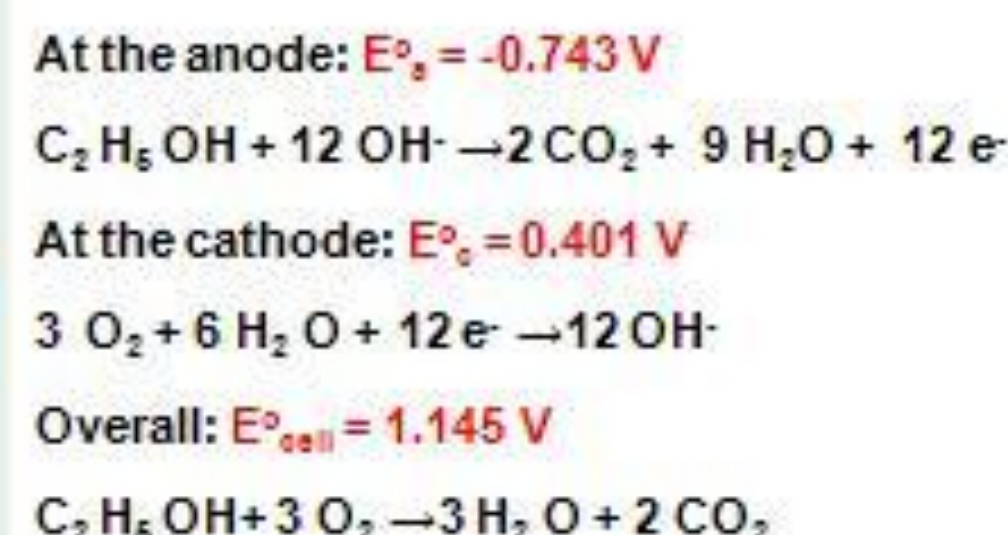
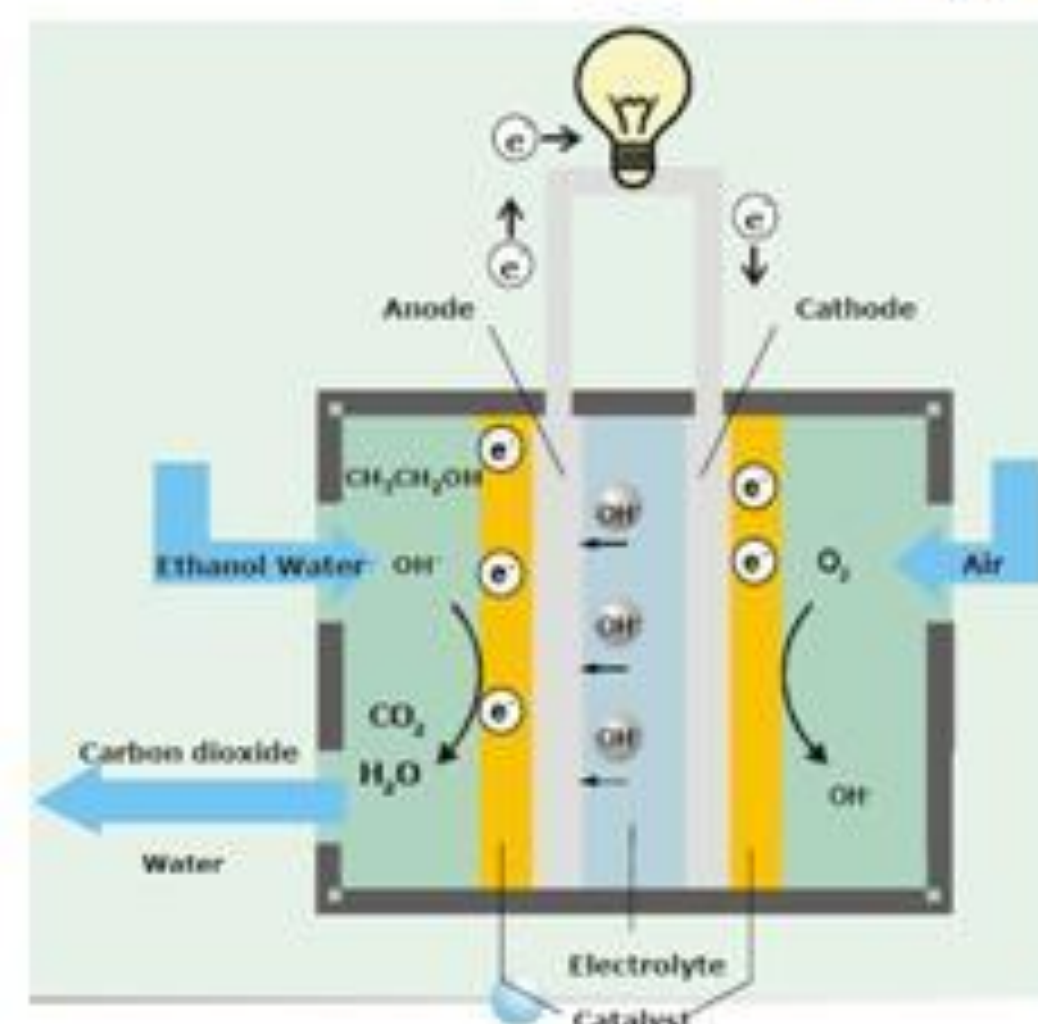


