Innovative Inkjetting and Spray Deposition for Low-Cost, High-Performance Fuel Cell Catalyst Coated Membrane Manufacturing

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Cabot Fuel Cells

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Project ID #:
MFP1

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Overview

Timeline

- Start- Nov 2005
- Finish- Jun 2006
- 95% complete

Barriers

- Barriers addressed
  - CCM/MEA manufacturing cost
  - CCM/MEA performance
  - CCM /MEA cost of high Pt content
  - CCM/MEA durability

Budget

- Total project funding
  - DOE : 610K
  - Contractor : 592K
- Funding received in FY07
  - 82.5K
- Funding for FY08
  - 310K

Partners

- MTI Micro Fuel Cells

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Objectives

The goal of this project is to provide innovative solutions for low-cost, high-performance, durable next generation MEA manufacturing to accelerate DMFC commercialization.

- **Objective 1. Improve printing/deposition technology to manufacture MEAs with >95% production yield with improved performance.**
- **Objective 2. Demonstrate a manufacturing throughput > 1000 MEAs per month per shift.**
- **Objective 3. Identify 2 hydrocarbon membranes with lower methanol and water crossover, and higher dimensional stability than Nafion.**
- **Objective 4. Demonstrate hydrocarbon MEA with > 20% performance and cost advantages over Nafion .**
- **Objective 5. Demonstrate hydrocarbon MEA durability > 1000 hours.**

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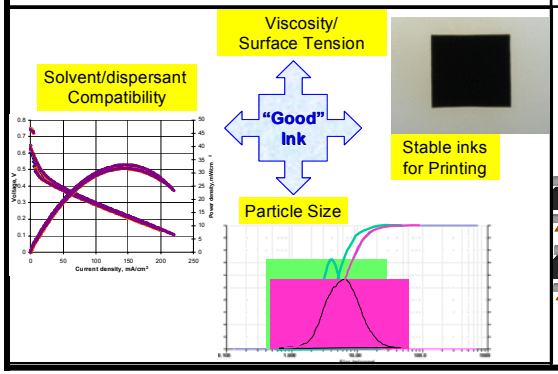
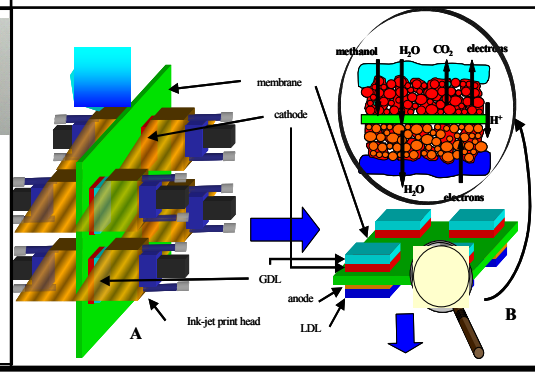
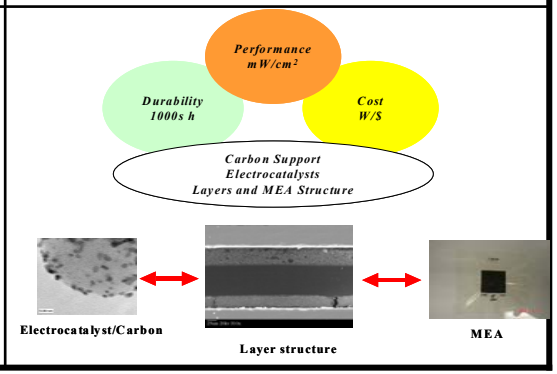
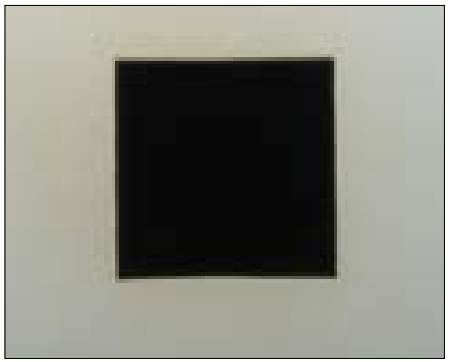
Key Milestones

