



Portable Kit for Alkaline Membrane Fuel Cell (AMFC)

Advisor: Juan Ordonez,
Jose Vargas
Sponsor: FIPSE
Group 10

TEAM

NICOLE ALVAREZ
BRYAN ANDERSON
COLLIN HEISER
MUSTAFA NEK
JAMES RICHARDSON

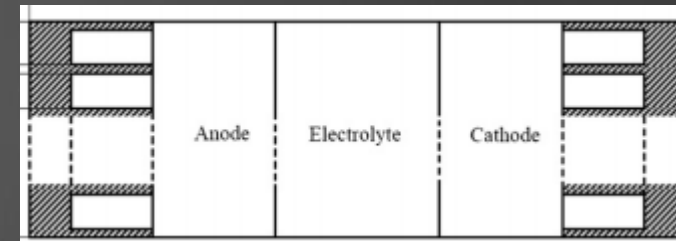
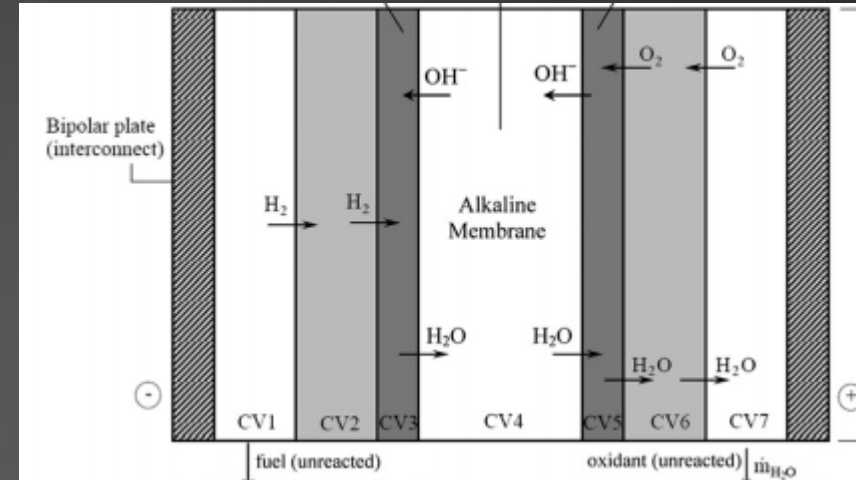
What is an Alkaline Membrane Fuel Cell

- ▶ Four Main Components

- ▶ Anode
- ▶ Cathode
- ▶ Membrane
- ▶ Bipolar Plates

- ▶ Advantages

- ▶ No environmental pollutants
- ▶ Higher Current Density
- ▶ Organic Membrane used



Basic Schematic of an AMFC

Why use an AMFC over PEM?

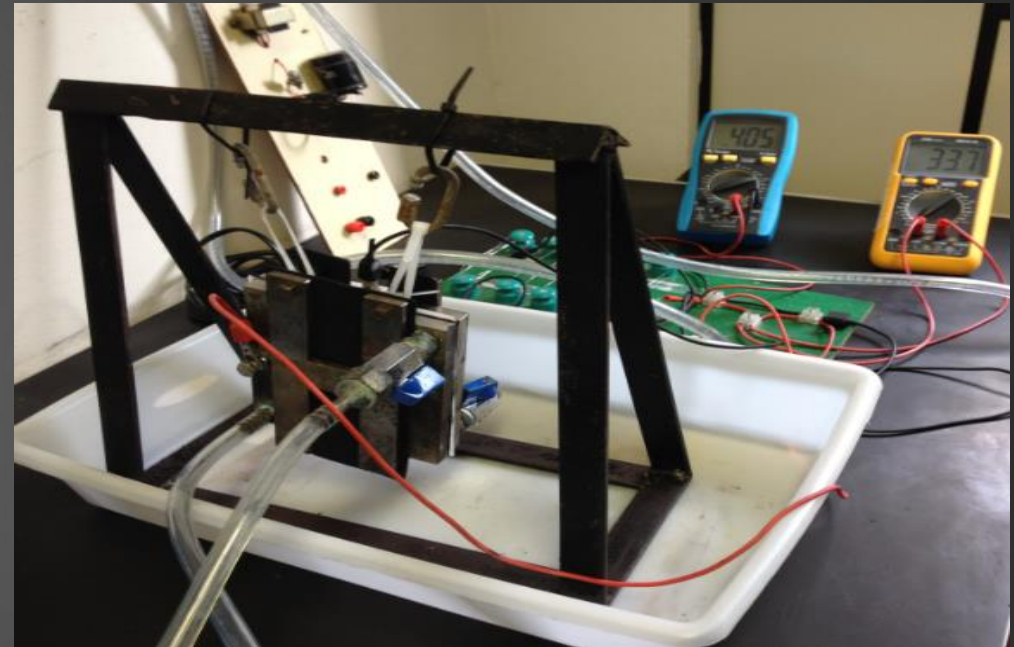
- ▶ AMFC's have a higher performance when compared to PEM Fuel Cells
 - ▶ AMFC can reach up to 60% efficiency in certain applications
- ▶ AMFC's have significantly longer run time than current PEM Fuel Cells
- ▶ AMFC's have a lower operating temperature than PEM Fuel Cells



