

Hydrogen, Fuel Cells & Infrastructure Technologies Program (HFCIT)

The HFCIT Program at ORNL is working to deliver technology breakthroughs that will enable the widespread use of hydrogen as an energy carrier. Use of fuel cells powered by hydrogen will increase energy efficiency, reduce the environmental impacts and reduce dependence on imported fossil fuels. ORNL is active in several key areas including developing materials, components and processes for fuel cell systems, materials for hydrogen delivery, new methods for hydrogen production, novel technologies for hydrogen storage, evaluation of education needs, and R&D efforts for modeling the transition to a hydrogen economy.

Technologies developed by Hydrogen Program scientists and engineers, have led to the introduction of commercial products through the transfer of technology to private industry.

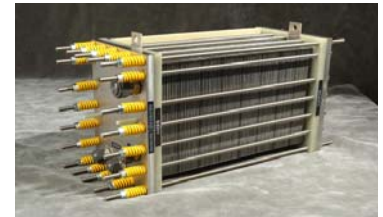
- **Carbon Bipolar Plates** —Low-cost low corrosivity, high conductive graphite plates composed of carbon fiber material sealed with a CVD graphite layer. Licensed to Porvair.
- **Nitrided Metallic Bipolar Plates**— Nitridation forms protective, pin-hole defect free nitride surface coatings that enables thin metallic bipolar plates which translate into high power density fuel cell stacks of interest now in scale-up and testing with OEM's for automotive applications.

Fuel Cells

Fuel cells offer a cleaner, more-efficient alternative to the combustion of gasoline and other fossil fuels in vehicle engines, and provide power in stationary and portable power applications. ORNL is working closely with national laboratories, universities, and industry partners to overcome critical technical barriers to fuel cell commercialization. Current R&D focuses on the development of reliable, low-cost, high-performance fuel cell system components for transportation and buildings applications. ORNL R&D activities encompass fuel cell membranes, bipolar plates, cathode catalysts, thermal management systems, and diagnostics to understand degradation mechanisms.

Hydrogen Delivery

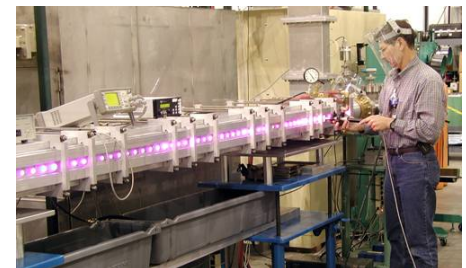
ORNL is DOE's lead laboratory for hydrogen delivery and is represented on the DOE Delivery Technical Team and the DOE Pipeline Working Group. High pressure hydrogen transmission is expected to provide the most economic delivery of hydrogen on a large scale. The HFCIT Program at ORNL leverages the facility's long history of leadership in materials sciences in order to investigate solutions for pipeline delivery



Fuel Cell



Nitrided Bipolar Plate



Graphitization of Carbon Fiber



Friction Stir Welding

of hydrogen. ORNL research experience in characterization, failure analysis, and materials design in high temperature and high pressure applications is valuable in the development of new materials that are resistant to hydrogen embrittlement, development of new welding materials and welding processes, investigation into applications of fiber-reinforced polymer pipeline materials, and evaluation of materials for compressors.

Analysis

Systems analysis leads to increased understanding of individual components to the hydrogen energy system and is used to continually evaluate various alternatives in the future hydrogen economy. It supports hydrogen infrastructure development and technology readiness by evaluating technologies and pathways, guiding the selection of RD&D projects and estimating the potential value of RD&D efforts. ORNL has developed the HyTrans model, a tool for simulating market transitions to a hydrogen transportation system, and has used the model to evaluate scenarios for the transition to hydrogen vehicle systems.

Storage

Hydrogen Storage R&D focuses on the development of on-board vehicular hydrogen storage systems that will allow for a vehicle driving range of more than 300 miles. ORNL is conducting exploratory research into new materials and concepts. Active research areas include the investigation of single-walled carbon nanohorns for hydrogen storage, the development of complex hydrides, such as the borohydrides, which show the potential for use in reversible hydrogen storage, testing the leak rates in polymer liners for compressed gas vessels, and manufacturing of low-cost carbon fibers for both on-board and off-board storage vessels.

Education

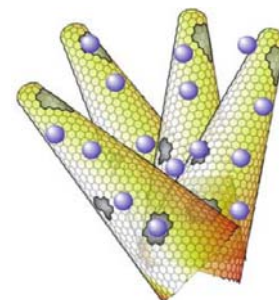
Current public knowledge and awareness levels of hydrogen and fuel cells are low, and prevalent misunderstandings of hydrogen properties have led to negative opinions about the safe use of hydrogen as an energy carrier. ORNL is the lead organization for the DOE Baseline Knowledge Assessment Survey. The data collected in this activity will guide education program development and activities and will provide a quantifiable baseline from which to measure changes in knowledge of hydrogen technologies among key target audiences over time.

Point of Contact:

Dr. Timothy R. Armstrong, Manager
Hydrogen, Fuel Cells & Infrastructure Technologies Program (HFCIT)
Oak Ridge National Laboratory
PO Box 2008 MS 6186
Oak Ridge TN 37831-6186
Phone: 865-574-7996
Fax: 865-241-0112
E-mail: armstrongt@ornl.gov
<http://www.ornl.gov/sci/hfcitprogram/>
<http://www.ornl.gov/sci/fuelcellprogram/>



Cable Winder for Fiber Reinforced Pipeline



ORNL Carbon Nanohorn

