and hybrid mica) for perimeter seal
6. Compressive loading applied
7. Final sealing at 930°C/2h the tested at 800°C

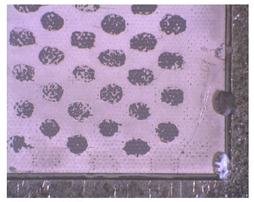


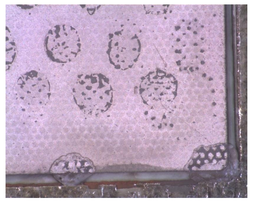


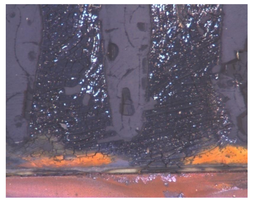
Cell #3 showed performance after clearing the blocked air path

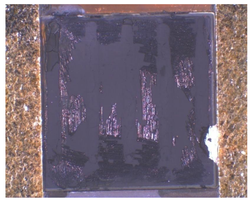
Post-mortem analysis of anode and cathode side

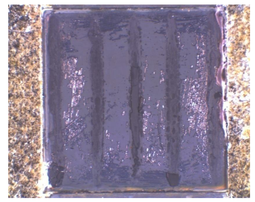

Cell#1


Cell#2

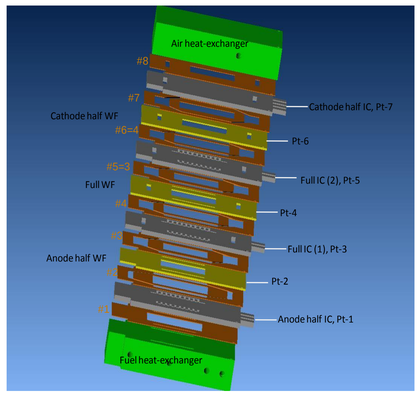

Cell#3


Cell#1

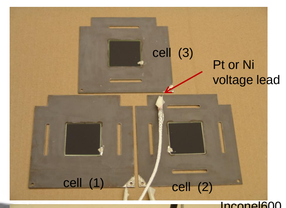

Cell#2

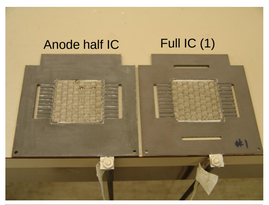

Cell#3

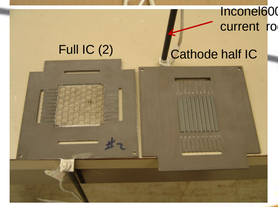
3-cells short stack testing

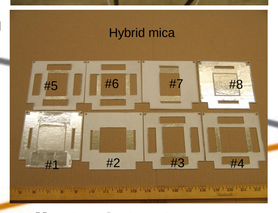


schematic drawing shows the assembly of a short stack of 3-cells



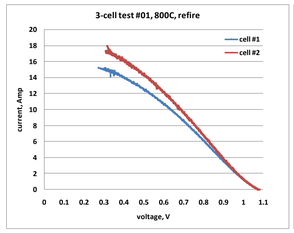


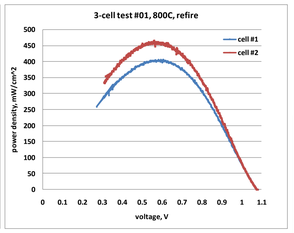


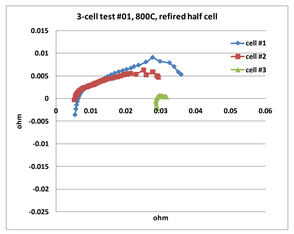


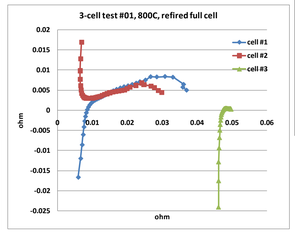
Parts used in 3-cell stack test

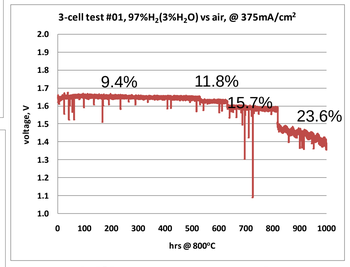
3-cells test #01





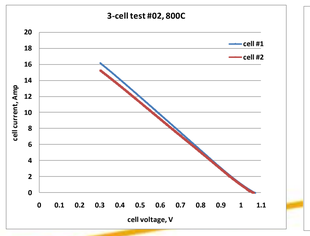


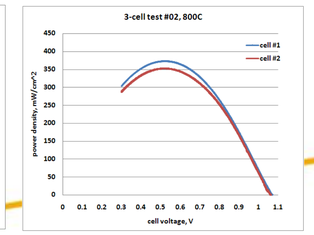


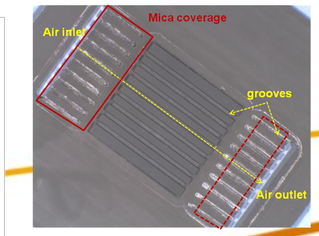


Stability test at various fuel utilization and 800°C

3-cells test #02

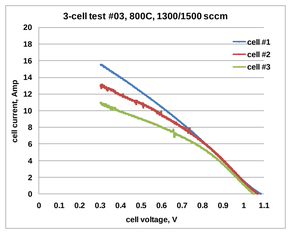


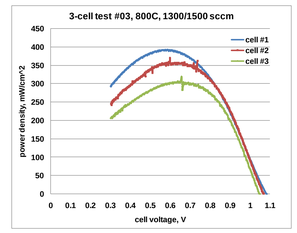


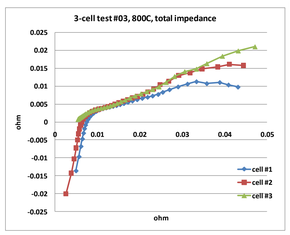


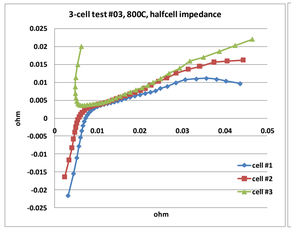
Cause of no performance of cell #3 for test #01& #02

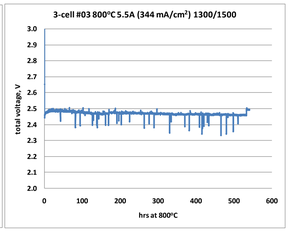
3-cells test #03











Summary and Conclusion

1. 2nd generation stack test fixture was developed.
2. Three 3-cells stack tests were conducted.
3. Cause of no performance of cell#3 for stack test #01 and #02 was identified and fixed.
4. Stack test #03 showed success for the current stack test fixture.
5. Current seal systems worked fine, and performance is very dependent on gas flow, insensitive to leaks.
6. Preliminary results showed lower performance at higher fuel utilization.

ACKNOWLEDGEMENT

The authors wish to thank W. Surdoval, B. White, and T. Schultz for their helpful discussions regarding this work. This work was funded by the U.S. Department of Energy's Solid-State Energy Conversion Alliance (SECA) Core Technology Program.