164c Macrohomogenous Modeling of Sofc: Analysis of Dry Methane Fuel

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A framework for macrohomogeneous modeling of porous SOFC electrodes operating under dry methane fuel has been developed taking into account multi-component diffusion, multiple electrochemical and chemical reactions, and electronic and ionic conduction. The model applies to both porous anode and porous cathode. The derivation of the model is illustrated by considering different chemical and electrochemical reaction schemes. The framework of the model is general enough such that additional chemical and electrochemical reactions can be accounted for. The possible reaction mechanisms involved in operating an anode fed with dry methane were analyzed in successive steps. Methane pyrolysis as well as the Boudouard reaction (at equilibrium or not) were considered as possible causes of carbon deposition. The cell was first considered at open circuit and analyzed for carbon deposition when an initial feed of hydrogen was changed to methane. Next, cell operation under load was modeled starting from the open circuit conditions simulated previously.