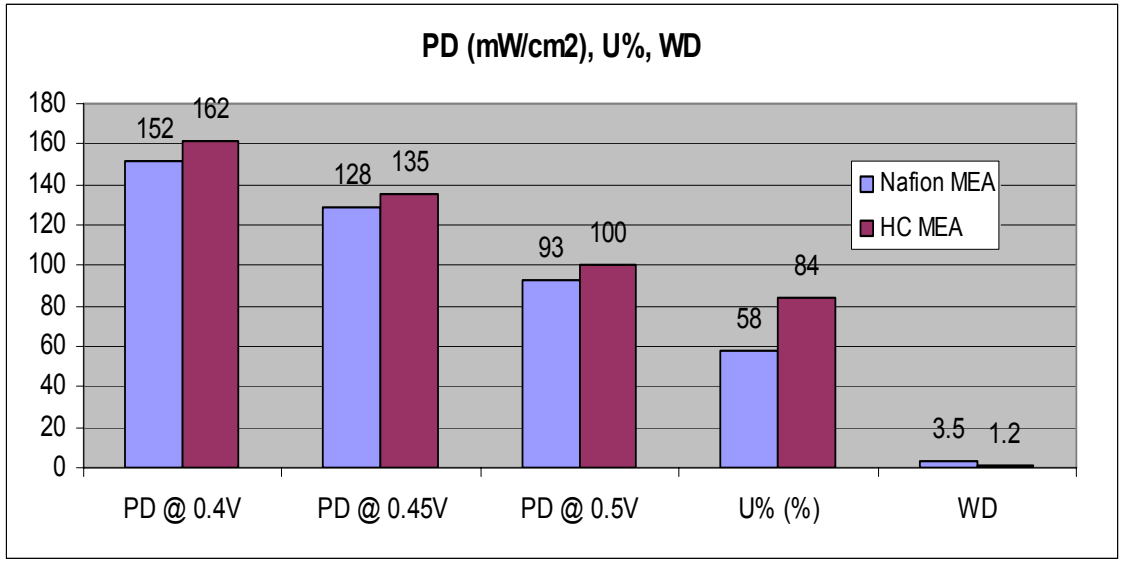
Month/Year	Milestone or Go/No-Go Decision
Mar-07	Go/No-Go decision: Complete the assessment of inkjetting and spray deposition feasibility study in manufacturing CCM/MEA and decide the path forward for Phase II. Developed advanced electrocatalyst ink formulation and demonstrate the operation stability for 24 hours operation. Established a baseline of BOL and durability for down selection of HC CCM/MEA for DMFC.
Feb-08	Milestone: Complete automation of catalyst deposition on membrane with high performance and excellent reproducibility and >95% yield with down selection of 2 HC membranes after initial round of MEA fabrication and testing against Nafion membrane.
May-08	Milestone: Demonstrate >1000 hours durability with HC MEAs and better powder density, high fuel utilization and lower water crossover than Nafion system.

Plan & Approach

Electrocatalyst ink & HC membrane: development & optimization	Printing technology development for catalyst layer deposition	Manufacturing advancement for CCM/MEA products
• Catalyst particle size reduction • Ink formulation with improved stability • Down selection of HC membranes	• Inkjet • Spray deposition • MEA Performance demonstration: HC vs Nafion	• Engineering process automation • CCM manufacturing with high QC and yield • Demonstrate advanced MEA performance with >1000 hrs durability
		

Technical Accomplishments





- **Successful demonstration of automation of CCM manufacturing, incorporated with advanced catalyst inks and HC membranes.**

- **Validation of HC MEA has a higher power density, higher fuel utilization and lower water drag number than Nafion membrane.**

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Progress/Status

- Cabot successfully developed advanced electrocatalyst inks with good stability and compatibility for catalyst layer deposition.
- Cabot new manufacturing platform produced high performance, low cost and durability CCM/MEAs with high production yield.
- Cabot demonstrated HC membrane's advantage in MEA performance, fuel utilization and water management against Nafion membrane.
- Cabot's low cost, durable DMFC CCM/MEAs with less Pt content have presented an attractive path for DMFC commercialization.
- Cabot has been working with DMFC players to validate the value of new manufactured MEAs.

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Future Work

- **Improve manufacturing efficiency via advancing Access Database managing system.**
- **Optimizing depositing process to maximize HC MEA performance with reduced Pt loading.**
- **Demonstrate > 1000 hours durability.**

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Project Summary

Relevance: Help to address FC CCM/MEA manufacturing cost and performance for DMFC commercialization.

Approach: Develop and apply Inkjet/Spray deposition platform for next Gen HC CCM/MEA manufacturing.

Technical accomplishment and progress: Successfully demonstrated new platform for CCM/MEA manufacturing and the advantage of HC membrane over Nafion.

Technology transfer and collaborations: Partner with MTI under Phase I for CCM/MEA performance demonstration; broad industrial validation of CCM/MEA advancement.

Proposed future research: Further improve manufacturing efficiency, demonstrate > 1000 hours durability of HC MEA.

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