V.0.7 Martin County Hydrogen Fuel Cell Development*

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*Congressionally directed project

Objectives

- Double the speed of the extrusion line manufacturing process without negatively affecting cell performance.
- Transfer a new membrane production process from research and development to the manufacturing floor for increased shelf life and consistent quality control parameters.
- Complete research and development on the effects of optimizing the fuel cell module electrical connections to allow enhancement of module performance.
- Design and develop industrial-grade automated Unicell production process equipment for mass production.
- Transfer the fuel cell module production from research and development to the manufacturing floor for production level assembly.

Technical Barriers

This project addresses the following technical barriers from the Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan:

(B) Cost

(E) System Thermal and Water Management

Technical Targets

- Extrusion line speed of 2 meters/minute
- Power Output: 10-12 Watts per Unicell

Approach

The objective of this project is to continue the research and development required to take a microfiber fuel cell technology to a high-volume manufacturing level while maintaining product performance and quality. This microfiber fuel cell technology has the potential to meet the need for high volume fuel cell manufacturing processes. With the sub-recipient's patented technology all the components of a single fuel cell, i.e., the electro-catalyst of cathode and anode, the polymer electrolyte membrane, and the current collector are extruded into a single microfiber (Figure 1). As the speed of the extrusion line is increased, it is important that no bottlenecks occur in the subsequent processes.

In support of the project objectives, additional process equipment for extrusion of microfibrous fuel cells was designed and constructed based on prior designs at the research and development level. This equipment was installed at a manufacturing facility for doubling the production line speed while maintaining cell performance. In addition, a membrane preparation system was designed, installed and tested at the manufacturing facility for increased shelf life and consistent quality of production. For the next step in the process, Unicell production, research and development was conducted on the production machinery necessary for Unicell production (Figure 2). New programs and

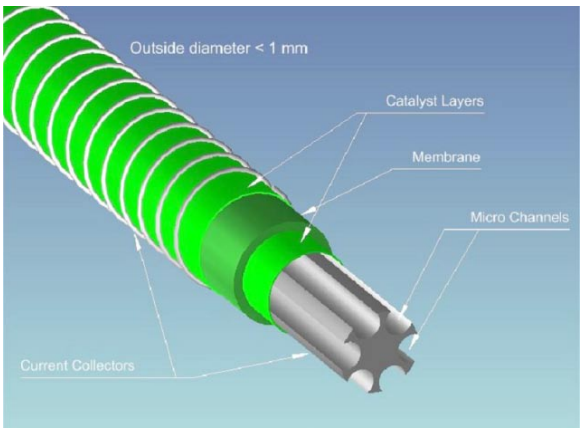

FIGURE 1. Microfiber Fuel Cell

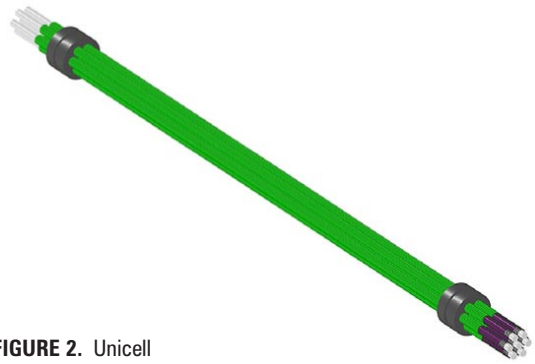

FIGURE 2. Unicell

software were developed to enhance human interface and operability for efficiency and increased productivity. For the last step in the fuel cell assembly process, module production, design enhancements for the module electrical connections were developed and tested for increased module performance. Module production was transferred from research and development to the manufacturing floor while performance targets were maintained the same as those produced at the research and development level (Figure 3).

Accomplishments

- Production line equipment has been procured/ constructed, installed and commissioned at the manufacturing facility. High-speed production line testing continues.
- Membrane production system has been designed, constructed and installed at the manufacturing facility. Manufacturing level volumes of membrane material are now produced and successfully extruded with the requisite rheology and properties.
- A new software program was developed for single cell wrapping to enable faster wrapping speeds and increased cell throughput.
- Standard operating procedures for Module assembly and testing have been developed (Table 1). Production equipment has been purchased, installed and commissioned. Training on Module assembly has been completed and production employees have shown successful assembly at the manufacturing level.

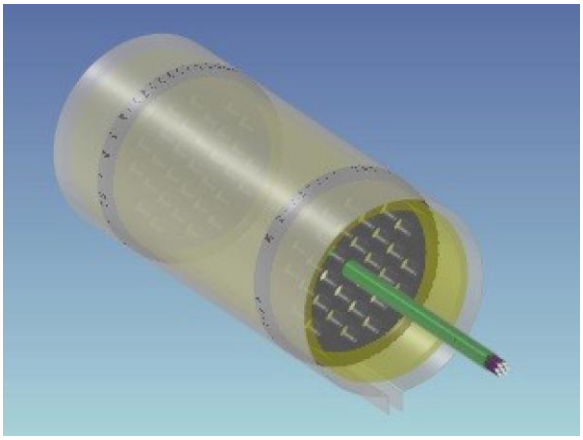

FIGURE 3. Fuel Cell Module

TABLE 1. Fuel Cell Module Characteristics

	Production	R&D
Operating Temperature	65-70°C	65-70°C
Module Size (inches)	3"OD x12"L	3"OD x12"L
Voltage	12	12
Single Cell Voltage	0.6	0.6
Current (A)	44.2	45
Power (W)	530	540

OD - outside diameter

FY 2010 Publications/Presentations

1. Microcell made a presentation at the National Hydrogen Association conference in Long Beach, California – May 3–7, 2010.

2. A poster presentation was made at the DOE Annual Merit Review (June 8, 2010).