Project Overview

- ▶ We are designing a portable AMFC with custom specifications to meet our particular application
- ▶ Helping to prove the effectiveness of the organic cellulose membrane and KOH
- ▶ This will be done by taking the existing research as a base for introducing some of the new ideas we will be implementing

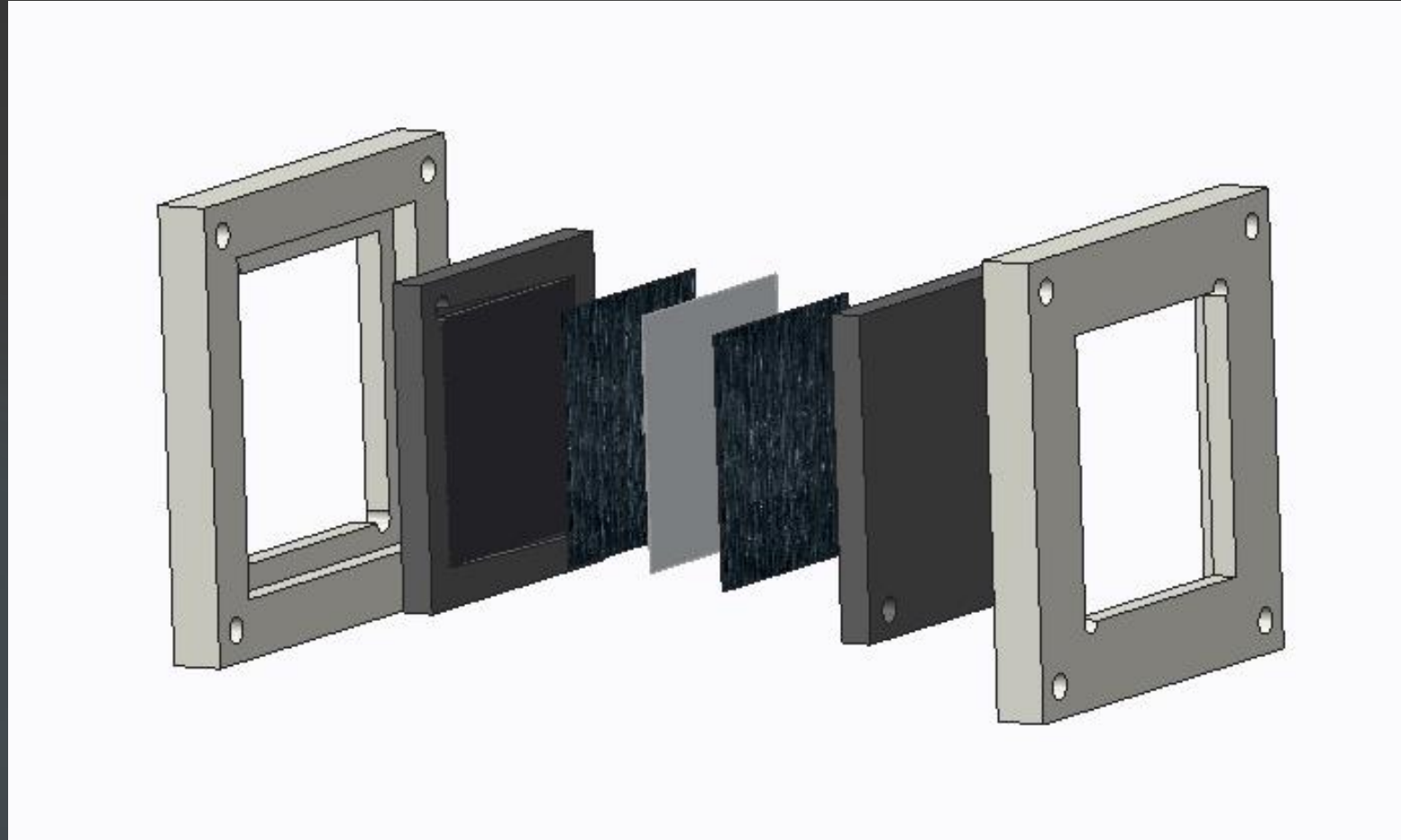
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Existing AMFC in Brazil

