SURFACE MODIFICATION THROUGH OXIDE ALD TO IMPROVE OXYGEN EXCHANGE RATE ON PEROVSKITE SURFACE

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Segregation and phase separation on perovskite oxide (ABO$_3$) surface have been considered as a key detrimental factor to the performance of energy conversion devices such as solid oxide/electrolysis cells. Recently, the overcoat of less reducible cations has been suggested as a way to suppress the surface Sr segregation on Sr-containing perovskite oxides. However, the detailed requirements of the coating layer to sufficiently stabilize the perovskite surface hasn't been systematically investigated yet. In this work, we fabricate La$_{0.6}$Sr$_{0.4}$CoO$_3$ (LSC) thin-film model electrode via pulse layer deposition and observe how the degree of Sr segregation varies with the type and thickness of the overcoat layer. Al$_2$O$_3$ and HfO$_2$ with different thickness are coated on LSC via ALD, and the oxygen exchange rate of both bare and ALD-coated samples is measured via electrical conductivity relaxation. It is found that both Al$_2$O$_3$ and HfO$_2$ layers suppress the Sr segregation only within a narrow thickness range, i.e., 1–2 nm for Al$_2$O$_3$ and 0.2 – 0.4 nm for HfO$_2$, respectively. These observations are discussed with solubility and diffusivity of Al and Hf in the host oxide lattice, providing a critical guideline of a new surface modification method to stabilize the perovskite surface at high temperatures.

![Figure 1](image)

*Figure 1 – The surface oxygen exchange coefficient ($k_{chem}$) of LSC film with and without HfO$_2$ coating*