**Fuel Cell Manufacturing R&D**

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**Motivation for Our Research**

- We are ever going to realize the significant potential benefits of the switch to a hydrogen economy.
- The most necessary breakthrough (in order for the hydrogen economy to develop) will have to be cost reductions of fuel cells through the development of high-temperature PEM fuel cells and other technologies.
- Research and development are needed to enhance the manufacturing capabilities and lower the cost of fuel cells (DOE 2002).

**The Challenge and Risk**

The Fuel Cell Manufacturing Challenge:

- Any time you change one or more of the following you may have a profound impact on the viability of certain manufacturing processes and systems:
  - Fuel cell or component architectures
  - Materials
  - Application
  - Fuel cell size

**The Risk**

- If we do not aggressively pursue Research and Development of fuel cell manufacturing methods and systems we may well find ourselves in the position of leaders in the design and development of fuel cells, only to have the value added manufacturing performed offshore.
- What if fuel cells don’t succeed? What Will all of our investments be wasted?
- BUT, What if fuel cells do succeed? Will we be prepared for a potentially explosive growth in demand?

**The Opportunity**

One simple example of the potential:

**Laptop Computers**

- 2002 value of approximately 30M units
- Sales could reach 300M/year
- Each computer uses 20 MEAs
- Sales could reach 100M/year
- MEA component material properties
- Manufacturing process parameters
- Resulting MEA material attributes, and
- Performance of the MEA in a stack

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**Our Strategic Focus**

- The focus of our fuel cell manufacturing research is on fuel cell stacks, their materials and components, and the production and assembly thereof.

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**Automated Assembly of High Temperature PEM MEAs**

- Objectives: Develop manufacturing processes and pilot manufacturing line for assembly of high temperature MEAs

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**Membrane Casting – Slot Die Design**

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**Fuel Cell Stack Assembly Research Consortium**

- While many fuel cell system components have similarities to other manufactured components, the stack is fairly unique.
- A fuel cell stack can consist of several hundred layers of thin fragile materials, each with its own dimensional tolerances.
- Assembly and material tolerances can result in poor sealing and stack failures.
- Planning workshop to be held in JQ06, with the consortium membership starting in Q406
- CATS researchers have secured the first ever research equipment grant from the Robotics Industries Association (RIA) to support this research.
- For more information, see http://www.CATS.RPI.EDU

**Experimental Press for MEA Assembly Processes**

- There is a need to better understand the relationships among:
  - MEA component material properties
  - Manufacturing process parameters
  - Resulting MEA material attributes, and
  - Performance of the MEA in a stack

**Energy Efficient Manufacturing Processes for HT MEAs**

- Partner: Progressive Machine and Design (Victor, NY)
- Sponsor: New York State Energy Research and Development Authority (NYSERDA)
- Objectives: To investigate alternative manufacturing processes and systems that will save energy, reduce costs, and improve product quality

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**Schematic of typical PEM fuel cell stack and components (Woodman, 1999)**

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