Collin Heiser
Portable Kit of AMFC

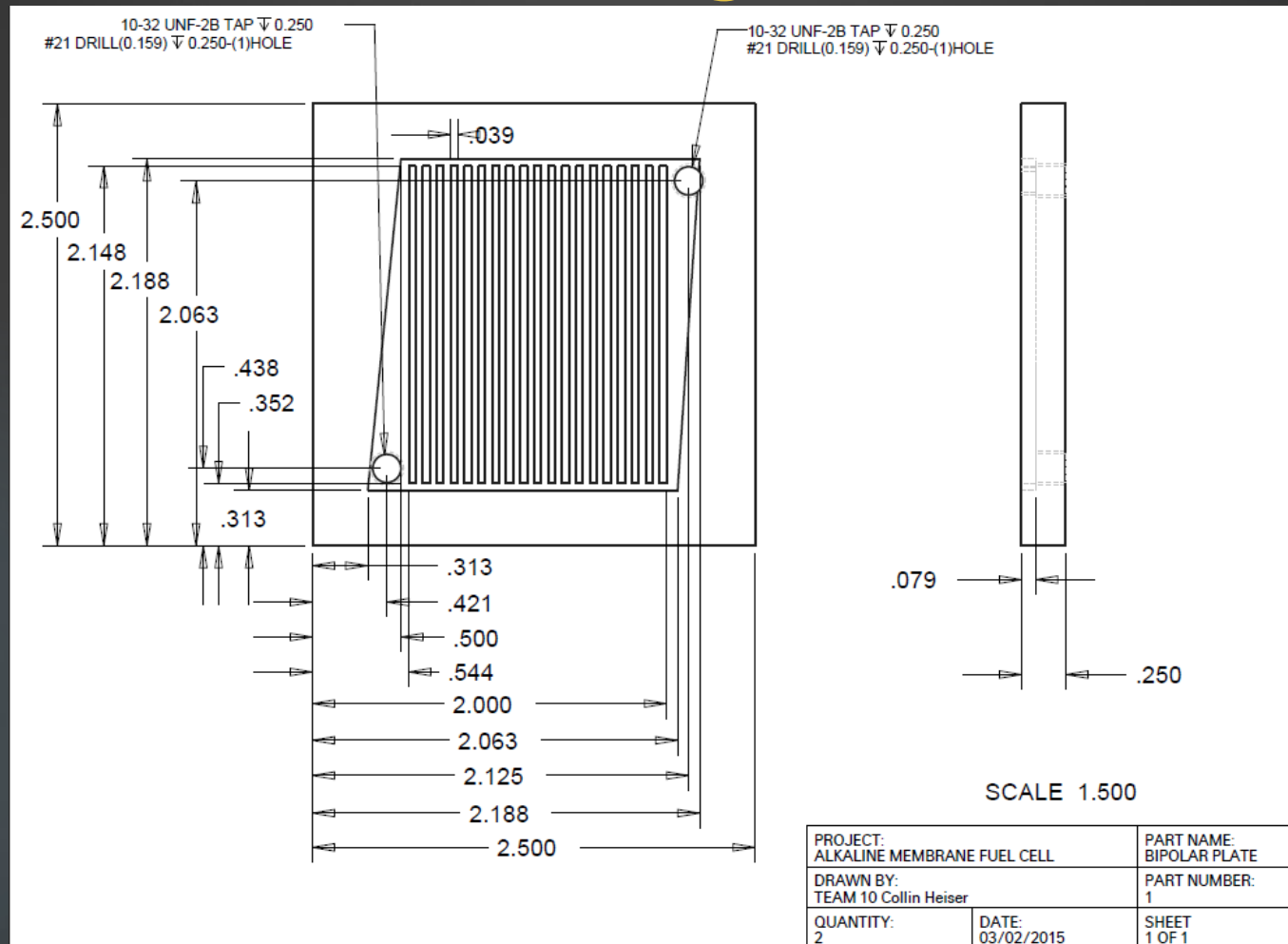
Exploded View



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Collin Heiser
Portable Kit of AMFC

