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Research on Working of an Alkaline Fuel Cell Vechicle

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ABSTRACT
A Fuel cell vehicle is best replacement of internal combustion engines with zero emissions .A fuel cell produces a electricity by electrochemical reaction between hydrogen and oxygen with release of water vapour. Now fuel cells have proton Exchange member which consists of platinum electrodes to fast the reaction . But is some what little expensive. To overcome this problem Alkaline fuel cells(AFC) are used in the place of PEMFC . AFC has high electric efficiency and also cheaper for manufacturing this fuel cell. Maximum 70% efficiency obtained by AFC. AFC requires a pure oxygen so air filter is provided to removal of unwanted particles from air.

Keywords: Alkaline fuel cell, Electrochemical reaction.

I. INTRODUCTION

A fuel cell operates like a battery by converting the chemical energy from reactants into electricity, but it differs from a battery in that as long as the fuel (such as hydrogen) and an oxidant (such as oxygen) is supplied, it will produce DC electricity (plus water and heat) continuously.. In the 1960s, the fi rst practical fuel cells were developed and then used in the U.S. Gemini and Apollo programs for space applications. Since then, fuel cells have also been used increasingly for terrestrial applications although it remains a “new” technology in so far as its commercialization. As some of the fundamental obstacles are being overcome, fuel cells have become more feasible for several applications and are gradually being developed and commercialized.

Alkaline Fuel Cells (AFCs) are easy to handle, have very high electrical efficiency and are very suitable for dynamic operating modes.Alkaline fuel cells (AFCs) were the first practically working fuel cells capable of delivering significant power, particularly for transport applications. Conventional AFC uses aqueous KOH/NaOH solution with mass fraction of 35–85 wt.% as the liquid electrolyte, and generally operates at less than 100°C to avoid water loss from the alkaline electrolyte solution. Therefore, AFC has some common advantages with PEMFC, including low thermal insulation requirement, unlimited thermal cycling, second-level start-up or shut-down, excellent load following, simple BOP, cold start, etc. Moreover, AFC only needs to use nonnoble metal catalysts (typically nickel) as electrode materials, thereby reducing component cost remarkably. Similarly to PEMFC, AFC can be poisoned by CO and S. Furthermore, alkaline electrolyte is quite sensitive to CO_2 existing in fuel or oxidant stream, leading to AFC suffering a dramatic degradation due to hydroxide ionsdecreasing and porous electrode blocking (metal carbonate precipitating). Removing CO_2 from inlet fuel and oxidant stream or recycling electrolyte for outside scrubbing is alternative solution to address this issue.

To avoid the formation of precipitate potassium carbonate supply clean air by air filter and scrubber is used to remove the small amount of precipitate formation.

ALKALINE FUEL CELL :
Anode: $2H_2$ (g) + 4(OH)- (aq) → $4H_2O$ (l) + 4e-

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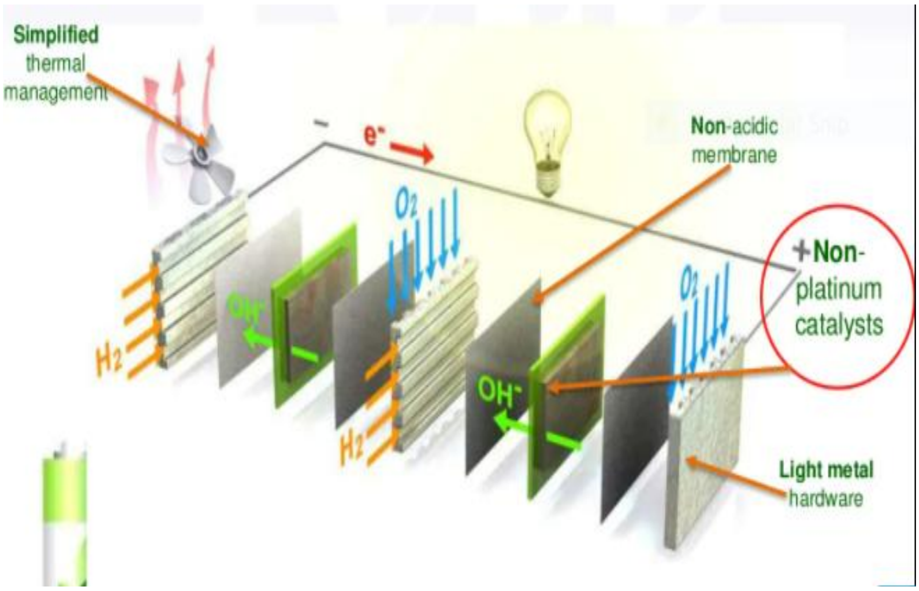
Cathode: O_2 (g) + $2H_2O$ (l)+ 4e- → 4(OH)-(aq)
Overall: $2H_2$ (g) + O_2 (g) → $2H_2O$ (l)
Components in fuel cell vehicle :

