**The Challenge**

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 type
- Fuel cell or component architectures
- Materials
- Design tolerances
- Application
- Fuel cell size

**The CATS Focus**

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

**The Opportunity**

- One simple example of the potential-
  - Laptop Computers
    - 4Q2006 sales of >20M units, exceeding sales of desktop computers for first time
    - 2007 sales projected at 91.7M units, and 137M units in 2010
    - Assume a modest market penetration, say 20%, that's still 27.4M stacks per year from just one application, 548 Million MEAs
    - That's 52 stacks per minute on a 24/7/365 basis, and 17 MEAs per second 24/7/365

**Development of a HT PEM MEA Pilot Manufacturing Line**

- Partner: Progressive Machine and Design (Victor, NY) and BASF Fuel Cell
- 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
  - Fuel cell size
  - Design tolerances
  - Manufacturing process parameters
  - Resulting MEA material attributes
  - Performance of the MEA in a stack

**Energy Efficient Manufacturing Processes for HT MEAs**

- Partners: Progressive Machine and Design (Victor, NY) and BASF Fuel Cell
- 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
  - UV or CO2 lasers
  - Certified class 1 laser system
  - Built in exhaust system
  - Precise linear stages

**Adaptive Process Controls for MEA Pressing**

- DOE target of 500,000 cars/year
- That requires that one stack be assembled every minute on a 24/7/365 basis, 7 MEAs per second
- That requires that 250,000 m² of electrode be produced each day
- We simply cannot take a day or more to assemble an automotive fuel cell stack

**Another Example**

- Performance of the MEA in a stack
- Resulting MEA material attributes
- Manufacturing process parameters
- MEA component material properties

**Energy Efficient Manufacturing Processes for HT MEAs**

- Resulting commercial laser cell
  - UV or CO2 lasers
  - High precision, high speed
  - Assist gas
  - Built in exhaust system
  - Certified class 1 laser system

**Conclusions**

- We cannot wait until we know all the answers to address key fuel cell manufacturing issues.
- There will be a “technology tipping point” that will result in an exponential growth of demand.
- To minimize risks employ modular, flexible manufacturing processes and systems.
- Major advances are required to make fuel cells viable on a wide-spread basis.

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