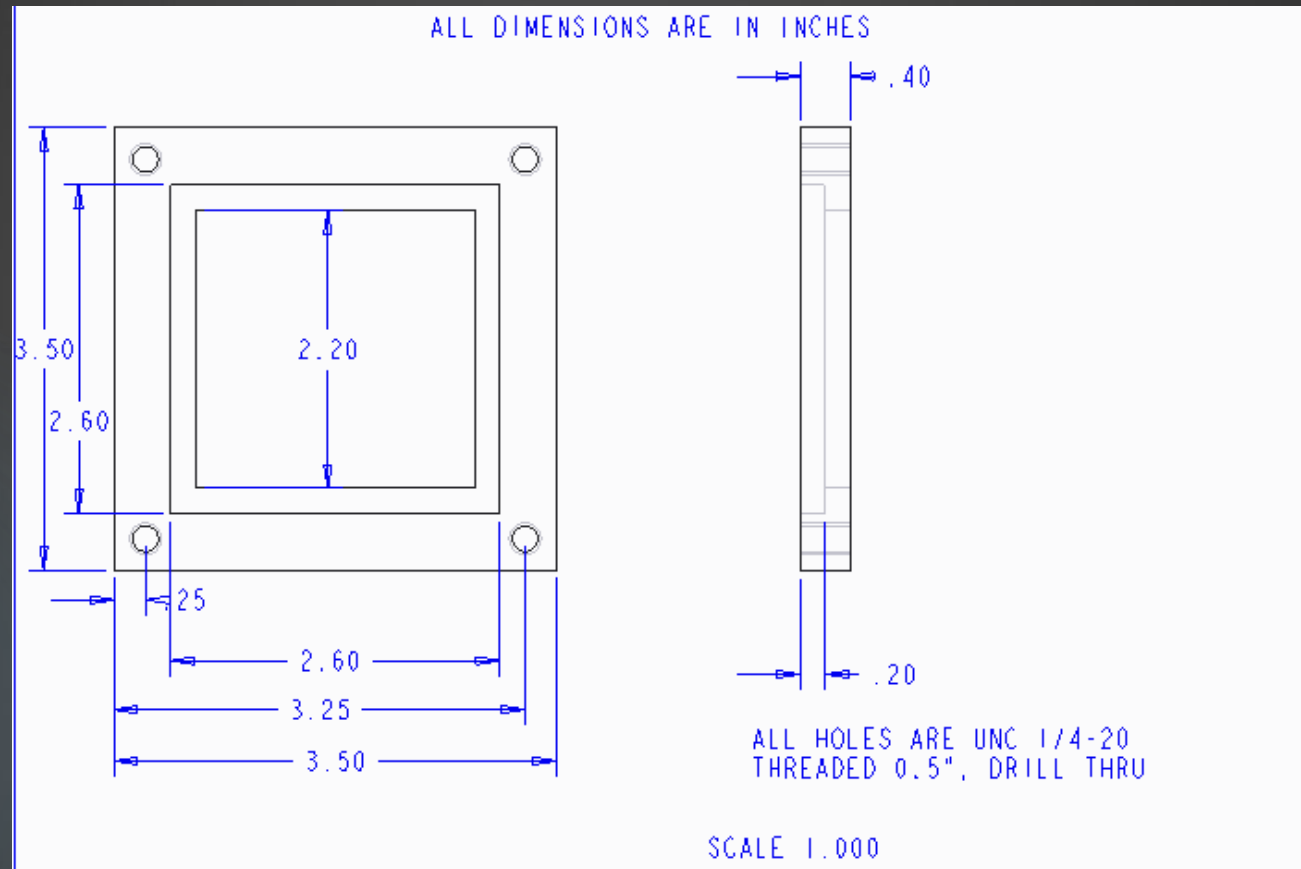
Bipolar Plate Drawing



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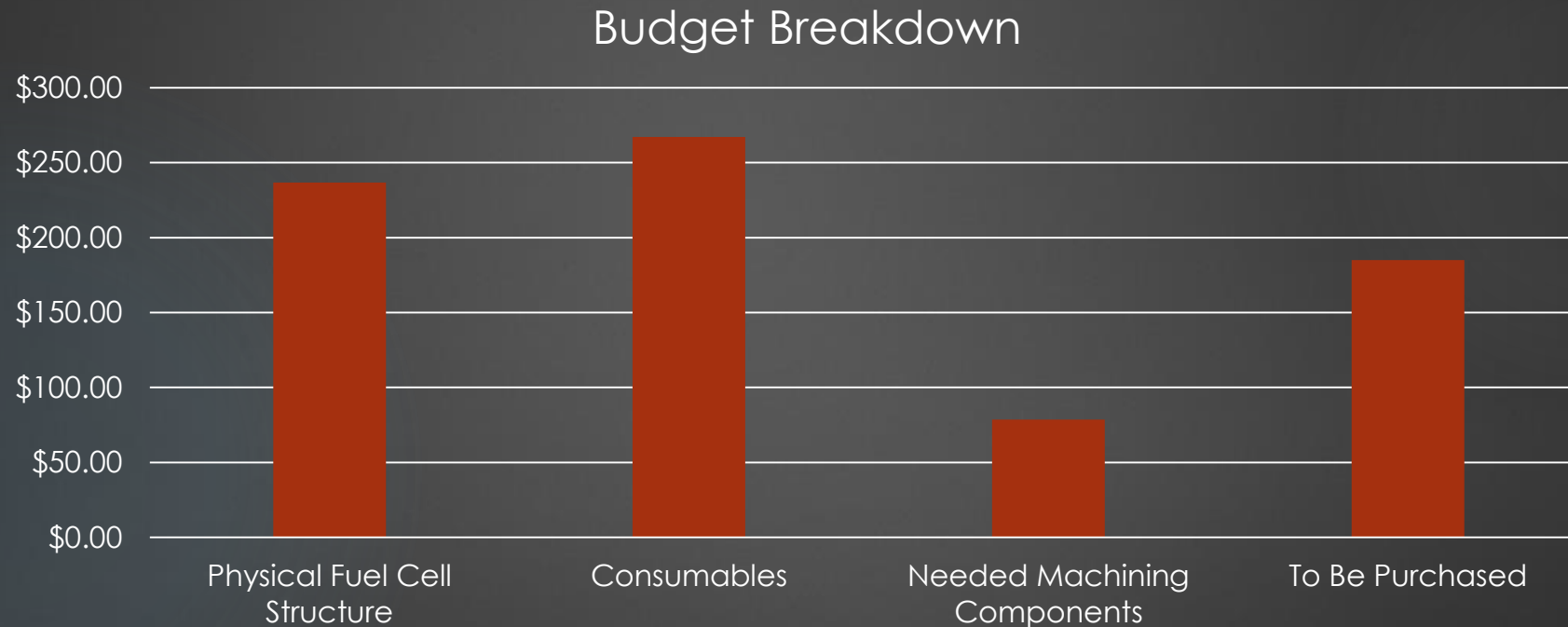
Collin Heiser
Portable Kit of AMFC

Mounting Bracket Drawing



Budget Summary

- ▶ 77% of the budget has been used with no more expected costs



Fuel Cell Testing Site

- ▶ Testing of the fuel cell will occur at the High Magnet Laboratory.
- ▶ The facility has hydrogen and oxygen gas as needed, as well as a safe controlled environment to conduct the testing.
- ▶ The laboratory supervisors who have approved all aspects of this testing are Mark Vanderlaan, Brian Mastracci, and Ram Dhuley.