Research Expertise

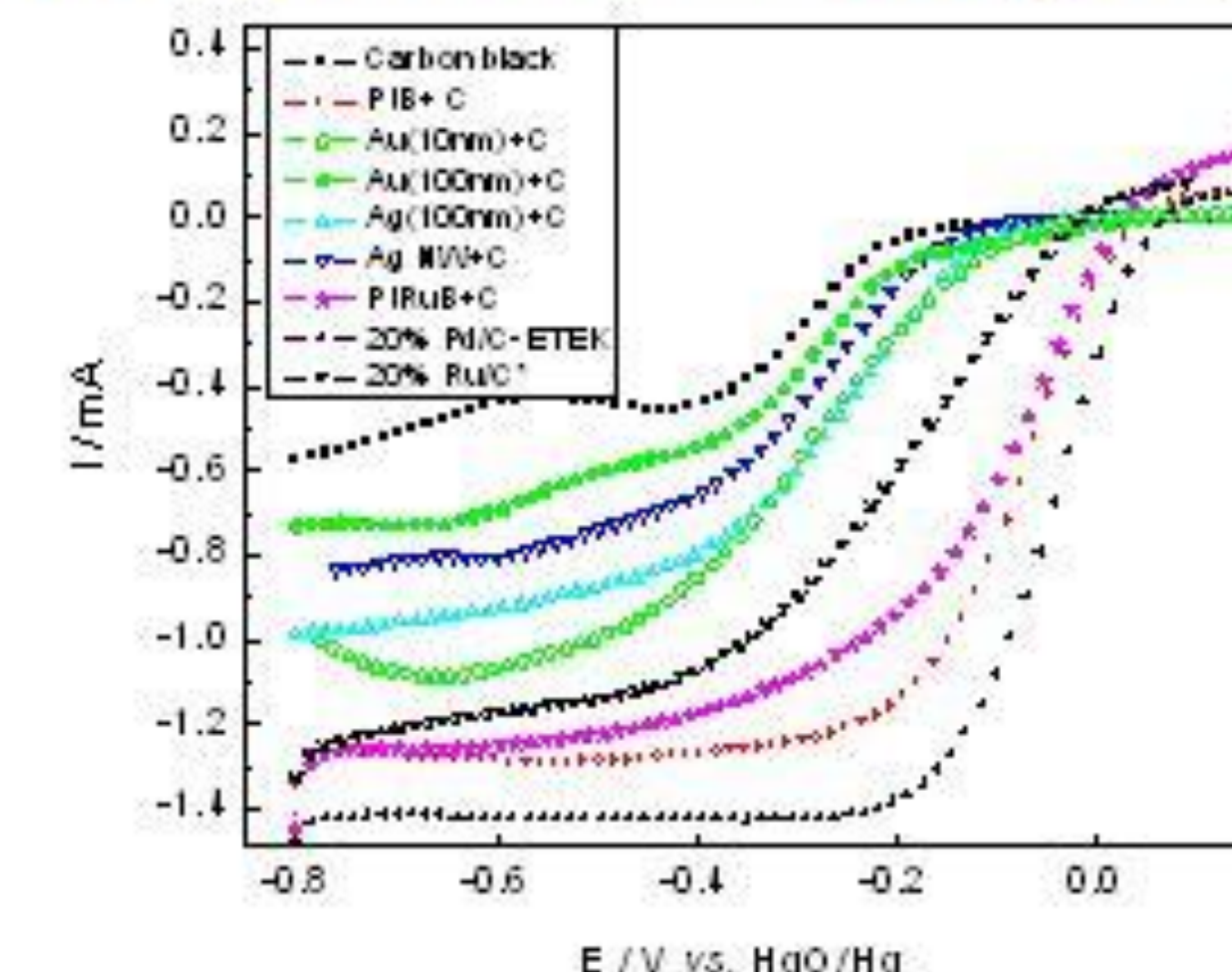
- Electrochemical Technology and Engineering
- Material science and engineering
- Design and application of rechargeable battery systems
- Design and application of polymer electrolyte fuel cells
- Design and application of solar cells

