Solid Oxide Fuel Cell Research and Development Program at the Connecticut Global Fuel Cell Center

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The Connecticut Global Fuel Cell Center is a newly established partnership between the state of Connecticut, Connecticut industry and the University of Connecticut. The mission of the Connecticut Global Fuel Cell Center is to be a "leading world-class institution in fuel cell research, design, education and training, and product development". The Center will not just focus on one fuel cell technology or market, but will provide a source of technical strength capable of addressing the multitude of issues across the fuel cell product platform.

The Connecticut Global Fuel Cell Center began in December 2001 as a partnership between the School of Engineering at the University of Connecticut, Connecticut Innovations, and Connecticut industry. This endeavor arose from the confluence of several key factors: Connecticut's existing strength in the commercial development of fuel cell products (both OEM's and their suppliers), and the University's strong core of innovative research in fuel cell and related technologies.

The Connecticut Global Fuel Cell Center (CGFCC) has a dedicated, state-of-the art, 16,000 square foot facility, as shown in Fig. 1, which serves as the focal point for multidisciplinary fuel cell research. This building was completed during 2001 through $2M in funding from the Department of Commerce and the Economic Development Authority combined with $670K from the University of Connecticut. The research portion of the building consists of 8 laboratories; four are approximately 1,000 sq. ft. high bay areas, and four are 900 sq. ft. wet chemistry laboratories.

Although the CGFCC covers research and development in a wide range of fuel cell technologies, this paper will examine a number of programs being undertaken in the solid oxide fuel cell group within the CGFCC. These include, but are not limited to:

- Fabrication (by extrusion) and testing of intermediate temperature micro-tubular based SOFC systems (single cells, and small stacks), running off both hydrogen (see Fig 2 for typical results) and hydrocarbon-based fuels (1-2)
- Mechanical testing of electrolytes and cells in a number of different morphologies.
- Electrical properties of intermediate temperature electrolyte materials including ceria and perovskite based systems.
- Issues affecting the reliability and durability of SOFC cells, stacks, and systems.
- Modeling aspects including micro and macro modeling (for example, one modeling approach has the capability to capture truly random topological effects, and has been validated as a method of predicting mechanical stiffness of randomly porous materials, as described in Figure 3) (3)

Figure 1 The Connecticut Global Fuel Cell Building

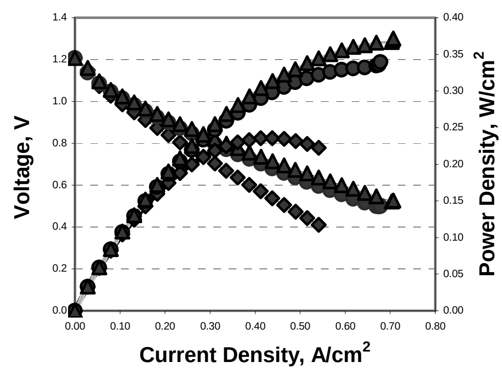

Figure.2: Cell voltage and power density as a function of current density at 800°C and various operation times. The cell consisted of air, LSC/LSGM/SDC/Ni, H_2/ H_2O. LSGM thickness was 0.55 mm.

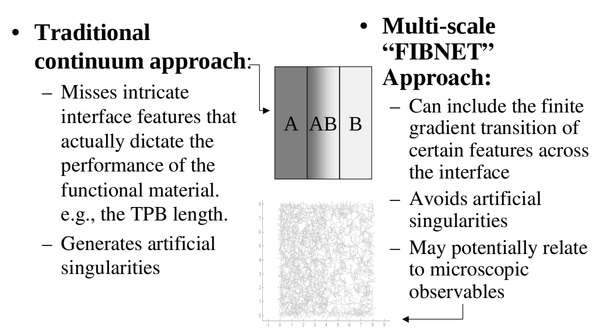

Figure 3: Advantages of new "FIBNET" model for the representation of the local geometry and global properties of heterogeneous porous materials with internal gradients.

References

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