

Fast Heat Treatments of Solid Oxide Fuel/Electrolysis Cells

Rapid, energy-efficient heat treatments yield larger, cheaper, more robust solid oxide fuel/electrolysis cells compared to furnace sintering.

Solid oxide cells (SOCs) are electrochemical devices that can transform chemical energy into electrical energy. Depending on their use, they can be solid oxide fuel cells (SOFCs) or solid oxide electrolysis cells (SOECs). Typical structure configuration includes planar structure in which an electrolyte layer is sandwiched between two electrode layers. During operation of the cell at elevated temperatures, one electrode is in contact with oxygen or air, and the other is in contact with a fuel gas. The cell layers are generally made by tape casting and then dried and sintered. The conventional sintering places the green tapes in a furnace and heats for hours. The process consumes a significant amount of time and energy. The cell is limited to a small size as the uneven temperature field in a furnace leads a larger size to crack.

Researchers at Purdue have developed a technology that allows for quicker and more cost-effective sintering of SOCs. This technology uses an apparatus for the measurement of temperature of a heating stage connected to electrodes for easy modification from a power source. The temperature controller, which is linked to a data processor, can adjust the power supply based on the output temperature value, thereby regulating the temperature of heating stage. Application of this technology will allow for the development of cheaper and more robust SOCs with an increase in sample size as well as a decrease in the use of energy required for formation.

Technology Validation:

- Sintering full cells within a short duration of time

Advantages:

Technology ID

2023-XIE-70045

Category

Energy & Power Systems/Energy
Storage
Semiconductors/Devices &
Components
Energy & Power Systems/Power
Generation

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- Significantly less time and energy consumption compared to conventional furnace sintering
- Increased size of full cells compared to conventional furnace sintering

Applications:

- Solid Oxide Fuel/Electrolysis Cells

TRL: 2

Intellectual Property:

Provisional-Patent, 2022-11-09, United States

Utility Patent, 2023-11-06, United States

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