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NATIONAL ENERGY TECHNOLOGY LABORATORY

INTEGRATION OF THERMAL ENERGY STORAGE INTO SOLID OXIDE FUEL CELL SYSTEMS

OPPORTUNITY:

Research is active on the design and development of solid oxide fuel cell (SOFC) systems featuring thicker interconnects for increased thermal energy storage. A large amount of heat can then be extracted from the interconnects and used to quickly increase the electric load in a hybrid power system. This invention is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory (NETL).

OVERVIEW:

SOFCs operate at high temperatures (600–1000 ˚C) and have immense potential for thermal energy storage (TES). Testing at NETL has shown that more thermal energy can be stored by increasing the thickness of the interconnect material—usually made of stainless steel. A significant amount of energy can then be recovered without damage to the fuel cell. In fact, initial testing has shown that when integrating TES, a fuel cell became more efficient, lasted longer, and in general, was more robust. This integration of TES into fuel cell systems can be used to overcome the problems associated with intermittent power production from renewable sources.

This invention describes the design and development of a more efficient and flexible SOFC system with thicker SOFC interconnects used as a storage medium for storing thermal energy. Total heat capacity is increased by increasing the mass of the interconnects within the fuel cell. For example, a 500 kW SOFC at the nominal or baseline condition has approximately 2.6 GJ of stored thermal energy. By modifying the design and materials of construction this amount of energy can be easily doubled, substantially improving the capacity of the SOFC as a dynamic TES device. During transient operation, heat could be stored or removed without adversely affecting the temperature gradient within the fuel cell, dramatically increasing system flexibility.

David Tucker

SIGNIFICANCE:

- Provides the ability to extract large amounts of heat from fuel cell interconnects to increase the electric load of a hybrid system within milliseconds
- Eliminates the need for separate energy storage devices
- Provides advanced power generating systems the flexibility to adjust to electric load demands
- Increases fuel cell efficiency, resiliency, and robustness
- Helps overcome problems associated with intermittent power production from renewable sources

APPLICATIONS:

- Hybrid fuel cell power generation systems

RELATED PATENTS AND PATENT APPLICATIONS:

U.S. Provisional Patent Application No. **62/450,863** filed on January 1/26/17

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