Innovative Self-Healing High-Temperature Seals for Solid Oxide Fuel Cells (SOFC)*

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A variety of seals such as metal-metal, metal-ceramic, and ceramic-ceramic are required for a functioning SOFC. These seals must function at high temperatures between 600-900°C and in oxidizing and reducing environments of the fuels and air for up to 40,000 hours. Among the different type of seals, the metal-ceramic and ceramic-ceramic seals require significant attention, research, and development because the brittle nature of ceramics and glasses can lead to fracture and loss of seal integrity and functionality.

A new concept of self-repairing glass seals has been developed and used for making metal-glass ceramic seals for application in solid oxide fuel cells (SOFC) in order to enhance reliability and life of cell. The performance of these seals under long-term exposure at higher temperatures coupled with thermal cycling is demonstrated by leak tests. Self-reparability of these glass seals has also been demonstrated by leak tests along with the long-term performance. In addition, the role of ceramic particulate reinforcement/fillers on the thermo-physical properties of the self-healing glasses is investigated through measurements of expansion behavior, glass transition temperature, and stability in fuel and air environments typical of a SOFC. These results will be presented and discussed in terms of the suitability of these seals in offering long-term and cost effective solutions to SOFC systems.

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