In their work, PNNL researchers pointed to two types of leakage source: path I through the mica itself and path II via the interface between the component and mica.

High Performance Mica-based Compressive Seals

Battelle Number(s): 13158-E, 13904-E

Patent(s) Issued

Available for licensing in all fields

SUMMARY

One of the critical issues in designing and fabricating a high-performance, planar, solid oxide fuel cell (SOFC) stack is the development of the appropriate materials and techniques for hermetically sealing the metal and ceramic components. Researchers at Pacific Northwest National Laboratory (PNNL) have developed a method for sealing SOFC components that has shown ultra-low leak rates when applied to hybrid compressive mica seals.

The National Energy Technology Laboratory selected PNNL as the national laboratory to support its SOFC program, in part to develop technologies for the Solid State Energy Conversion Alliance (SECA). Basic to the needs was finding a way to stop leakages in SOFCs.

Researchers at PNNL developed a method for overcoming the chemical, mechanical, thermal, and electrical limitations of glass and air brazed seals, which commonly fracture during repeated thermal cycling, forming electrical shorting, or performance degradation under SOFC operating conditions.

The high-performance mica-based compressive seals have overcome these limitations by using a "mica sandwich,” where a metal (such as silver) or a glass layer is put on either side of the mica. When heated up to 800-930Â°C, the metal layer conforms to the irregularities in the surfaces, forming a seal of very low leakage.
ADVANTAGES

Better control over chemical reaction between H2 and O2, which translates into higher fuel cell efficiency
Use comprehensive SOFC parts are not physically bonded, which allows the reuse of some components
Environmentally friendly mica is a natural mineral containing no hazardous elements
Method allows materials to resist build-up of residual stresses mica actually removes potential stresses
Materials are commercially available and low cost, allowing for easier implementation of the method
Design allows for wider range of materials selection
Excellent thermal cycle stability materials have been tested over 1000 thermal cycles in dual environments
Excellent durability materials have been tested over 28,366 hours at 800°C in dual environments.

RELATED LINKS

"National Energy Technology Laboratory"
Coal and Power Systems: Fuel Cells

"Solid State Energy Conversion Alliance"
Overview, news, events, projects
http://www.netl.doe.gov/technologies/coalpower/fuelcells/seca/

PATENTS & INTELLECTUAL PROPERTY

7,258,942

TECHNOLOGY PORTFOLIO(S)

Fuel Cells

POTENTIAL INDUSTRY APPLICATION(S)

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