**International Collaborations**

**Program:** SOFC’s for Energy Security  
**Sponsor:** NATO Science for Peace and Security Program

**Accomplishments:**  
1) Developed anode and cathode nano structured material  
2) Developed the EBEC electrolyte deposition technique  
3) Validated cell performance  
4) Collaboration with 8 international partners

PI: A Smirnova

**SOLID OXIDE FUEL CELLS**

**Program:** Development of low-cost integrated composite seals  
**Sponsor:** DOE SECA Core Program

**Accomplishments:**  
Developed a novel composite sealing approach that improves thermo-cycling capabilities of SOFC’s  
PI: X Huang

**Program:** Development of Tubular SOFC Hybrid Systems  
**Sponsor:** U.S. Army

**Accomplishments:**  
1) Improved processing techniques to produce 8YSZ tubes with sealed electrolyte layers and solid current collector connections  
2) Multiphysics analysis showed the association of performance losses with observed physical changes  
PI: K Reifsnider, N Sammes, P Menard

**Program:** Advanced Fuel Cell Research for Weapon Applications  
**Sponsor:** ONR

**Accomplishments:**  
1) Demonstrated SOFC performance using synthetic reformate fuel gas  
2) Model SOFC cell/stack to optimize design to meet underwater requirements  
PI: WKS Chiu

**Program:** Structural Imaging & Optimization of Microtubular SOFC Electrodes  
**Sponsor:** ARO

**Accomplishments:**  
1) Tomographically reconstructed 3-D anode structure at 50 nm resolution  
2) Developed Lattice Boltzmann models to perform detailed pore-scale analysis of multi-component gas transport, reformation and electrochemistry  
3) Mapped Ni & YSZ phases by Auger electron spectroscopy and used in pore scale numerical analysis of electronic & ionic charge transfer  

PI: WKS Chiu

**Advanced Materials, Processes and Cell Testing Methods**