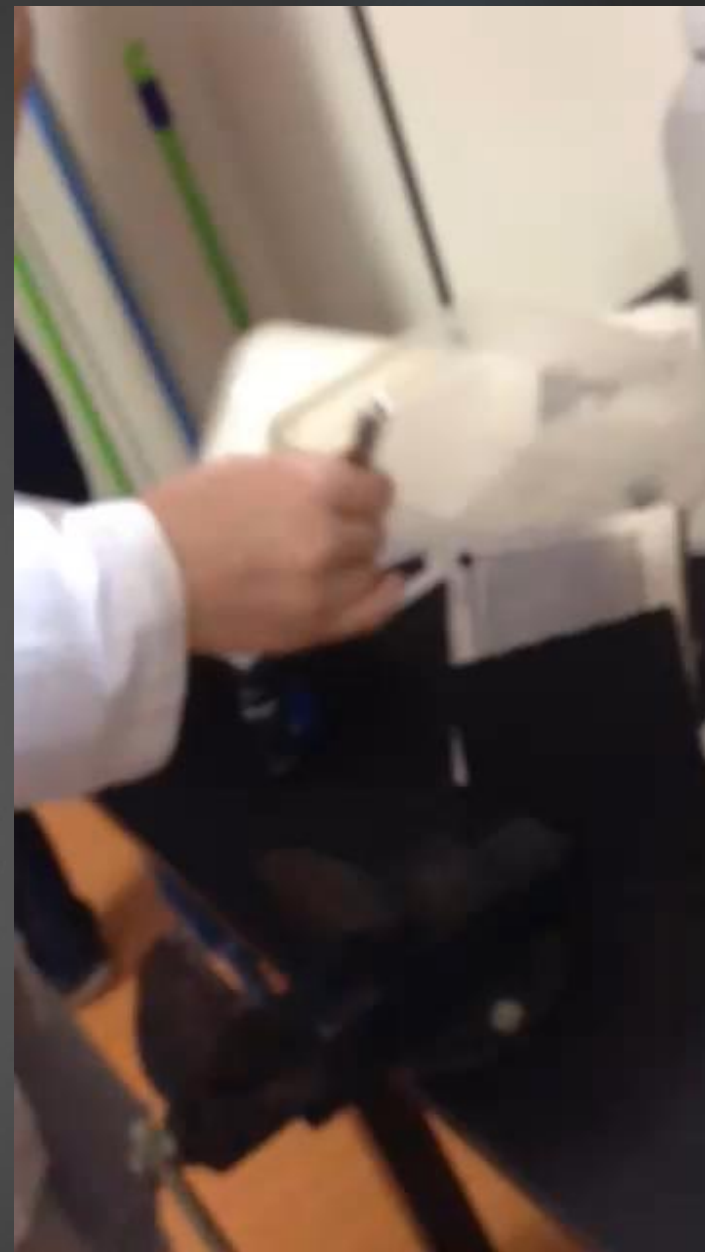


Tests to be Conducted

- ▶ The polarization curve of the cell
- ▶ An endurance test
 - ▶ This tests the duration that the cell can run before failure
- ▶ A Membrane Durability test
 - ▶ This increases the pressure on a fully used membrane until failure