- Fuel cell (Anode, Cathode, Electrolyte)
- Fuel cell subsystem
- Hydrogen storage(Tanks, Energy – Ultracapacitor)
- Electric Drive system(Traction motors , Induction motors) etc

- Fuel cell power electric vehicle (FCV) uses hydrogen fuel as the major source of electric power to drive its electric traction motor through a fuel cell system. There are three major components in the FCV system. The fi rst is the fuel cell and fuel cell subsystem, the second is the hydrogen storage or the fuel processor, and the third is the electric drive system.
- The most common way to store hydrogen is to simply compress it in cylinders with high pressure to increase its density. The major concerns of compressed storage are the required large volume and the weight of gas containers which are normally made from steel alloy. Aluminum can be possibly used to make the body of the cylinder, but it is easy to be broken and currently expensive. Typically, storage pressures are between 200 and 450 bars (3000–6000 psi) [6]. In practice, storage densities are between 3% and 4% of hydrogen. The volume of these storage tanks ranges from 30 to 300 L [6].
- At a temperature of 20 K and vapor pressure of 0.5 MPa, liquid hydrogen can be obtained. Cryogenic liquid hydrogen storage can be used if a large amount of hydrogen is needed.
- Electric Drives Subsystem A fuel cell vehicle is an “electric drive” vehicle. The rotating torque of the traction motor in the FCV is powered by electricity generated by the fuel cell. Induction motors, permanent magnet (PM) synchronous motors, and switched reluctance motors (SRMs) can be used for FCV applications [23].

Figures:



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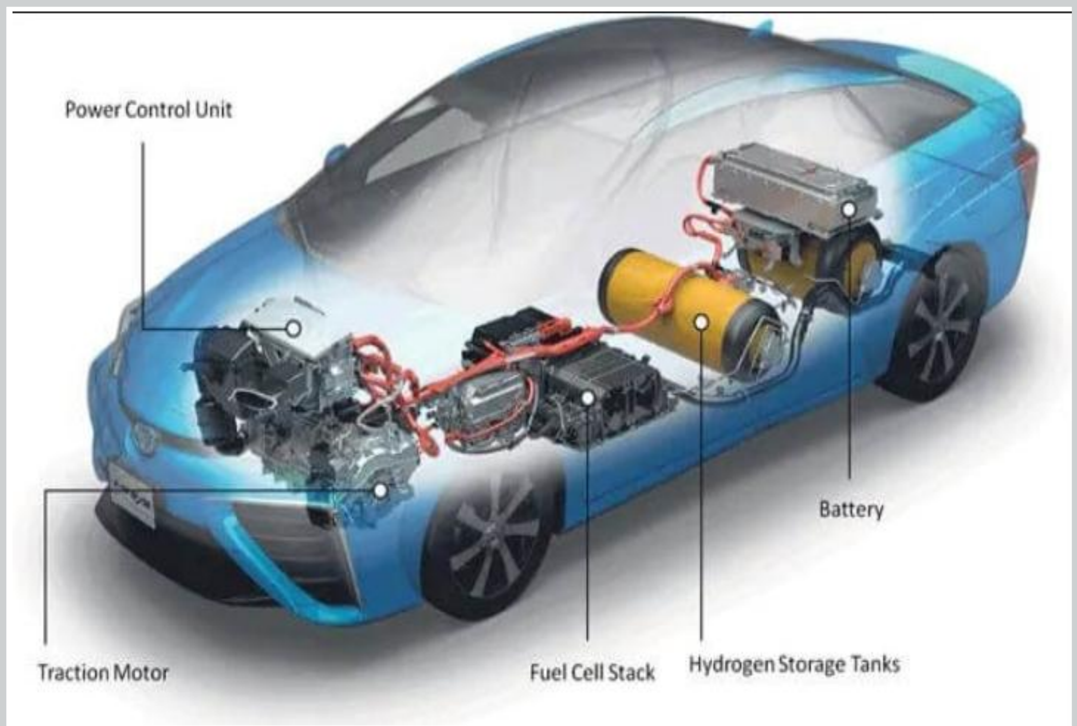

II. CONCLUSION:

AFCs offer potential benefits over PEMFCs due to non-noble metal catalysts and the ability to use cheaper and more versatile hydrocarbon-based membranes. PEMFCs face an issue of H2 and O2 crossover because of electro-osmosis and diffusion; however, for AEMFCs, the transport of hydroxide occurs from cathode to anode while water moves from anode to cathode, therefore, the crossover problems are solved in AEMFCs. The alkaline environment of AEMFCs allow the use of non-precious metal catalysts such as iron, cobalt, silver, and graphene, which significantly reduces the cost of the fuel cell system. Water management issues can also potentially be solved by tuning the properties of the polymer to allow for water diffusion from the anode to the cathode.So AFC can replace with PEMFC.

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