DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

SEMINAR

Date: Monday, August 11, 2003
Time: 11:00 am - 12:00 pm
Room: SL 165

Reception starts at 10:45 am. Everyone is invited

Challenges and Opportunities in Fuel Cells Development: From Materials to Devices

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Abstract. Fuel cells are electrochemical devices which efficiently generate electrical power from chemical fuels (e.g., hydrogen and oxygen) with minimal or zero harmful exhaust emission. The membrane electrode assembly (MEA) is the core of polymer electrolyte fuel cells (PEFC), consisting of anode and cathode catalyst layers bonded onto both sides of a polymer electrolyte membrane. The catalyst layer is a composite of recast Nafion® (a proton conducting polymer) and a nano-particulate metal catalyst supported on an electronically conducting material such as amorphous carbon. To overcome the slow electrochemical reactions, a highly effective catalyst, for example, platinum, is required in fuel cells. A proton-conducting polymer is used as both electrolyte for proton transfer between anode and cathode, and gas separator for preventing the mixing of hydrogen and oxygen gases.

The development of a high performance PEFC involves the development of both materials (i.e. catalysts, carbon supports, membrane electrolytes) and devices (i.e., gas diffusion layer (GDL), gas flow field, bipolar plates). In general, fuel cells research includes the materials development, materials processing (MEA making), mass transport phenomena (both liquid and gas), heat transfer and hardware design. This talk will focus on the characterization/understanding of the MEA structure, development of new MEAs based on the knowledge of the MEA structure and the formulation of catalyst ink. The comparison of different catalysts for PEFC and the durability of PEFC will also be discussed. The potential research opportunities for fuel cells will be presented in terms of materials development, flow dynamics, simulation/modeling, and hardware design. The potential disciplinary collaboration from mechanical engineering, electric engineering, materials science and technology, chemical engineering, and chemistry will be proposed.