215g Sofc System Components Modeling and Integration

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The fuel cell principle represents an ideal means of extracting maximum electrical work from suitable fuels. Several fuel cell technologies have been developed to exploit the principle, of which solid oxide fuel cells (SOFC) are favored for medium scale to large scale stationary power generation, particularly when combining with gas/steam turbine technology to make use of the high-temperature exhausts (650-1000C). An SOFC system consists of fuel processor, fuel cell stack and power conditioner. Good SOFC modeling capability is critical for understanding the fundamentals of device behavior, for exploring design options before the expensive step of making prototypes, and for interpreting the results of experiments. A challenging feature of SOFC modeling are multi-scale physics, multi-species transports and combined electro- and thermo-chemical reactions, particularly when SOFC devices are internally coupled with fuel reforming for a high system efficiency. To ensure the consistency of system components modeling, reliable databases of thermodynamics, electrochemical kinetics and species transport properties are essential and should be shared by all system components modeling.

This presentation summarizes recent efforts at Corning Inc made to integrate electro/thermochemical models of solid oxide fuel cells and thermochemical models of fuel processing based on shared thermodynamic and transport database and easy-accessible computer platform. As the result of this model integration, a comprehensive SOFC system components simulator has been created. The vision of this simulator is to provide an efficient modeling tool for people seeking to understand and simulate Corning SOFC system components. While the details of component models will not discussed, this presentation will focus on the overall simulator performance and introduction to those developed individual modules.