Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Computation of Nonlinear Impedance Spectra in Samaria Doped Ceria[1] FRANCESCO CIUCCI, California Institute of Technology — Samarium Doped Ceria (SDC) electrodes are currently of great interest for solid oxide fuel cells (SOFC) applications. For example, ceria-containing anodes can be operated directly on hydrocarbons without coking, and in addition can be used at lower temperatures than Ni/YSZ. In order to design, optimize, and characterize electrodes, it is very useful to have models to aid in interpreting experimental results. In this work, we present a non-linear, time-dependent model for the study of SDC. This model allows us to compute species concentrations, electric potential and currents under medium bias conditions. A regular perturbation of the drift diffusion equations and Poisson's equation is used to derive the model for the behavior of bulk of the material. We also include the kinetics of reactions occurring at the SDC-gas surface where the SDC is exposed to a spatially uniform hydrogen-water-argon mixture at fixed total pressure. The numerical procedure allows for fast computations and for the direct determination of fast and rate limiting steps. Impedance spectra are computed in the 2D case and a quantitative comparison between experimental (symmetric cell) and numerical results is presented. Our model can be naturally extended to the non-symmetric case, i.e. the case under which the two sides of the SDC assembly are exposed to different atmospheres.

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Francesco Ciucci
Caltech

Date submitted: 18 Dec 2008 Electronic form version 1.4