101年大學部國際交流甄選專題成果展

Design and Application of the Metal Foam Fuel Cell

4

Researchers : Yang, Che-Chia Huang, Tzu-Yuan
Advisor : Tseng, Chung-Jen

Abstract

Fuel cell is a green power device using hydrogen. In this study, a flow pattern of a air-breathing fuel cell is developed, and a 5-cell stack is assembled. With the hand-made used MEA, the OCV of the stack is 4.5V, and the peak power reaches 3.64W. The result also shows that our flow design could deal with the air supply of the cathode side. This device will be expanded to achieve the USB power requirement in our following study.

Purpose

- Design a USB power device
- Design a air-breathing fuel cell stack
- Use the metal foam on the cathode plate

Design of the Flow Plate

- Reaction area : 29mm x 30mm
- Design a bridge to prevent gas leakage

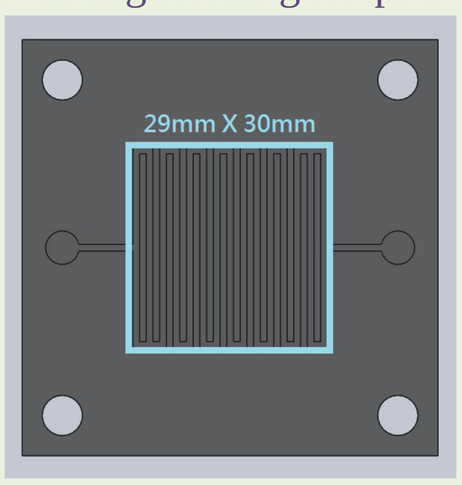


Fig1. Reaction area

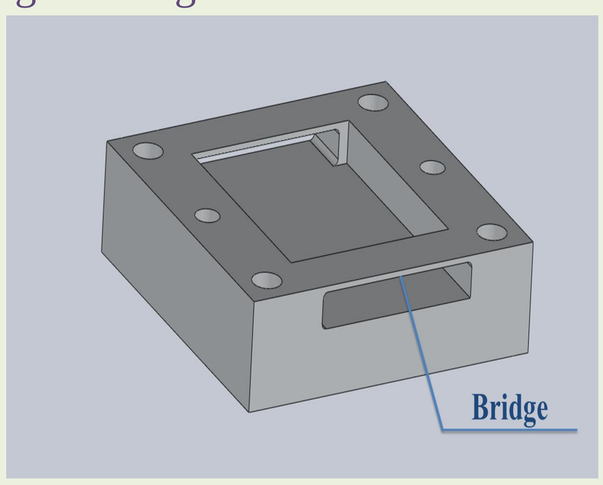


Fig2. Metal-Foam Design

Introduction

- **Metal Foam :**

Metal foams are special cases of porous metal and we use the open-cell foam for cathode flow plate. Its high open ratio might contribute to air convection.

- **Hydrogen and Air Supply :**

Hydrogen flow into the hole and distribute to the every fuel cell, and U-turn to recycle the rest hydrogen from the other hole.
For air-breathing fuel cell, we don't provide the air. We use convection to let air get into cathode side.

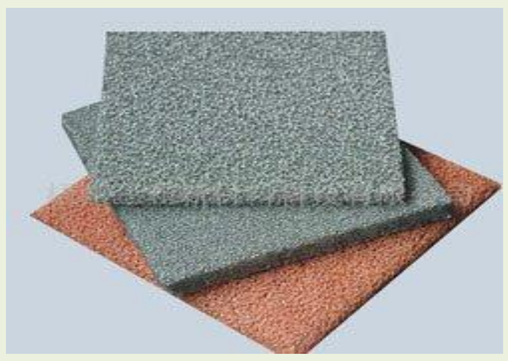


Fig3. Metal-Foam

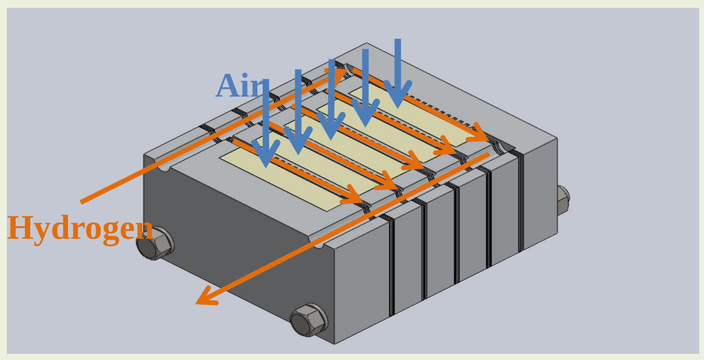
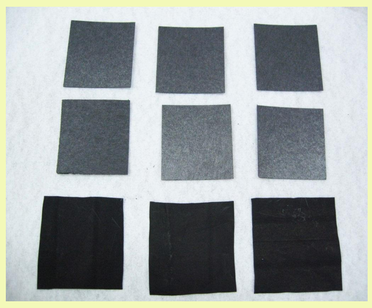


