

重庆大学-辛辛那提大学联合学院

学生实验报告

CQU-UC Joint Co-op Institute (JCI)

Student Laboratory Report

课程名称 Course Name 工程基础 Engineering Foundation

开课实验室（学院） Laboratory (School) JCI

学院 School CQU-UC 年级专业班 Student Group 18ME01

姓名 Name (中 Chinese) 易弘睿 学号 Student Number 20186103

姓名 Name (拼音 pinyin) Yi Hongrui (English) Horace

学年 Academic Year 2018 学期 Semester Fall

Report Title [Solar Cell Experiment & Fuel Cell Experiment]

实验时间 Date of Experiment 2018 年 Year 10、11 月 Month 31、7 日 Day

报告时间 Date of Report 2018 年 Year 11 月 Month 12 日 Day

| | |
|---------------------------------|--|
| 成绩 Grade | |
| 教师签名 Signature of Instructor | |

| 实验项目类型/Type of Laboratory project | | | | |
|-----------------------------------|--------------------|---------------------|--------------|--------------|
| 验证 Verification | 演示 Presentation | 综合 Comprehensive | 设计 Design | 其他 Others |
| | | | | |

批改说明 Marking instructions:

指导老师请用红色水笔批改，在扣分处标明所扣分数并给出相应理由，在封面的平时成绩处注明成绩。

Supervisors should mark the report with a **red ink pen**. Please write down **the points deducted** for each section when errors arise and specify the corresponding reasons. Please write down **the total grade** in the table on the cover page.

实验目的 Description/Introduction

● The Introduction of the experiments:

I. Solar Cell Experiment

- a) About Solar Cell: Solar cells, also known as "solar chips" or "photovoltaic cells", are photovoltaic wafers that use sunlight to generate electricity directly.
- b) Experiment Goal: Measure maximum power output of a solar cell.

II. Fuel Cell Experiment

- a) About Fuel Cell: Fuel cell is a kind of chemical device which directly converts the chemical energy of fuel into electric energy, also known as electrochemical generator.
- b) Experiment Goal: Build a fuel-cell-powered car.

● The Structure of the report:

The report will introduce the description/introduction, procedure, results, discussion and conclusion of Solar Cell Experiment and Fuel Cell Experiment.

实验步骤 Procedure

I. 【Solar Cell Experiment】

- a) Measuring resistance:

Use resistors with resistances between 1 and 200 ohms to measure R. Set the dial on the meter to W. Place red and black leads across the resistor. Read the resistance on the meter.

- b) Illuminating the solar cell:

Use a halogen desk lamp to illuminate the solar cell. Bend flexible handle on lamp. Raise the solar cell. Use a book to raise solar cell and use adjusting rod to adjust lamp if necessary. Use position marked to maximize the output power of the solar cell.

- c) Measuring current:

Use several resistors with resistance between 1 and 200 ohms. For each resistor, measure current in circuit (I).

- d) Measuring voltage and calculate the power:

Use several resistors with resistance between 1 and 200 ohms. For each resistor, measure voltage in circuit (V) and multiply current x voltage to get power ($P = I \times V$).

e) Draw the graph of the power output:

Plot power on vertical axis. Plot voltage on horizontal axis. Find maximum power output of solar cell.

II. 【Fuel Cell experiment】

a) Preparation:

Compose the electrolyzer, the water tanks, the fuel cell, the clamp, the caps and the stopper together. Put the device on the plate.

b) Setting the hydrogen generation:

Fill distilled water into the two tanks and tighten the clamp and connect the solar panel to the electrolyzer. Put the solar panel below a lamp.

c) Drive fan with fuel cell:

Loosen the clamp and remove the stopper and let about 10 mL of H₂ flow out of the tank. Briefly open the cap on the fuel cell and let the H₂ flow, then put the cap back.

d) Building A fuel-cell-powered car:

Disconnect the device and place it on the car. Loosen the clamp between the hydrogen tank and the fuel cell. Turn the switch to "On". If it does not run, try to briefly open the cap and quickly put it back so that some more hydrogen can flow into the fuel cell.

