

An Account of Development of Fuel Cells

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ABSTRACT

The revolution of the world could be found in hydrogen fuel cells. It is an ingenious technology that generates electricity, heat, and water from a chemical reaction of oxygen and hydrogen. It had passed many tests along the way, from when it was first invented to its innovation stage. The diversity of domestic resources can favour the production of hydrogen fuel cells. Hydrogen fuels can be used in fuel cells or internal combustion engines. The use of hydrogen as a fuel in the transportation sector has not been embraced well. Still, with the government's help, the industries are working toward achieving clean, safe, and economical production of hydrogen for them to distribute to be used in fuel cell electric vehicles (Moore et al., 2006). Fuel cell technology has been developed in recent years with advancements within the energy sector and automotive industries. It has brought the world to an era where the use of hydrogen fuel cells is important.

Keywords: Hydrogen Fuel Cells, Energy Usage, Fuel Cell Energy, Conversion Of Chemical Energy to Electrical Energy.

INTRODUCTION

Human beings are getting more into personal transport with the introduction of the Western lifestyle as the country's economy grows. The transportation sector highly relies on petroleum products as a fuel source, resulting in the production of many greenhouse gases such as carbon dioxide, which exposes the transportation sector to an uncertain situation of diminishing supplies of oil (Coates & Blair, 1974). This has been a result of the use of internal combustion engines, which also affects the health of human beings as the gases produced in their manufacture and use are dangerous when it comes to life. This has resulted in the introduction of hydrogen as an alternative.

WHY HYDROGEN?

The use of hydrogen in fuel cell vehicles (commercial) has begun, which includes cars used by the public sector, such as fuel cell buses that have been in use for many years, and fuel for spacecraft propulsion. In the stationary and moving generation of power from hydrogen, the use of fuel cells is considered vital (Lin et al., 2019). The propulsion system in a vehicle engages the fuel cells in its performance. An electrified train involving an electric motor and a battery by use of fuel cells is more vital than using an internal combustion engine. The use of fuel cells calls for a better economy than internal combustion engines.

For many years, people residing in the United States have been using oils and natural gases to fuel their cars. The use of these gases has played a role in polluting the environment, making people dependent on other regions of the world as they neglect their reserves. Some of the bronchial diseases such as emphysema and asthma are a result of pollution of the environment. More than twenty-six per cent of the world's oil is consumed by the people residing in the United States, although they make five per cent of the world's population (Heywood, 2018). Running out of oil means that internal combustion engines will no longer function, forcing them to use other alternatives such as hydrogen fuel cells that are considered environmentally friendly.

RECENT DEVELOPMENTS

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LIMITATIONS

The use of high purity hydrogen in the fuel cells to prevent it from being poisoned, making it more expensive to maintain, and their heaviness, can be an obstacle, and people may consider the use of internal combustion engines. The high cost of maintaining it is an advantage and guarantees good health and a friendly environment whenever the fuel cells are being used. Hydrogen internal combustion engines are considered cost-effective and light as they can be run in impure or multiple fuels but are not efficient. This is because of the production of gases that are not friendly to the environment.

The use of hydrogen for the long term can only be related to the use of fuel cells. A reverse of the electrolysis process is undertaken in fuel cells in the generation of electricity. Fuel cells top up 70 per cent in terms of efficiency (Manoharan et al., 2019). The basic technology has been introduced in fuel cells' premises, forcing the automakers to work on design fuel cell stacks that result in systems such as cooling, fuel delivery, and water drainage. The GM 5th generation stack is an example of a unit designed to be mass-produced at a relatively low cost on automated equipment. The production of fuel cells from renewable sources holds a promising future in the transportation sector.

HOW IT'S CHANGING THE WORLD

The growing trends in the transportation sector of electric cars are an example of hydrogen technology. Our current infrastructure is based on the existing hydrocarbons. Still, the hydrogen economy is looking into transforming it from the generation of static power to a range of transportation appliances that ensure adequate use of hydrogen to avoid carbon dioxide emissions (Hames et al., 2018). When bulkier vehicles travel long distances as they carry heavy loads, the introduction of fuel cell electric vehicle technology could be effective as they will require minimal downtime to refuel. The cost of hydrogen is going down globally due to the reduced cost of renewable energy and improvements in water electrolysis and technology in the use of fuel cells.

Hydrogen is the most available element in the universe, with some challenges associated with its extraction from water, but it is a renewable energy source. This makes it a perfect element to be used for the zero-carbon requirements that need to be satisfied to make the environment more friendly. Hydrogen use helps supply heat and electricity, which is essential for all human beings (Alves et al., 2013). Electricity is an essential part of our industries in the manufacture of different products and offering services and domestic use.

