

A BRIEF STUDY ON FUEL CELL

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ABSTRACT

Fuel cell converts chemical energy into electric energy. In the coming years, hydrogen and fuel cell will be a part of power as a new emerging energy service as it can be produced accurately from renewable energy sources and is non-polluting and thus environment friendly. It's going to additionally be used as a gas for '0 emission' cars, to heat homes, chambers, and places of work, to produce energy, and to gas plane. In this paper, we have discussed the latest technology utilized in fuel cells, type of fuel cells, their advantages, limitations, their applications and working of fuel cells. The fuel cell may be used as a power source in each battery-operated device. FCEV stands for fuel cell electric vehicles which are powered by hydrogen.

Keyword: Fuel cell, energy, hydrogen, FCEV, electric.

1. INTRODUCTION

A fuel cell is a device which converts the chemical energy into electric energy with the help of redox reaction. The major difference between rechargeable battery and fuel cell is that gasoline cellular wishes continuous delivery of gas. In the future, fuel cells should energy our automobiles with hydrogen changing the petroleum gasoline that we use in maximum automobiles nowadays. Most of the car producers are focusing on making environment friendly vehicles. Researchers are studying and gaining knowledge of the fuel cell technology. In the near future, we may soon use the fuel cell technology to produce electricity for all kinds of vehicles.[1]

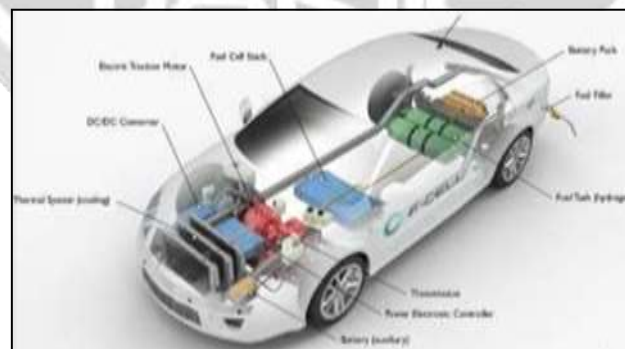


Fig 1-Fuel cell in a car

Fuel cell can generate electricity. As we know fossil fuels like petroleum emit harmful gases which results in polluting the environment. Fuel cell electric vehicles (FCEVs) use electricity to power an electric motor. As

compared to electric vehicles, FCEVs produce electricity using a fuel cell which is powered by hydrogen instead of drawing electricity from a battery only. Various types of fuel cells are:

- Solid oxide fuel cell
- Molten carbonate fuel cell
- Phosphoric acid fuel cell
- Proton exchange membrane fuel cell.

3. LITERATURE REVIEW

In this, the FCEVs are explained and discussed with the help of previous researches and other reports. A technical overview is represented for FCs and FCEVs in phrases of the present-day nation of generation to foreseen expectancy. Infrastructure analysis and destiny elements overview component is likewise discussed for quarter's angle on FCEVs. The close to destiny perspective of the FCEVs, which is seen as the following step in EVs, is mentioned in element in the subsequent quarter-century imaginative and prescient. The authors concluded in their research that in between 2030 and 2050, the FCEVs technology will keep developing and may be implemented with lowering the cost of technology; more power optimization; more range limits, and more hydrogen refueling stations in future.[2]

The paper explains a hybrid gasoline mobile power generation system with higher efficiency. The Thermo monetary modeling of the MWe-scale systems the usage of different fuels is conducted to evaluate the financial feasibility below the subsidy policy of Japanese, China. This painting's goal is to expand the technology roadmap for this form of smooth electricity machine. They are efficient and mostly suitable for hybrid machine while the petroleum fuel and water gasoline has lower efficiency and also high cost. [3]

FCVs can have a significant impact in meeting each strength security and it can reduce environmental problems related to pollution. beginning for the idea that public attractiveness and attitudes research were commonly positive closer to hydrogen and fuel cells vehicles, although the general public knows few matters approximately this generation; authors then were given the idea to give a simplified scientific painting managing the outline of the electricity control and flows calculations onboard FCVs. The technology will prove more sustainable.[4]

This paper goals to present an overview of the capacity aviation programs where hydrogen and gas cell technology can be used. Also, the primary demanding situations that limit the huge adoption of hydrogen generation in aviation are highlighted and future studies possibilities are identified.[5]

