Progress in Metal-Supported Solid Oxide Fuel Cells

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Symmetric-Architecture at LBNL

Power Density Progress at LBNL

Nissan’s SOFC-powered Vehicle

MS-SOFC Scalability

Fabrication

Advantages of symmetric-architecture MS-SOFCs

1. Tape casting and lamination of all cell layers in a single step
2. Co-sintered ceramic and stainless steel layers in reducing atmosphere (catalyst absent)
3. Catalyst introduced by infiltration (flexible catalyst compositions)

- 5 layers laminated
- Tape casting
- Lamination/Trimming
- Degassing
tfering
- An cat.
- infiltration
- Ca cat.
- infiltration

Current Collectors Welded on Cell

- Cathode Metal support: Electrolyte
- Anode Metal support

- Cathode Metal support
- Electrolyte
- Anode Metal support

- 65 x 80 mm
- 50 x 50 mm

Baseline

Improved

Improved

1.56 W/cm² at 700 °C

1.105

1.110

OCV (V)

1.090

1.095

-2 -1 0 1 2 3

0.2

0.4

0.6

0.8

1.0

1.2

1.4

Current Density (A/cm²)

0 25 50 75 100

Time (hours)

Peak Power (W/cm²)

Z' (Ohm·cm²)

Z" (Ohm·cm²)

Improved

Electrolysis

Peak Power (W/cm²)

Baseline

Fuel cell

Catalyst processing

Catalyst processing

700 °C hold at 0.7 V

Baseline

Minor degradation <1%

No degradation

Steam content: 50% H₂O - H₂

Temperature: 700 °C

Improved catalysts

Power Density Progress at LBNL

Time (hours)

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Baseline

Minor degradation <1%

Improved catalysts

Thermal and Redox Cycling

Excellent thermal shock/gradient tolerance

Stable performance after multiple thermal cycles

Cell 4

Cell 3

Cell 2

Cell 1

Operated @ 0.7 V, 700 °C

Baseline

Minor degradation <1%

Developed Solid Oxide Fuel Cells (SOFCs)

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