cussons
TECHNOLOGY

P9040
FUEL CELL
DEMONSTRATION
UNIT

EXPERIMENTS

- Demonstrate Fuel Cell characteristic.
- Measure current efficiency of Fuel Cell
- Demonstrate battery charging (with P9042)

FEATURES

- Uses Hydrogen and Air to produce Clean Electricity
- No Power supply required
- Desk top mounted

INTRODUCTION

Fuel cells are a very flexible source of power that have the potential to dominate transport and local power generation during the 21st century, yet many students will have no direct experience of using them. Cussons P9040 provides a working fuel cell system capable of investigating the performance of a fuel cell.

Fuel cells work much like batteries, In both batteries and fuel cells two electrodes are separated by an electrolyte. Whereas a battery contains all the required substances for the electrochemical reaction to take place for a limited period of time, the fuel cell is able to supply electricity as long as a supply of fuel is readily available.

DESCRIPTION

As shown in the illustration, the power element in the unit is a Hydrogen / Air fuel cell comprising ten cells in a stack connected to a control unit incorporating a loading system consisting of a variable rheostat, Ammeter and Voltmeter.

The characteristics of the fuel cell array can be determined by the instrumentation provided. Provision is made for the use of data logger, to log the output of the fuel cell. (Cussons P7141)

The fuel cell employed is a PEM type giving an energy conversion of around 40%.

The cells are a polymer membrane coated with platinum sandwiched between two machined plates. The plates are then sandwiched into a 10 cell assembly between two steel end panels which form the electrodes.

BACKGROUND INFORMATION

The modern fuel cell stems from a discovery in 1839 by Sir William Grove and was an accident which happened during an electrolysis experiment.

When he disconnected the battery and shorted the electrodes together he noticed a current flowing in the opposite direction, consuming the Hydrogen and Oxygen that he had just generated. He called this his ‘gas battery’. The first model consisted of Platinum electrodes placed in test tubes of Hydrogen and Oxygen immersed in a bath of dilute Sulphuric acid. In 1842 he connected a number of gas batteries together to form a ‘Gas Chain’ which he used to

power an electrolyser to split water into Hydrogen and Oxygen however due to instabilities and corrosion of the electrodes the fuel cell was not practical. As a result there was little research or development for many years.

Significant work on the fuel cell began again in the 1930's by Francis Bacon , a chemical engineer at Cambridge. In the 1950's he successfully produced the first practical fuel cell, it comprised of an alkaline electrolyte and sintered nickel electrodes which were much less expensive than platinum.

Figure 1 shows diagrammatically the fuel cell circuit employed in the Cussons Product. This uses an Air breathing cell utilising the Oxygen available in Air and compressed Hydrogen for the fuel. The cell comprises a number of thin ion conducting membranes between platinum electrodes and affords a comparatively high power density. At the anode Hydrogen Molecules contact the platinum surface forming weak H-Pt bonds. Each hydrogen atom releases its electron which travel round the external circuit to the cathode (this flow of electrons is the current flow). The remaining hydrogen proton bonds with a water molecule forming a hydronium ion. The oxygen atoms form weak O-Pt bonds enabling a reduction reaction to take place. Each oxygen atom combines with two electrons and two protons to form one molecule of water. The reaction has now been completed.

Figure 2 shows the output of the module

TENDER SPECIFICATION

Hydrogen / Air fuel cell comprising ten cell module with maximum output about 12W and control unit for laboratory use comprising switching circuit, load resistor, ammeter , voltmeter, all carried in a high quality instrument case.

PHYSICAL DETAILS

	Nett Weight		Length		Width		Height	
	lb	kg	mm	in	mm	in	mm	in
	40	18	560	22	630	25	700	28

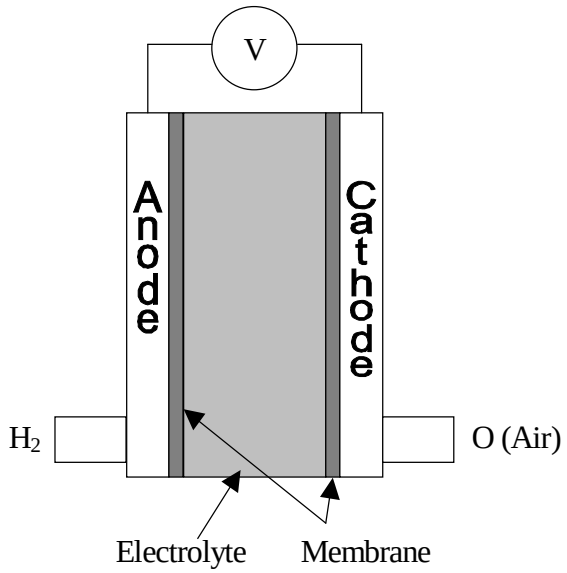

Fig. 1 PEM Fuel Cell

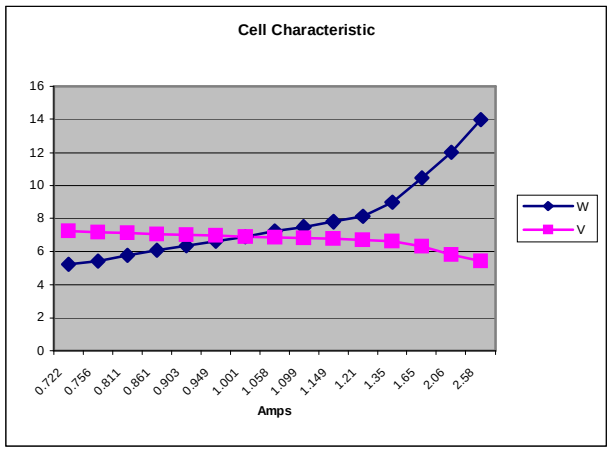

Fig. 2 Fuel cell output

ACCESSORIES

P9041 Metal Hydride Hydrogen storage bottle and Pressure Regulator.

P9042 Rechargeable batteries. (Lead Acid & NiMH)

P9043 Electrolyser to generate small quantities of Hydrogen.

P9044 Hand held Hydrogen leak detector

P9046 Control unit to provide constant power output from Wind, Solar and Fuel cell experiments.

P7141 Data logger

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