Contribution ID: **130** Type: **3. Oral presentation**

Microstructure control in solid oxide cells by Ultra-fast high temperature sintering

Sintering of functional ceramics remains a critical and cost-intensive step in the manufacturing of advanced electrochemical devices. This challenge is amplified in multilayer systems requiring different sintering temperatures, such as solid oxide cells (SOC). Conventional manufacturing relies on prolonged high-temperature exposure to promote particle connectivity; however, grain growth is difficult to control and often leads to the loss of nanoscale features, directly impacting electrochemical performance.
To improve microstructural control while reducing processing time and limiting the volatility of temperature-sensitive elements (e.g. Ba), ultrafast high-temperature sintering (UHS) has emerged as a promising alternative. In this work, UHS was applied to study the densification of 8YSZ electrolytes and the sintering of LSC-based oxygen electrodes, both state-of-the-art SOC materials. UHS-sintered 8YSZ exhibited ionic conductivity comparable to conventionally sintered samples (0.036 $S \cdot cm^{-1}$ at 750 ℃) across all investigated conditions. In contrast, UHS processing of LSC64 electrodes, tested in complete anode-supported cells, preserved nanoscale features while maintaining good adhesion to the electrolyte, resulting in improved electrochemical performance with current densities of 1.84 $A \cdot cm^{-2}$ for 0.7V at 750 ℃ in SOFC mode (38% higher than conventional cells).

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

Advanced Engineering Materials (Wiley)

Invitation letter for visa

No

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Session Classification: Ultra-fast High Temperature Sintering UHS

Track Classification: Group 3: Ultra-fast High Temperature Sintering UHS