Hydrogen Fuel Cell Operated Remote Control Car

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by

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Abstract:

This project uses a hydrogen fuel cell as a form of alternative energy to power a simple remote controlled car and presents some research on how hydrogen is made, how a hydrogen fuel cell works. We showed that a hydrogen fuel cell can be used for operating the remote control car. We used two different setups for the hydrogen fuel cell remote controlled car.

1.Introduction

The purpose of this project is to use an alternative energy source other than a conventional battery, gas power or other source of energy to power a simple remote control car. In this work, we used a hydrogen fuel cell (1-2) which uses hydrogen and air and produces electrical power. A hydrogen fuel cell is used to power a simple remote controlled car rather than a battery or a gas powered engine. The byproducts of a hydrogen fuel cell is only water and heat and the fuel sources are only hydrogen and air which are easier to handle then battery acid and gasoline. The fuel cell is applicable to today's consumer needs because a hydrogen fuel cell is much quieter, is lighter (mass power ratio) and is more environmental friendly. Also the efficiency of hydrogen fuel cells is higher than gas powered engines. In this project a remote control cars battery will be replaced with a hydrogen fuel cell that is able to generate twelve watts of power.

2.Experimental Procedure

2.1 Activating and Refueling

The first step in this project was to measure the voltage and current needed by the remote control car. We found that the initial power needed to start the electric motor within the remote controlled car was six volts of potential and two amps of current. This information told us that we needed a fuel cell that was able to generate at least twelve watts of power. We then were able to find a manufacturer of the hydrogen fuel cell that could generate this required power. We also made sure that the dimensions of this fuel cell did not conflict with the space within the remote control car. The manufacturer (Horizon Fuel Cell, Germany) shipped our hydrogen fuel cell with all of the specifications on refueling as well as the power and voltage graphs of the fuel cell(2).

The second step was to design the fluid system that could transfer hydrogen from a high pressure tank to our low pressure tanks. We used several Swagelok (1) devices made of stainless steel that could withstand high pressure over 5000 psig. These devices also were made to transport flammable gas such as hydrogen. We designed a system that could withstand high pressure and with a high factor of safety.

The third step was to activate the hydrogen tanks (20 standard L). Each tank contains a metal hydride within it that acts as a sponge for hydrogen after it has been activated (3-4). To activate this metal hydride we needed to go through a four step process where we first connected

our tanks to the fluid system that we designed and set the low pressure gage reading on our pressure regulator to thirty bar (435 psig) and waited eighty minuets. We then released the pressure to about ten bar and increased the pressure back to thirty bar. We repeated this process four times.

After activation was complete we refueled the tanks by connected them to our fluid system and set the low pressure reading to thirty bar. After thirty minutes we disconnected the tank.

2.2 Connecting and Testing the Fuel Cell and Remote Control Car

We connected the hydrogen tank to the fuel cell and reproduced graphs one and two that are shown in the appendix which illustrate the relationship between the voltage, current and power of the fuel cell (5).

The Second step was to connect the hydrogen fuel cell to our remote control car and test the car. We found that the system worked just as well as with the original battery but one advantage was that the system was able to last for about two hours while the battery was only able to power the car for about thirty minutes.

The third step was to connect a wireless camera with a range of approximately three-hundred feet to our remote control car and tested it. The camera sent a signal to a router which was connected to a television or any recording device. The purpose of this is to be able to have a system that you can control from a remote location.

3. Results

- Charging time for a battery is about one hour.
- Charging time for a hydrogen tank is about thirty minutes.
- The battery will last for a little more than thirty minuets.
- The hydrogen tank will power a hydrogen fuel cell for about two hours.

- We found that the fuel cell lasts longer and required less time to recharge between uses.

The only disadvantage of the proposed design was the cost. The hydrogen fuel cell and accessories for this system cost us about $1550 which was expensive compare to battery operated system. However, when we consider the fact that a hydrogen fuel cell has no green hour gas emissions and hydrogen fuel cell technology is still in the experimental stages, one can see that this technology has greater promise in the near future. When fuel cell production becomes commercialized the cost of the fuel cell will go down.

3. Conclusion

After overcoming the initial difficulties with trying to implement the fuel cell system onto a remote control car and fabricating the fluid system between the pressure regulator and the tank, the system worked properly and safely.

4. Cost Analysis

- **Remote Control Car #1**
    - **$40.00**
- **Remote Control Car #2**
    - **$281.31**
- **Pressure regulator**
    - **$456.81**
- **Hydrogen Fuel Cell, tank holder and controller**
    - **$1550**
- **Total cost**
    - **$2328.12**

5. Acknowledgements

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6. References

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2. http://www.horizonfuelcell.com/store.htm

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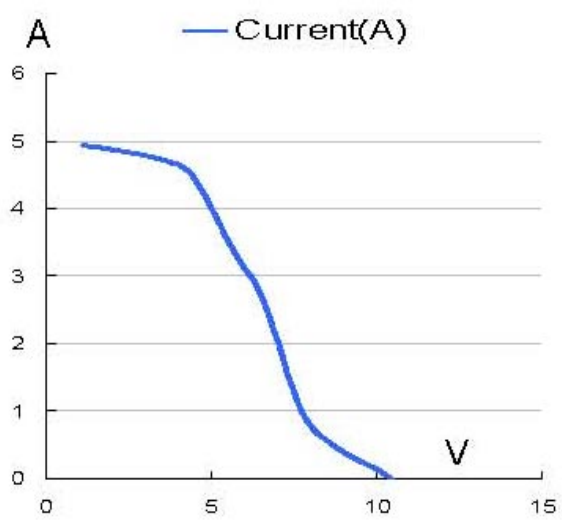
4. Holman, J. Heat Transfer, Ninth EditionMcGrew-Hill Publishing Company Limited, 2002

5. Budynas, Richard and Nisbett, Keith, Mechanical Engineering Design, Eighth Edition, 2008

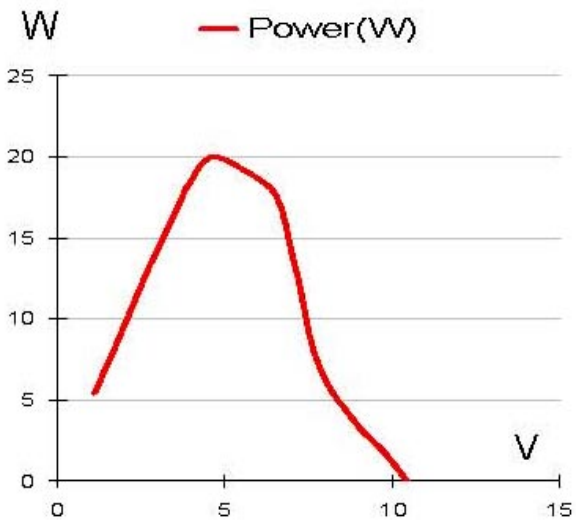
Appendix

Voltage vs. Current

Voltage vs. Power



Graph 1



Graph 2