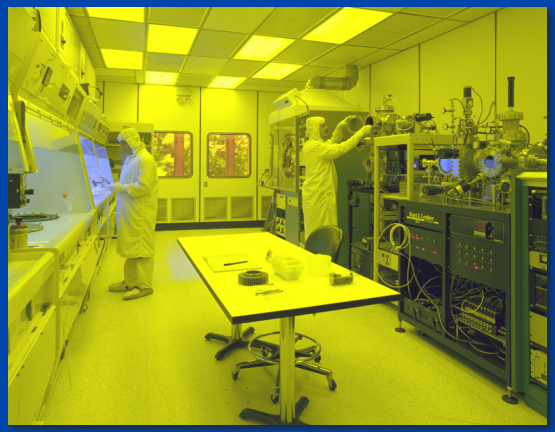
Energy Related Labs



Clean room

The fuel cell test lab designed to test fuel cells of various power levels and chemistries

Hybrid hydrogen fuel-cell-powered carry-all utility truck

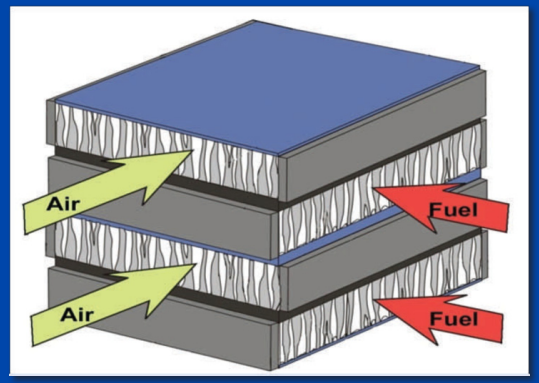
General Information

NASA Glenn Research Center
www.nasa.gov/centers/glenn/home/

Glenn Test Facilities Guide
http://facilities.grc.nasa.gov/documents/facilities_Booklet_2005.pdf

Glenn Research Center Resume
www.nasa.gov/centers/glenn/about/

Business Development and Partnership
http://newbusiness.grc.nasa.gov



Advanced solid oxide fuel cell

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National Aeronautics and Space Administration

Battery and Fuel Cell Competencies

www.nasa.gov

General Information

Batteries
NASA missions demand a high level of performance from their energy storage devices. Lithium-based batteries provide a versatile, reliable, modular, lightweight, portable source of energy for aerospace applications. NASA's lithium-based battery development efforts address operation in the unique environments required by aerospace missions. Technology challenges involve the development of compact, lightweight, safe, battery systems that operate over a wide range of temperature and pressure environments.

Fuel Cells
Fuel cells are electrochemical conversion devices that continuously transform chemical energy into electrical energy. Fuel cells provide a primary source of power that can support a wide range of aerospace applications. Fuel cells will generate electricity as long as reactants (fuel and oxidant) are supplied. Conventional fuels include hydrogen, hydrocarbons, and alcohols; oxygen and air are the most common oxidants. In addition to technology challenges similar to those for batteries, fuel cells in space environments involves fluids management and operation in multigravity environments and the use of pure oxygen.

Regenerative Fuel Cells
Regenerative fuel cells combine a fuel cell with an electrolyzer that is capable of converting the fuel cell product(s) (often water) into reactants (hydrogen and oxygen) when energy is supplied. The addition of an electrolyzer results in a reversible energy storage system that functions much like a battery and can be used for applications that require large-scale storage.

Terrestrial Challenge

Utilize and demonstrate electrochemical systems as an effective energy storage option for renewable energy systems based on solar or wind sources for power generation.

Battery and Fuel Cell Competencies

Electrochemistry
This competency addresses advanced electrochemical power generation and energy storage devices. It is focused on fuel cells, regenerative fuel cells (fuel cell + electrolysis cell), and batteries. It encompasses materials development and evaluation, cell component development and optimization, stack and battery technology, and overall system design elements focused on maximizing specific energy, energy density, performance, and life. Capabilities also include design and performance modeling and technology specification and validation for NASA mission applications.

Instrumentation and Controls
This advanced research in harsh environment sensors, high-power electronics, micro/nano electromechanical systems, high data rate optical instrumentation, and active and intelligent controls to enable self-feeling, self-thinking, self-reconfiguring, and self-healing systems. This competency is responsible for conducting and directing basic and applied research advanced instrumentation controls technologies for aerospace propulsion and power applications.

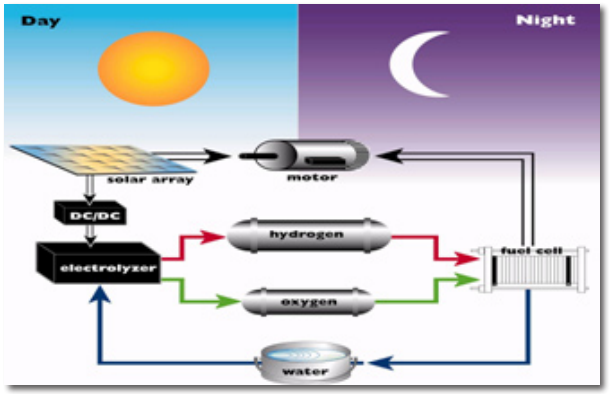
Materials
This competency develops processes and characterizes materials for aerospace applications. Metallic, ceramic, and polymeric materials are the current focus, both monolithics and composites. It is possible to enable and extend component durability by understanding, developing, and demonstrating the feasibility and viability of advanced coatings.

Photovoltaics
The objective of this competency is to develop future high-efficiency photovoltaic cells with high power/mass ratios. Capabilities include high-power, lightweight systems, including development of robust, easily deployed, high-efficiency arrays.

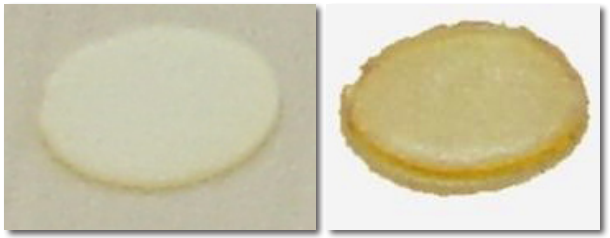
Program Management
The ~100 project and program managers at Glenn have experience in managing 119 Centaur rocket launches, the Space Station Freedom power system, Ares launch vehicle systems, as well as numerous electric propulsion, communications, aeropropulsion, and microgravity projects.

Simulation and Modeling
This competency focuses on the design and modeling to identify systems as well as components. Virtual reality techniques support the design of new technologies. Simulation of environments provide testing for systems and components.

System Analysis and Engineering
This competency focuses on using tools to analyze aerospace vehicles, propulsion, and power concepts. It is focused on the development and maintenance of systems engineering processes and the application of engineering processes at a systems level.



Regenerative fuel cell.



High-temperature proton exchange membrane fuel cell membranes.