

## Correlative Tomography at the Cathode/Electrolyte Interface of Solid Oxide Fuel Cells

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Modern solid oxide fuel cells (SOFC) typically use Y<sub>2</sub>O<sub>3</sub> stabilized ZrO<sub>2</sub> (YSZ) as electrolyte and mixed ionic-electronic conducting perovskites like La<sub>1-x</sub>Sr<sub>x</sub>Co<sub>1-y</sub>Fe<sub>y</sub>O<sub>3-δ</sub> (LSCF) as cathode. One drawback of using LSCF in combination with YSZ are secondary phases forming at the interface between both layers [1-3]. Although a diffusion barrier interlayer of Gd<sub>0.2</sub>Ce<sub>0.8</sub>O<sub>2-δ</sub> (GDC) is introduced between cathode and electrolyte, the formation of a SrZrO<sub>3</sub> (SZO) phase and other secondary phases in minor concentrations are observable at this interface region. This may unfavorably affect the outstanding oxygen reduction reaction and/or the oxygen ion transport across the complex nature of this interface into the solid electrolyte [4, 5].

This contribution will highlight an advanced approach in FIB-SEM tomography for visualizing the three-dimensional nature of the diffusion barrier layer and of the SrZrO<sub>3</sub> phase (cf. Figure 1). Using the Everhart-Thornley and Inlens detectors in combination with different primary electron energies leads to a broader spectrum of greyscale information between the primary and secondary material phases. The material assignment is supported by energy-dispersive X-ray spectroscopy in a transmission electron microscope. A 3D data set, representing chemical composition and microstructure of the entire interface region, will be shown to highlight the impact of choosing a certain sintering condition. This enables great possibilities of visualization and modeling of ionic transport through this interface. Simulated current streamlines on basis of the different data sets, representing different manufacturing conditions, will be shown and are correlated to cell performance measured by electrochemical impedance spectroscopy.

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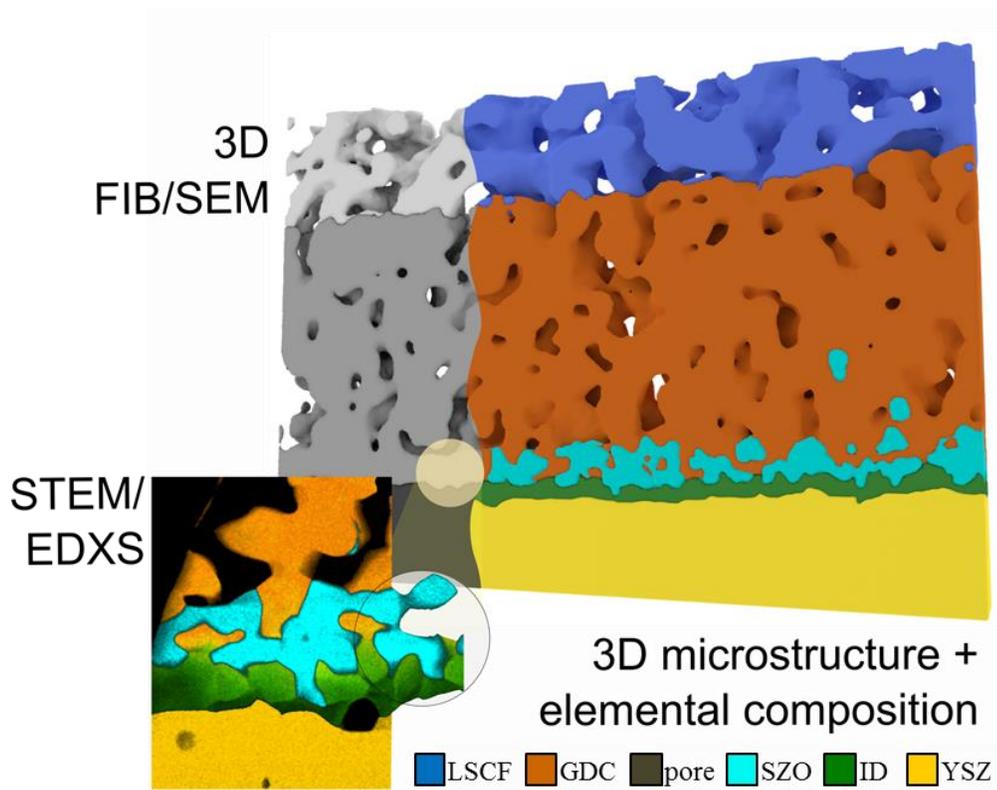


Figure 1: Visualization of all phases present in the interface region between cathode and electrolyte.

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