The Impact of MLC Manufacturing on Fuel Cell Commercialization

Presented at the 2nd Annual SECA Workshop
Arlington, VA
March 29, 2001
Traditional Methods vs. MLC

**Traditional Methods**
- Electrolyte or electrode supported with subsequent application of additional cell layers
- Multiple firings
- Metal interconnects
- Labor intensive stack assembly

**MLC Method**
- Co-fired repeat units consisting of anode, cathode, electrolyte and interconnects
- Single firing step
- 3rd generation ceramic interconnects
- Limited stack assembly required
Traditional Methods vs. MLC

**Traditional Process**

1. Cast Porous Anode → Fire Anode → Screen-Print Electrolyte → Fire Electrolyte → Screen-Print Cathode → Fire Cathode → Assemble Stacks

**MLC Process**

1. Cast Ceramic Layers → Screen-Print Electrodes → Laminate Stacks → Fire Stacks

   **Interconnects**
   - Laminate Filled Via Interconnects
   - Form Metal Interconnects
   - Coat Metal Interconnects

**Cells**
- Fire Anode
- Screen-Print Electrolyte
- Fire Electrolyte
- Screen-Print Cathode
- Fire Cathode
- Assemble Stacks
Advantages of MLC Co-fired Approach

- Process time savings
  - Single firing step
  - Reduced stack assembly

- Performance Gains
  - Intimate electrode contact - low polarization losses & contact resistance between interconnects
  - Improved seals
  - Minimizes thermal mismatch & corrosion

- Established high-volume, low-cost, high-quality production methods
Cost Reduction Roadmap

- Automation, Material Optimization, Performance Improvement
- Current pSOFC Technology
- MLC Production Techniques

Manufacturing Cost ($ / kW)

- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007

10^5
10^3
10^2

Demonstrate Technology
Demonstrate Commercial Viability
Commercialization

Demonstrate Commercial Viability
Buffalo Manufacturing Facility