实验结果/数据 Results

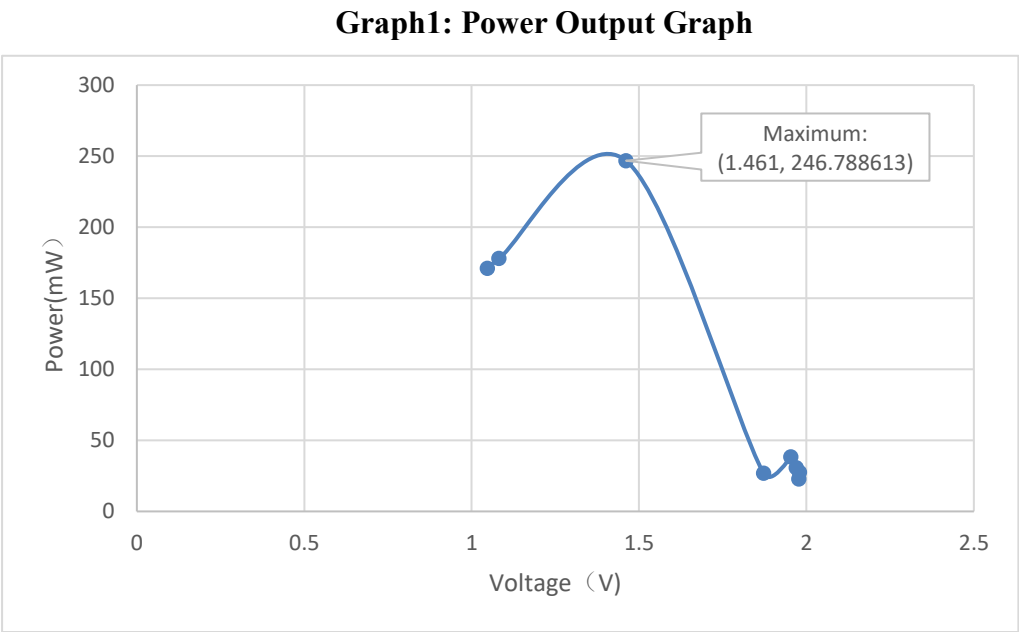
I. Solar Cell Experiment

Table1: Power Output Data

| Data Point | Nominal Resistance | Measured Resistance | Measured Current (I) | Voltage Calculated (V=I x R) | Measured Voltage | Power (P=I x V) |
|------------|--------------------|---------------------|----------------------|------------------------------|------------------|-----------------|
| 1 | 6.25 Ω | 6.4 Ω | 163.5mA | 1.0464V | 1.047V | 171.0864mW |
| 2 | 6.67 Ω | 6.9 Ω | 160.6 mA | 1.10814V | 1.082V | 177.96728mW |
| 3 | 9.09 Ω | 9.3 Ω | 162.9 mA | 1.51497V | 1.461V | 246.78861mW |
| 4 | 120 Ω | 117.4 Ω | 15.1 mA | 1.77274V | 1.872V | 26.768374mW |

| | | | | | | |
|---|--------------|----------------|---------|-----------|---------|-------------|
| 5 | 100 Ω | 97.6 Ω | 19.8 mA | 1.93248V | 1.954V | 38.263104mW |
| 6 | 20 Ω | 20.2 Ω | 39 mA | 0.7878 V | 1.97 V | 30.7242mW |
| 7 | 30 Ω | 29.9 Ω | 27.6 mA | 0.82524V | 1.978 V | 22.776624mW |
| 8 | 130 Ω | 127.5 Ω | 14.7 mA | 1.87425 V | 1.98 V | 27.551475mW |

Table1 shows the data of eight different groups in Solar Cell Experiment



Graph1 shows:

- a) The change of power with voltage increasing.
- b) The maximum point.

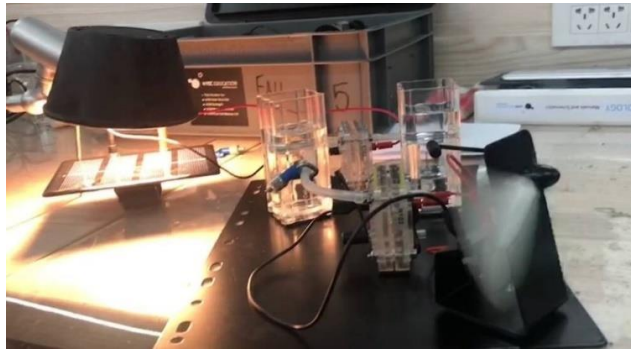
Observation

Through the observation, we find:

- a) The fan keeps running after being connected to the solar cell.
- b) The time of its running will get longer with the power increasing.

II. Fuel Cell experiment

Picture1: The fan is running



Picture1 shows:

- a) The fan ran in this experiment.
- b) The run time is about 3 minutes 4 seconds consuming 1 mL water.

Picture2: The car is not running



Picture2 shows the car doesn't run successfully.

讨论 Discussion

1. Discussion of inaccuracies of measurements(Lab1)

In the Solar Cell Experiment, according to the Table1: Power Output Data and graph1: Power Out Graph, we can find that the maximum point is not in the exactly right location and the curve is not very smooth in the very right side. We think it's because of the area of the data. In the experiment, the last three points' voltage is much higher than other points and the location of these three points is too far from the maximum point. If we can choose more data points which has the voltage close to the maximum point, then the data points' location can be more average, so the real maximum point's location will be more precise and the curve will be more smooth.

2. Explanation of why the fan is running(Lab2)

This result agrees to the theory. The solar energy forces the water to experience a chemical reaction, disintegrating into oxygen and hydrogen. The hydrogen gets into the fuel cell so that the Fuel Cell give voltage source to the fan, formulating the current which flow through the two sides of the fan. Then the fan can run.

3. Explanations of why the car is not running(Lab2)

This result doesn't agree to the theory. There are two possible reasons. One is that the hydrogen is not collected enough so that the source energy is not sufficient. Because during the lab the hydrogen might fly away from the device, the amount of hydrogen might decrease which affect the source energy. The other is that the force of friction is too large so that the car can hardly move forward. We can see that the tires of the car are moving if we lift the car by hands. As a result, we conclude that the friction make it hard for the car to run on the table.

结论 Conclusion

● The summary of the two labs

There are two labs in the experiment. In the first lab, we measure maximum power output of a solar cell. The result agree with the theory but can be improved by predicting the area of data before doing the research. In the second lab, we build a fuel-cell-powered car. The car is not running successfully which tell us that this experiment should be done with carefulness upon the hydrogen collection and in the place that has little friction force.

● Remarks

Bad luck! I've received the broken devices for successive two times in the lab! Hope I can get devices of good qualification next time! And thanks for TAs and professor's patient instruction!