Special Issue

Advanced Materials for Solid Oxide Cells: Performance and Degradation Modeling

Message from the Guest Editors

Solid oxide cells (SOCs), encompassing both fuel cells (SOFCs) and electrolysis cells (SOECs), are key technologies in the transition to sustainable energy systems, offering high efficiency, fuel flexibility, and reversible operation. However, their widespread deployment is hindered by complex performance-limiting mechanisms and long-term degradation under high-temperature operation. Accurate modeling and prediction of SOC performance and degradation are essential to improving their reliability, longevity, and integration into real-world applications. This Special Issue aims to gather cutting-edge research focused on the modeling, simulation, and prediction of SOC behavior. We welcome contributions that use multi-physics and multi-scale modeling approaches to examine degradation mechanisms, predict lifetime prediction, and optimize performance under realistic operating conditions. Topics of interest include: electrochemical modeling of SOC components; thermal and mechanical stress analysis; degradation modeling of electrodes and electrolytes; modeling of redox cycling, poisoning, and thermal aging; and data-driven or machine learning approaches to performance forecasting, etc.

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