A conventional car propelled with best the internal combustion engine (ICE) is not clean to decorate the fuel economy because of the huge range operation requirement of the powertrain. But, a hybrid electric-powered car (HEV) that consists of an ICE and one or more than one electric automobile can successfully improve the performance of the powertrain. In this paper, we propose an adaptive energy management strategy (PMS) based totally on the equivalent fuel consumption minimization approach (ECMS) for a four-mode HEV. The four-mode HEV which includes an ICE and two cars gives 4 modes of operation, including electric automobile (EV) mode, variety extended (RE) mode, hybrid mode, and engine model. The adaptive PMS is designed for price maintaining such that the country of price (SOC) may be maintained at a certain price. A self-organizing fuzzy controller (SOFC) is employed to adaptively alter the equivalence thing of electrical electricity consumption based on the SOC deviation and the exchange of SOC deviation. An instantaneous value function which includes the gasoline consumption of ICE and the equal fuel consumption of the battery is minimized to reap the most useful electricity distributions of the ICE and two vehicles. Simulation effects display that the adaptive PMS can effectively improve the gasoline economic system for one-of-a-kind driving cycles.[7]

4. TYPES OF FUEL CELL:

4.1 Solid Oxide Fuel cell:

A solid oxide fuel cell is an electrochemical conversion device that produces power directly from oxidizing a gas. Gas cells are characterized using their electrolyte cloth; the SOFC has a ceramic electrolyte. Stable oxide gas cell uses ceramic as an electrolyte which is in the solid state. It operates at 1000 degree celcius, and gasoline mobile efficiency is 50-60%.

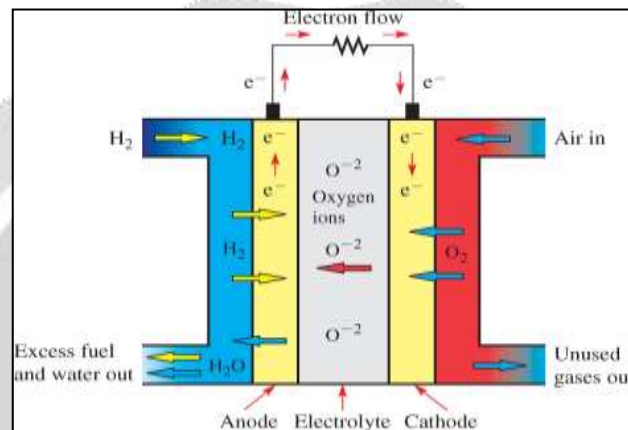


Fig 2-Solid oxide fuel cell

Advantages of Solid Oxide Fuel cell:

1. High combined Heat
2. High power efficiency
3. Long term Stability
4. Fuel flexibility

Disadvantages of Solid Oxide Fuel cell:

1. Needs high operating temperature
2. Longer startup time

Applications of Solid Oxide Fuel cell:

1. Transport
2. Industrial Equipment
3. Cooling power

4.2 Molten carbonate fuel cell.

Molten carbonate fuel cells are the high temperature fuel cells that work at a temperature of 600 degree celcius and above. The operating stress is between 1to 8 atm and temperatures are among 600- 700 degree C. They use carbonate salts as an electrolyte which is in a liquid state, it operates at 650 C, and fuel cell efficiency is 50-60%.

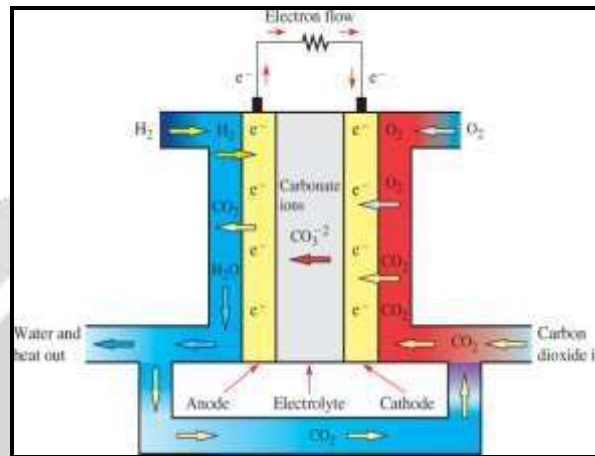


Fig 3- Molten carbonate fuel cell

Advantages of Molten carbonate fuel cell:

1. No need to use precious metals as catalysts.
2. Tremendous cost-saving benefits
3. Increases reliability and reduces maintenance costs
4. Highly efficient

Disadvantages of Molten carbonate fuel cell:

1. High temperatures decrease cell life
2. Require a considerable warm-up period

Applications of Molten carbonate fuel cell:

1. Large, stationary power plants

4.3 Phosphoric acid fuel cell

Phosphoric acid fuel cells are a sort of fuel mobile that makes use of liquid phosphoric acid as an electrolyte. They were the first fuel cells to be commercialized. Phosphoric acid gasoline cell use phosphoric acid as an electrolyte which is in the liquid state. It operates at 200 degree celcius and the gasoline cell efficiency is about 40-45%.

