An Overview on Fuel Cells and its Importance in Today's world

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Abstract - The dependence of the human race on fossil fuels has had a dull influence on the environment, this has become apparent now more than ever. Which has created a need to shift to different energy resources. A report shows that in 2020 an astounding 68.1 % of the petroleum demand was for transportation. Providing an alternative form of energy can help greatly reduce the consumption of fossil fuels such as petroleum, diesel, etc. The objective of this research is to compare the different types of batteries and compare their cost, capacity, and pollution caused when mining for materials required for the battery.

Keywords

- **Anode:** the place on a battery or any other electrical device from where the electric current enters.
- **Cathode:** the place on a battery or any other electrical device from where the electric current leaves.
- **Reactions:** a process that involves the rearrangement of a substance's molecular or ionic structure, as distinct from a change in physical form or a nuclear reaction.
- **Tailpipe:** an outlet by which engine exhaust gasses are expelled from a vehicle.

INTRODUCTION

In the electrochemical cells the chemical energy is converted into electrical energy. The cell potential is related to free energy change (G). In an electrochemical cell, the system does work by transferring electrical energy through an electric circuit. Thus, G for a reaction is a measure of the maximum useful work that can be obtained from a chemical reaction.

G = maximum work But we know that maximum work = nFE

When a cell operates, work is done on the surroundings (flow of electricity).

G = –nFE (or) G < 0

Decrease in free energy is indicated by (–)ve sign.

One of the main uses of galvanic cells is the generation of portable electrical energy. These cells are known as batteries.

Definition

A battery is an arrangement of several electrochemical cells connected in series that can be used as a source of direct electric current.

Thus,

- A cell: Contains only one **anode** and **cathode**.
- A Battery: It is a chain of several **cells**.
- Requirements of a battery

A useful battery should fulfil the following requirements.

1. It should be light and compact for easy transport.
2. It should have a long life both when it is being used and when it is not used.
3. The voltage of the battery should not vary appreciably during its use.

What are the types of batteries?

Primary Battery (or) Primary cells

In these **cells, electrodes** and electrode reactions cannot be ensured by passing external electrical energy. **Reactions** only occur once and disappear after use.

Examples: dry cell, mercury cell.

Secondary Battery (or) Secondary cells

In these cells, the electrode reactions can be reversed by **applying** external electrical power**.** Therefore, it can be **charged** by passing current and can be used **repeatedly.** These are also called storage cells **(or accumulators).**

Examples: lead-acid batteries, and nickel-cadmium batteries.

Flow battery (or) Fuel cell

In these **cells** reactants, products and electrolytes flow continuously through the cell. **Chemical** energy is converted into **electrical** energy.

Example: Hydrogen Oxygen Fuel Cell.

What are the uses of batteries in our day-to-day lives?

In our home

We depend on batteries for several gadgets that we use in our house. Devices such as remote controls and flashlights are powered by disposable batteries. Cell phones, handheld video game consoles, digital cameras, and many other devices use rechargeable batteries such as alkaline batteries. Appliances that consume too much power, such as laptops and other devices, are powered by advanced batteries such as lithium batteries.

In the medical field

Batteries are widely used in the medical sector. The ECG cardiac monitor has a battery connected so it can be moved with the patient and is always ON to display the patient's vital signs. Rechargeable batteries such as lithium-ion and nickel-cadmium batteries are often used in hospitals.

In the military

Batteries that offer high energy and power density are widely used in military operations. Batteries are used in radios that are used for communication. Even infrared goggles and various field equipment are battery-powered. Lithium batteries provide much longer device life and other batteries such as silver oxide batteries are used in rockets and submarines.

In vehicles

Electric vehicle (EV) batteries are often used in vehicles. Electric motors of electric cars are powered by this battery. Electric vehicle batteries are rechargeable. Electric cars usually use lithium-ion batteries.

What are the different types of batteries currently being incorporated into vehicles?

Lead acid batteries, Lithium-ion batteries, Nickel Metal hydride batteries, and silver calcium batteries. Currently, Lithium-ion batteries are regarded as the

best batteries as they have a high energy holding capacity, which gives the car a higher range

Experimental

The figure below, adapted from an analysis by the International Council for Clean Transportation (ICCT), shows an estimate of lifecycle emissions for a typical European conventional (internal combustion engine) car, the hybrid conventional car with the best available fuel economy (a 2019 Toyota Prius Eco), and a Nissan Leaf electric vehicle for

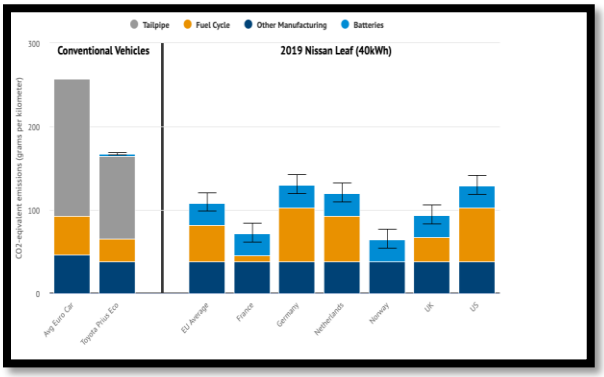

Figure 1

RESULT

Here we are comparing the emission data of two cars, an electric Nissan Leaf and a conventional European car, we can observe that although a conventional car causes much fewer emissions while manufacturing a Nissan leaf (Electric Vehicle) has no emission output after production throughout its life. Therefore, the conclusion of the comparison is that electrical vehicles have lower emissions and a shift to EVs is definitely a step in the right direction.

DISCUSSION

Throughout this paper, we have studied the types of batteries, and then we took a detailed look at the uses of batteries in different industries. As Electric vehicles are being called the future of vehicular movement, we also talked about how the argument stating electric vehicles cause more pollution, and emissions are false. To prove that we took a detailed view into the total emissions all the way from production to daily use between a Nissan leaf (Electric vehicle) and a conventional European car.

CONCLUSION

Finally, it can be concluded that Electric vehicles, Mass use of batteries throughout the transport industry may or may not be the next permanent step for humanity but it is definitely a good step towards the future and preservation of the Earth. It may not be the only step we need to take to prevent global warming and its adverse effects, but it is Indeed one which will help us to make a greener and better society.

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