THE HYDROGEN ECONOMY AND FUEL CELLS

General Colloquium–Physics Department

December 4th, 2008–Part of Purdue's Hydrogen Day Activities

Professor George H. Miley
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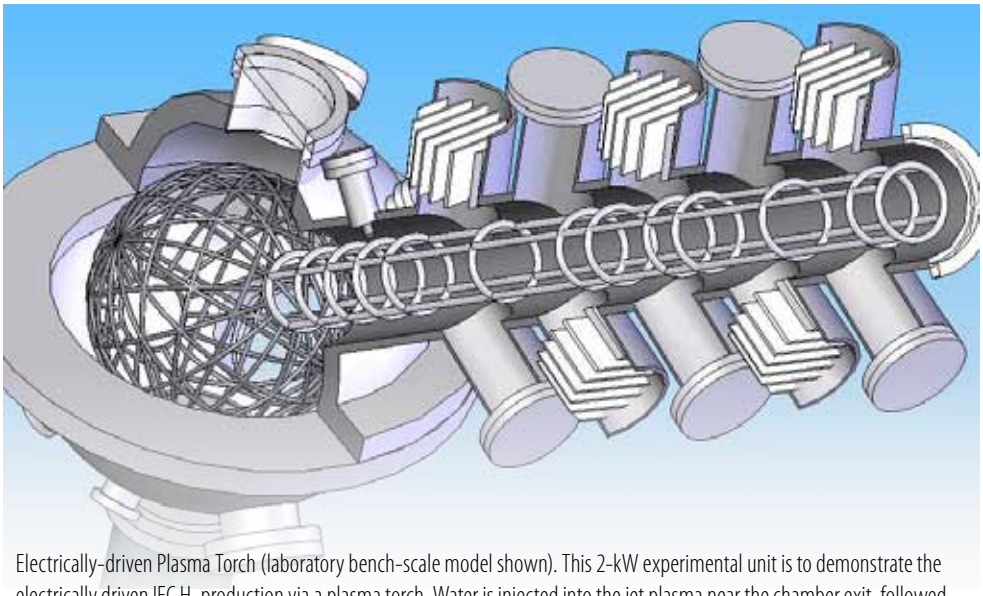
George H. Miley is known for innovative research on new energy sources and energy conversion. He is a Fellow of the APS and has received the Teller medal for research on inertial confinement energy.



Electrically-driven Plasma Torch (laboratory bench-scale model shown). This 2-kW experimental unit is to demonstrate the electrically driven IEC H_2 production via a plasma torch. Water is injected into the jet plasma near the chamber exit, followed by the electrostatic ion separation and energy recovery structure. Products are N_2, O_2, H_2 and electricity.

Hydrogen is proposed as the basis for a worldwide energy economy which can resolve current issues of dwindling supplies of fossil fuels and meet environmental requirements for a greener future. Hwever, to achieve this vision many obstacles must be overcome, starting with a greenhouse free production method and development of a distribution infrastructure.. The complete infrastructure for a hydrogen economy involves production (by both nuclear and non-nuclear energy sources), hydrogen handling and safety, and transportation and storage methods, from high pressure or cryogenic tanks to metal or chemical hydrides. The basic science and technology of fuel cells is very interdisciplinary, including electrochemical processes, fuel cell thermodynamics, and materials technology.

After a broad overview, Dr. Miley will discuss two of his ongoing research projects related to hydrogen generation and fuel cells. His fuel cell research involves the use of a chemical storage of hydrogen in sodium borohydride and oxygen in hydrogen peroxide. The two are used in a "direct" low-temperature PEM fuel cell which has a very high energy density and is air independent. It is very attractive for both space and underwater applications. Catalysis development was key to the success of this fuel cell and the catalyst physics will be discussed.

In a second hydrogen project, hydrogen production via a plasma torch process is under study. As illustrated in the figure above , this involves injection and ionization of water into a plasma "jet" stream followed by electrostatic separation and slowing of the ions, direct conversion of excess ion energy into electricity, and gas collection. The plasma physics of the torch and the physics of the energy conversion will be highlighted. Also, the extension to a self-powered fusion version will be discussed

The Future Hydrogen Economy December 4th, 2008

12:00-1:30 PM
Student luncheon (free pizza and soda) and discussion with Dr. George Miley, University of Illinois and General Motors Hydrogen Fuel group
Location: MSEE B12

2:00-3:00 PM
PM Hydrogen Storage Seminar-Eric Poirier, General Motors–"Experimental and theoretical methods for the investigation of hydrogen adsorption thermodynamics in nanoporous adsorbents"
Location: ME 155

3:30-4:00 PM
Reception–All invited (free coffee & cookies)
Location: PHYS 242

4:00-5:00 PM
Dr. George Miley's, University of Illinois, General Colloquium, "The Hydrogen Economy and Future Hydrogen Production Methods"
Location: PHYS 203

General Motors Hydrogen Fuel Group-Dr. Mei Cai, Dr. Anne Dailly, Dr. Eric Poirier, Dr. Darsh Kumar **University of Illinois, Hydrogen Production**-Dr. George Miley

A Preview of Purdue's Hydrogen Symposium, April 22-23, 2009

Host: Professor David Koltick
Physics Department
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