**Bi-pathway ORR Kinetics on SOFC Cathode**

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Many fundamental issues of SOFC cathodes remain elusive regarding electrode kinetics, mass-transport mechanisms, surface process and geometrical aspects. A better understanding of oxygen reduction reaction (ORR) in common SOFC cathodes, such as La1-xSrxMnO3 (LSM) and (La,Sr)(Co,Fe)O3 (LSCF), is thereby indispensable. In this work, an (one-dimensional) 1-D model for LSM-type cathode and two-dimensional (2-D) model for LSCF-type cathode have been respectively proposed according to the different material properties and conduction mechanisms. We have shown that electrochemical charge transfer of ORR process can occur through the triple-phase boundary (3PB) at the interface of electrolyte/gas/cathode, and two-phase boundary (2PB) at the interface of electrolyte/cathode in parallel. 3PB-2PB competition, transport of different species, rate-limiting steps (RLSs) and their interactions have been comprehensively governed to correlate the possible effect of operating conditions and microstructural geometry. Current-voltage (I-V) relations and distribution of ions and electrons have been derived for understanding ORR behavior in the related cathode materials.