# Long-term Stability of Electrochemical Solid Oxide Cells: The Role of Cation Segregation, Contaminants and Surface Reconstruction

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Electrochemical solid oxide cells (SOCs), which include solid oxide fuel cells (SOFCs), solid oxide electrolysis cells (SOECs), and reversible solid oxide cells (RSOCs), are key technologies for sustainable and highly efficient energy conversion and storage in future energy systems[1]. However, lifetime and reliability of the cells, which are frequently limited by issues cause by the air electrodes, need to be improved by efforts concerning both fundamental research and technical development[2].
State-of-the-art SOC air electrode materials are complex perovskite-type oxides, with the general formula $ABO_{3-\delta}$, which show high electronic and significant ionic conductivities and fast oxygen exchange kinetics. Perovskites, which are optimized for operation at 650-850°C, usually contain $La^{3+}$ and $Sr^{2+}$ on the A-site and mixed-valence transition metals on the B-site (Co, Fe). Degradation mechanisms, which involve cation (esp. strontium) segregation, surface recrystallization, heterogeneous reactions with critical impurities, as well as nucleation and growth of secondary phases[3-5], are governed by various factors. One the one hand, intrinsic material properties, such as chemical composition, bulk and grain boundary diffusivities, mismatch in cation ionic radii, compound basicity, and defect chemistry lead to differences in degradation mechanisms, depending on the A- and B-site composition of the perovskites. On the other hand, extrinsic factors, such as temperature and oxygen partial pressure, gas phase humidity, impurities from stack or balance of plant components, etc. have to be considered.
In the present talk, recent research results providing deeper insights into degradation mechanisms will be discussed, along with strategies to increase performance and long-term stability of SOC air electrodes.

**References:**

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