Thin Films Surface and Interfacial Modifications for Solid Oxide Cells

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The development of high-performance and durable ceramic electrodes is central to advancing solid oxide cell (SOC) technology for energy conversion. Perovskite oxides, such as $Sr_2Fe_{1.5}Mo_{0.5}O_{6-\delta}$ (SFMO), are promising electrode materials but face challenges like chemical instability and surface degradation during operation. This work aim to addresses these challenges by employing ceramic processing and surface engineering techniques to modify and enhance perovskite electrodes.

We utilize atomic layer deposition (ALD) and solution infiltration to apply nanoscale coatings and create highly defective surface layers on SFMO electrodes. These modifications are designed to suppress detrimental phenomena such as Sr cation segregation, a common degradation mechanism in ceramic perovskites. Our results demonstrate that the engineered surfaces significantly improve electrochemical performance by enhancing the kinetics of the oxygen reduction reactions (ORR) and reducing polarization resistance.

The talk will discuss the interplay between surface chemistry, oxygen vacancy concentration, and electrochemical activity in these modified ceramic interfaces. This work highlights the critical role of advanced surface modification technologies in developing more efficient and robust ceramic-based energy devices, underscoring the potential of interfacial engineering in ceramic science for sustainable energy applications.