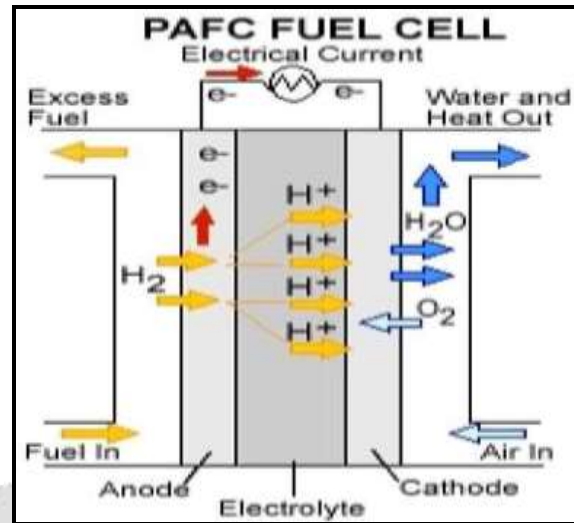


Fig 4- Phosphoric acid fuel cell

Advantages of Phosphoric acid fuel cell:

1. High efficiency
2. Can operate at high temperature

Disadvantages of Phosphoric acid fuel cell:

1. Low power density
2. Aggressive electrolyte
3. Produces less power

Applications of Phosphoric acid fuel cell:

1. Large vehicles such as buses

4.4 Proton exchange membrane fuel cell

The proton exchange membrane fuel cell is also known as polymer electrolyte membrane fuel cell. It has excessive energy density and a high working temperature of 50 to 100 C. The electrolyte is a polymer membrane. Proton trade membrane gas cell uses polymer membrane as an electrolyte which is in the stable nation, it operates at 80oC and fuel mobile efficiency is 60%.

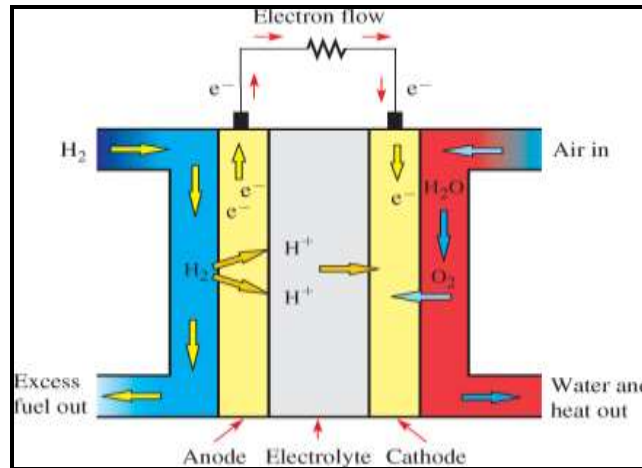


Fig 5- Proton exchange membrane fuel cell

Advantages

1. Lighter in weight
2. Produces sufficient power

Disadvantages

1. High maintaining cost

Applications

1. PEM fuel cells focus on transportation
2. Portable power generation

5. CONCLUSION

It can be stated that there will be a bright future for this hydrogen gasoline cellular if this hydrogen fuel cellular is positioned up to use in all vehicles via properly considering the protection count number first and if this eco-friendly generation is used, the charge of pollution is genuinely going to come back down. Hydrogen gas cell isn't the handiest ecofriendly, however, additionally serves to be a terrific gas source. Because the traditional gasoline resources won't be sufficient, there arises a need to increase a brand-new opportunity source of energy. Even though there are a few problems associated with the garage of hydrogen fuel, which is probably overcome as the era develops in addition.

6. FUTURE SCOPE

In the destiny, hydrogen will be part of strength as an important electricity service, because it can be produced adequately from renewable electricity assets and is without a doubt non-polluting. It will also be used as a gas for '0 emissions' vehicles, to warmthwarm, chambers and workplaces, to supply energy, and to fuel plane. Hydrogen has notablthe e capacity as a way to reduce reliance on imported strength sources inclusive of oil. But, before hydrogen can play a bigger strength role and end up a widely used alternative to gas, many new centers and gadgetgadgetsbe built. The era ought to be made low-priced to everybody.

Growing creation features to the onboard hydrogen tank and also at refilling stations by measuring the usage of 'auto-locking of delivering valves through the usage of hydrogen detector.

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