

Abstract:

Since fossil fuels are not an abundant resource in the United States, research on fuel cells is being done in order to find another way to provide power for cars. Fuel cells carry both advantages and disadvantages. This poster shows the process of electrolysis, as well as the calculation for the efficiency of the fuel cell car.

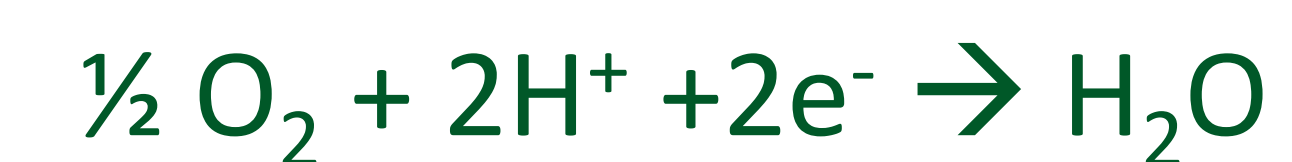
Background:

It is thought that the English physicist Sir William Robert Grove is the inventor of the fuel cell. There are two half-reactions that occur in a fuel cell, one on either side of the electrolyte.

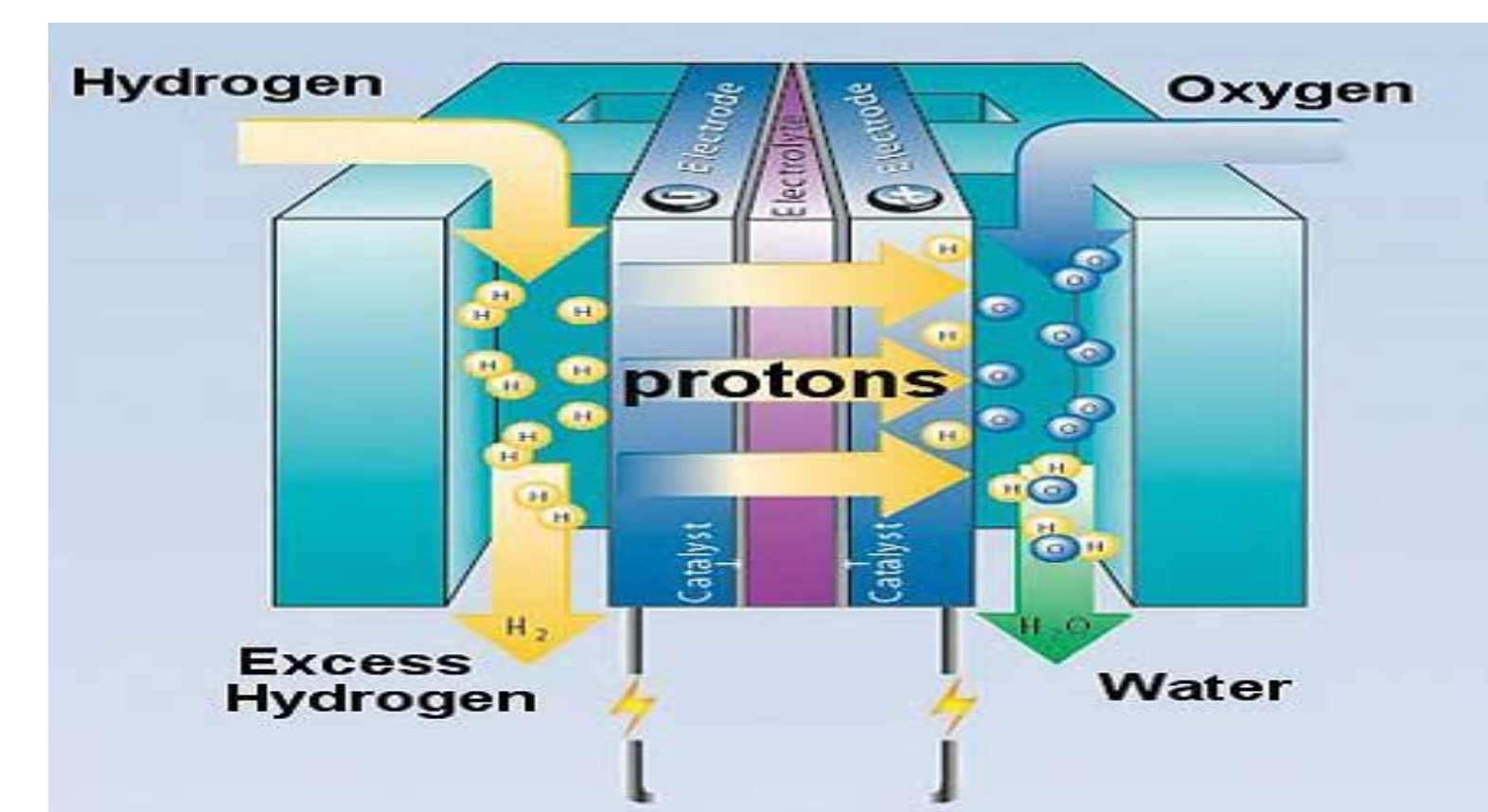
The reaction on the left side of the electrolyte occurs at the anode. It involves the oxidation of hydrogen:



The reaction on the right side of the electrolyte occurs at the cathode. It involves the reduction of oxygen:



The net reaction is:



The above picture demonstrates how a fuel cell operates.

The Process and Calculations:

The voltage on our battery pack was 2.94V; We attached the battery with two multi meters and measured the following:

H₂ production rate: 2 mL/min
O₂ production rate: 1 mL/min
Voltage: 2.03 Volts Current: 0.17 Amps
Ration of H₂ production to O₂: 2:1

Next we disconnected the motor from the fuel cell. Then set up the circuit so we could measure efficiency of the fuel cell under a constant resistivity load, and measured the following:

Rate of H₂ consumption: 13 mL/min
Voltage across the fuel cell: 0.92 Volts
Voltage across the resistor: 0.54 Volts
Current: 0.025 Amps
Power: 0.023 Watts

The Power Output:
0.329 Watts

The Efficiency of Electrolysis:
95.4%

The Power Input:
0.214 Watts

Fuel Cell Motor Efficiency:
10.7%



Results And Conclusion:

The efficiency of electrolysis was very high by our calculations, at 95.4%. The fuel motor cell efficiency, however, was much lower, at only 10.7%. This indicates that using fuel cells to power a car is not a very efficient process at the moment, as it takes a very long time to create all the hydrogen and oxygen needed to power a car for a relatively short amount of time. Although it is not a very effective process at the moment, there is one advantage of using fuel cells over fossil fuels to power a car. Fossil fuels pollute the environment and contribute to global warming. Fuel cells only emit water as a byproduct, therefore using a fuel cell to power a car has no negative effect on the environment.

Reference:

Thames & Kosmos. *Fuel Cell Car & Experiment Kit: Lab Manual*. Thames & Kosmos, LLC, Newport, RI. 2002.

Acknowledgement:

We would like to thank John Tatarko for providing us with the experiment kit and knowledge necessary to create this poster.