Design and Test of Polymer Electrolyte Fuel Cells



DEFC Fuel Cell: Ethanol + Oxygen \rightarrow H₂O + CO₂ + Energy

Development of Non-Pt Catalysts



E / V vs. HgO/Hg
 * For 20% Pt/C, the metal loading on electrode is 40.8 $\mu\text{g cm}^{-2}$
 For others, the metal loading on electrode is 204.1 $\mu\text{g cm}^{-2}$

Potentiodynamic oxygen reduction current obtained in RDE measurements. T=23°C. Electrolyte 0.1 M NaOH saturated with O₂. Scan rate: 10 mV s⁻¹

Research Highlights

OBJECTIVES

- To develop methanol and ethanol resistant non-precious metal catalysts for oxygen reduction;
- To study high efficiency catalysts for ethanol oxidation;
- To investigate reformer technologies to produce hydrogen from ethanol;
- To develop and evaluate new membranes for direct alcohols fuel cells.

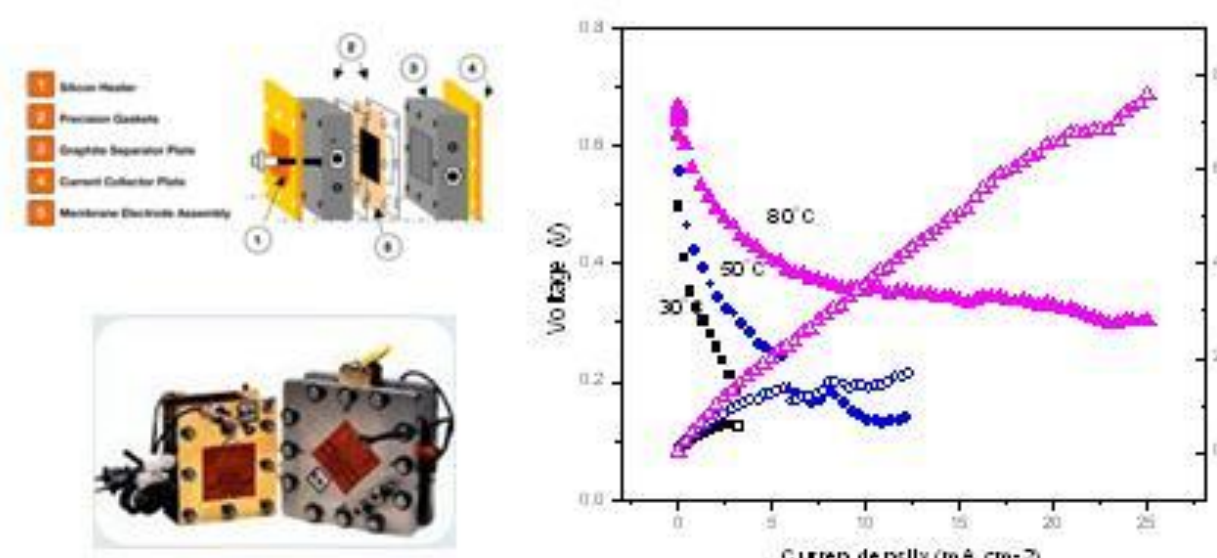
TECHNICAL CHALLENGES

- Reduce cost, improve activity and stability of catalysts for oxygen reduction.
- Improve activity of catalysts for ethanol oxidation.
- Improve efficiency of reforming ethanol to hydrogen.
- Reduce cost and improve ionic-conductivity and thermal/chemical stability of membranes for direct alcohols fuel cells.

APPROACHES

- Catalysts development through theoretic computation, synthesis of non-precious metal catalysts and electrochemical characterizations.
- Reformer development through screening different types of catalysts and testing key factors to determine hydrogen production efficiency.
- Ion-exchange membrane development through synthesis, thermal/chemical and electrochemical characterizations.

Design and Test of Solid-Alkaline Anion Exchange Membrane DAFCs



Applications of Fuel Cells

- Power portable electronics and devices.
 - Replace diesel generator by a backpack size fuel cell.
 - Refuel by a quick fuel cartridge replacement.
 - Recharge existing secondary batteries.
- Transportation
 - Clean, efficient and flexible fuels (methanol, ethanol, hydrogen or other types of fuels)



Facility and Capabilities

- **Electrochemistry and Material Synthesis Lab (ET 114B)**
 - Solartron Electrochemical (1287 and 1470) interfaces and Impedance (1260) analyzers
 - Pine Instrument Bipotentiostat
 - Veeco's Nanoscope III Scanning Probe Microscope
 - A glove-box for Li-battery research
- **Fuel Cell and Battery Assembly and Testing Lab (ET 114A)**
 - Hot-press equipment for making MEAs
 - Ethanol reformer to generate hydrogen
 - Fuel cell test equipment