Most of the necessary devices supporting human life depend on electricity as a form of energy. Hydrogen is one way in which this electricity is produced without polluting the environment. In the United Kingdom, about three-quarters of their electricity comes from power stations fueled by fossil fuels such as oil, natural gases, and coal. The first step of converting electricity involves the burning of fuels which converts chemical energy to heat. The heat produced is then transformed into electricity through the turning of turbines by using the steam generated in the process. It is an inefficient method compared to the conversion of hydrogen into electricity.

ADVANTAGES OVER OTHER ENERGY CONSUMPTION METHODS

The fossil fuels used are a non-renewable source of energy, and their limitation means they will be worn out and no longer in use. The burning of fossil fuels produces carbon dioxide, which increases global warming. Sulfur dioxide is released into the environment when oil and coal are burnt, adding acid rain and difficulty breathing for the living creatures. The development of fuel cells is a way of eliminating all these polluting methods currently used in the production of electricity (Ahluwalia et al., 2004). A fuel cell is known for its conversion of chemical energy into electricity directly. The different

fuel cells contain a negative side (anode), a positive side (cathode), and an electrolyte that completes the circuit allowing the flow of negative charges between the two sides of the fuel cell.

The production of hydrogen requires a relatively smaller land for its production, unlike biofuel, which is an element used in an internal combustion engine. Water as a by-product of hydrogen is being used as drinking water for NASA's astronauts (Cook, 2002). This is a clear indication that the use of hydrogen fuel cells is not harmful, making it a superior element over coal, nuclear power, and natural gases, which are hard to extract and dangerous as they poison the environment. The production, storage, and use of hydrogen play a significant role in promoting renewable energy sources.

As much as hydrogen is regarded as an energy source, it is an energy carrier that can store and transport energy. Hydrogen fuel cells fuel most vehicles, stationary energy generation systems, and portable electronic devices. Hydrogen may be used in heating systems for building or combustion in internal combustion engines but does not produce the best results when any living creature's life is involved (Haseli et al., 2018). Therefore, hydrogen fuel cells' use improves the quality of air and eliminates all the poisonous gases released in the environment. Fuel cells produce low noise compared to internal combustion engines making them more reliable. The possibility of fuel efficiencies in fuel cells as they do not suffer from Carnot thermodynamics limitations is guaranteed, with the internal combustion engines suffering from it due to petroleum products.

CONCLUSION

Fuel cells offer a promising technology as it plays a significant role in the economy as a country neglects the use of fossil fuels related to internal combustion. With fossil fuels existing for long and receiving no technology attention, the fuel cells may be improved with time and become dominant. The manufacturers are making the support systems in the fuel cells cheaper and more reliable. With the introduction of economies of scale due to commercialization, fuel cell prices may drop drastically.

REFERENCES

- [1]. Ahluwalia, R. K., Wang, X., Rousseau, A., & Kumar, R. (2004). Fuel economy of hydrogen fuel cell vehicles. *Journal of Power Sources*, 130(1-2), 192-201.
- [2]. Alves, H. J., Junior, C. B., Niklevicz, R. R., Frigo, E. P., Frigo, M. S., & Coimbra-Araújo, C. H. (2013). Overview of hydrogen production technologies from biogas and the applications in fuel cells. *International journal of hydrogen energy*, 38(13), 5215-5225.
- [3]. Coates, S. W., & Blair, G. P. (1974). Further studies of noise characteristics of internal combustion engine exhaust systems (No. 740713). SAE Technical Paper.
- [4]. Cook, B. (2002). Introduction to fuel cells and hydrogen technology. *Engineering Science & Education Journal*, 11(6), 205-216.
- [5]. Hames, Y., Kaya, K., Baltacioglu, E., & Turksoy, A. (2018). Analysis of the control strategies for fuel-saving in hydrogen fuel cell vehicles. *International Journal of Hydrogen Energy*, 43(23), 10810-10821.
- [6]. Haseli, Y. (2018). The maximum conversion efficiency of hydrogen fuel cells. *International journal of hydrogen energy*, 43(18), 9015-9021.
- [7]. Heywood, J. B. (2018). *Internal combustion engine fundamentals*. McGraw-Hill Education.
- [8]. Lin, R. H., Xi, X. N., Wang, P. N., Wu, B. D., & Tian, S. M. (2019). Review on hydrogen fuel cell condition monitoring and prediction methods. *International Journal of Hydrogen Energy*, 44(11), 5488-5498.
- [9]. Manoharan, Y., Hosseini, S. E., Butler, B., Alzahrani, H., Senior, B. T. F., Ashuri, T., & Krohn, J. (2019). Hydrogen fuel cell vehicles; current status and prospect. *Applied Sciences*, 9(11), 2296.
- [10]. Moore, R. M., Hauer, K. H., Ramaswamy, S., & Cunningham, J. M. (2006). Energy utilization and efficiency analysis for hydrogen fuel cell vehicles. *Journal of Power Sources*, 159(2), 1214-1230.