Fig4. Profile diagram

Research Methods

MEA Processing :

- Choose used MEA from lab.
- Cut the MEA to the size we want.
- Use laminating machine to laminate our border.



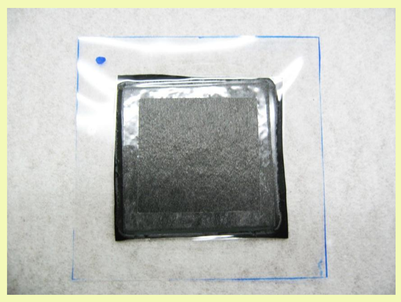


Fig5. MEA Processing

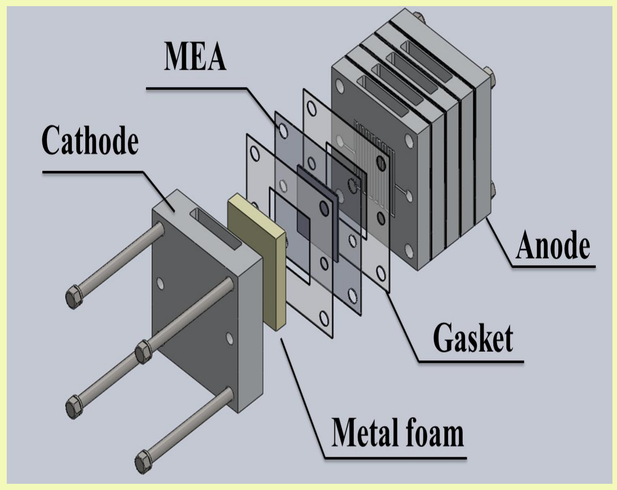


Fig6. Exploded diagram

Fig7. Entity diagram

Results & Conclusion

Performance Test :
Hydrogen supply : 50 cc/min
Oxygen supply : 0cc/min

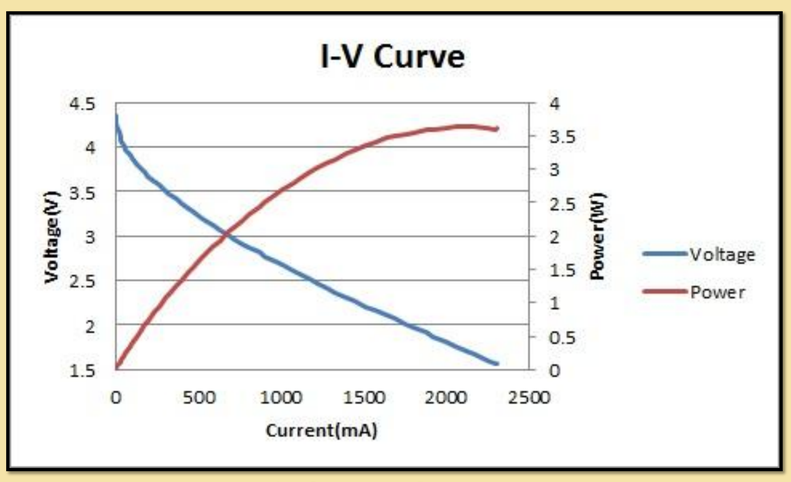


Fig8. I-V Curve

- Open Circuit Voltage : 4.5V
- Peak Power : 3.64W
- Apply Current : 0.5A Output Voltage : 3.31V
- Apply Voltage : 3V Output Current : 787.5mA
- Form 4.5V to 3.5V region, we call it activity polarization. If we use better MEA, we might decrease the activity polarization.
- Below 3.5V region, the linear line, we call it ohmic polarization, which is about fuel cell's resistance.
- When the current is high, concentration polarization usually occurs, it means the short of fuel. We don't have this phenomenon, so it proves that our design in this fuel cell can deal with air supply of the cathode side.
- We will achieve our purpose in our following study.