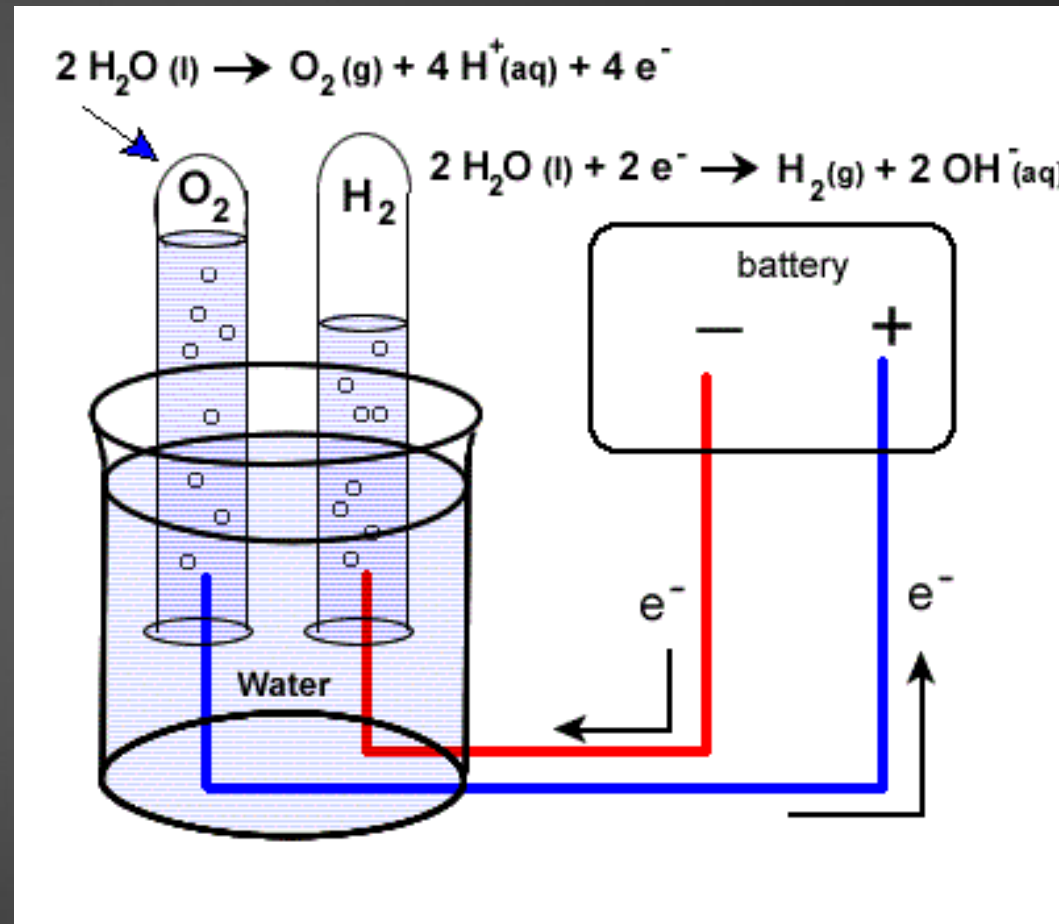
Items to Complete

- ▶ Final cell assembly
- ▶ Optimization of the cell through the tests mentioned
- ▶ Fit the cell into the custom cut casing
- ▶ Incorporate electrolysis and re-optimize



Electrolysis of water

- ▶ Ideal reaction
 - ▶ $2 \text{H}_2\text{O}(l) \rightarrow 2 \text{H}_2(g) + \text{O}_2(g)$
- ▶ H_2 & O_2 Gas production is proportional to the amount of electrical charge added to reaction
- ▶ Hydrogen to Oxygen development ratio
- ▶ Safety standards and precautions



Updates from UFPR

- ▶ Operation and Safety Manual
- ▶ Larissa Villar & Leonardo Oliveira
- ▶ Arriving on April 6th, 2015



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Mustafa Nek
Portable Kit of AMFC

Open House at



Center for Advanced Power Systems

- ▶ Brazilian Students participating with open house
- ▶ Week of 4/13/2015
- ▶ Provide prototype of kit with case
 - ▶ powering an LED light showcasing electrical output

Challenges Faced

- ▶ Parts changed to make machining process easier
- ▶ Communication between Machine Shop
 - ▶ Additional unexpected tools needed
- ▶ Staff
 - ▶ Limited Access

Future objectives

- ▶ Machining has begun
 - ▶ Machining started on 3/17/2015
- ▶ Perform the needed tests on the fuel cell
 - ▶ Testing can begin 3/23/2015
- ▶ Deliverables 4/03 & 4/10
- ▶ Design an electrolysis system sufficient to run the fuel cell
- ▶ Order the necessary casing to ensure the cells portability

Questions