Eco-Friendly Advanced Hybrid Automobiles

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Abstract: This paper is to associate photovoltaic generators, fuel cells, and electrolysers. Hydrogen is an energy carrier that can transform our fossil-fuel dependent economy into a hydrogen economy, which can provide an emissions-free transportation fuel. But we are generating hydrogen fuel from solar panels which is most economic and even its emission free. Here, to sustain the power demand and solve the energy storage problem, electrical energy can be stored in the form of hydrogen. This hybrid system produces hydrogen in the daytime and stores it in the storage tank in order to supply the required energy. Hydrogen has been hailed as the key to a clean energy future primarily because it can be produced from a variety of energy sources, it satisfies all energy needs, it is the least polluting, and it is the perfect carrier for solar energy in that it affords solar energy a storage medium. The development of sustainable is clean and it reduces the emissions of greenhouse gases. Research has been done that, the different methods for producing hydrogen, storing it in vehicles.
KEY TERMS: Hydrogen, PEM cell, Hydrogen fuel cell, Hybrid, Solar Energy, PV cell.

1. INTRODUCTION

Whereas the 19th century was the century of the steam engine and the 20th century was the century of the internal combustion engine, it is likely that the 21st century was the century of the fuel cell, but in 22nd century will be the century of hybrid of renewable resources i.e. solar energy with the fuel cell. Hydrogen is a very energy dense fuel and hydrogen fuel cells are emission less. They are also quick to refuel, which accounts for the growing use of hydrogen fuel cell electric vehicles (FCEVs) in warehouse logistics. The process of producing hydrogen from natural gas is energy-intensive. The use of solar energy to produce hydrogen can be conducted by two processes: water

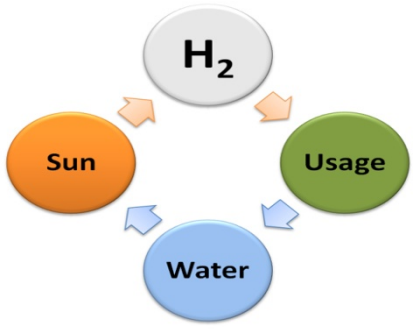

Fig 1. Hybrid Cycle

Electrolysis using solar generated electricity and direct solar water splitting. One solution is to use renewable energy, so if the hydrogen from solar energy and water thing sounds familiar, that's because the field of solar "water splitting" research has been expanding and progressing in recent years. There are a couple of ways to go about using solar energy for water splitting, one of which is to use the solar energy from photovoltaic cells. A more direct pathway is the use of photoelectrochemical cells. There have been quite a few developments on that front in recent years, including a low-cost, small-scale "artificial leaf" designed for undeveloped communities, and an advanced "bionic leaf" system. They have taken the photoelectrochemical approach, which they are calling a "solar fuel cell." The main technological options that are currently being considered are: improved internal combustion engine vehicles (ICEVs) powered by biofuels, battery electric vehicles (BEVs) and hydrogen fuel cell vehicles (FCVs). Hybrid solutions are also possible, such as battery electric vehicles equipped with range extenders (PHEVs), be they internal combustion engines or fuel cells.

2. PROPOSED SYSTEM

There are two ways in which hydrogen car works on Hydrogen fuel cell car and hydrogen internal combustion engine car and the hybridization of solar hydrogen fuel cell car. In hybridization of solar hydrogen fuel cell car, solar energy to produce hydrogen can be conducted by Fig 2. Regentrative Fuel Cell

two processes: water electrolysis using solar generated electricity and direct solar water splitting. When considering solar generated electricity, almost everyone talks about PV-electrolysis. The main use of solar energy is its very efficient energy carrier, to generate hydrogen, another energy carrier, and then convert it back into electricity again for use is possible in this water splitting – this technique uses semiconducting electrodes in a

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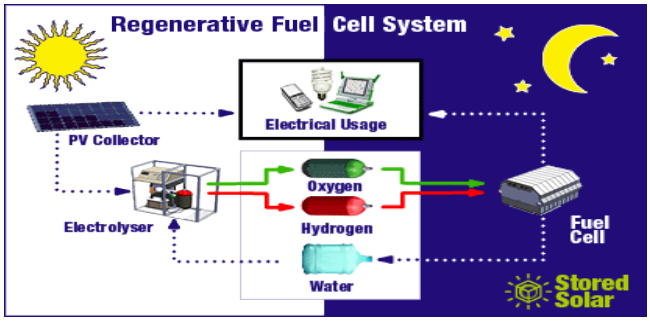
photoelectrochemical cell to convert light energy into chemical energy of hydrogen. There are essentially two types of photoelectrochemical systems – one using semiconductors or dyes and another using dissolved metal complexes. The solar cell is made by doping silicon with phosphorus and boron. Phosphorus is used because it contains five valence electrons (one more than silicon). Four of the phosphorus valence electrons bond to the silicon crystal leaving the fifth valence electrons free. A phosphorus doped region is called N-type silicon because of an excess of negative electrons. Boron is used because it contains only three valence electrons leaving room for a fourth electron and boron doped region is called P-type silicon. When a photon strikes a solar cell its energy is absorbed and transferred to an electron. The excited electrons now flow freely. The flow of electron in a complete circuit gives rise to electricity. The electricity produced is Direct Current (DC). Catching the rays of the sun and turning them into electricity is easy with solar cells but storing the energy for use when the sun goes down is another task. The solar energy can be stored as Hydrogen so we make Hydrogen by electrolysis of water. There are two atoms of Hydrogen and one atom of Oxygen in every molecule of water. The Hydrogen is eleven percent by weight of the water. Because of transition resistances, somewhat higher voltages are necessary in practice. So an electrolyzer is a device that puts electricity into water to break it apart. Different types of electrolyzers are usually distinguished by their type of electrolyte and/or electrodes. Hydrogen fuel cells are emerging as key players in the clean energy landscape of the future, except for one problem: it takes a lot of energy to make hydrogen, and here in the US, the preferred source of that energy appears to be natural gas. That's hardly a sustainable solution.



3. OPERATING PRINCIPLE

PV-Generator (Solar Panel): The solar cell is made by doping silicon with phosphorus and boron. The flow of electron in a complete circuit gives rise to electricity. The electricity produced is Direct Current (DC).

The Electrolyzer: An electrolyzer is a device that puts electricity into water to break it apart. Different types of electrolyzers are usually distinguished by their type of electrolyte or electrodes. Higher power electrolyzers are built as stacks in which individual electrolyzers are connected in series and voltages are added. PEM* electrolyzers have a particularly simple and compact design. The central component is a proton conducting polymer membrane which is coated with a layer of catalyst material on either side. These two layers are the electrodes of the cell.

Hydrogen Storage: Once the water is broken up, we need to store the Hydrogen if we are going to keep it for later use. Hydrogen can be stored as a gas in a container, but it is so light weight that a cubic foot weighs just 0.005 lbs. The methods of storage being developed are: Compressed gas, Liquid Hydrogen, Metal Hydride, Raw Iron Pellets and Liquid Carrier Storage. In this paper, the principle of the different methods of hydrogen storage is not explained.

Fuel Cell: Fuel cells are electrochemical devices converting a fuel's chemical energy directly to electrical energy with high efficiency. With no internal moving parts, fuel cells operate similarly to batteries. An important difference is that batteries store energy, while fuel cells can produce electricity continuously as long as fuel and air are supplied. Fuel cells electrochemically combine a fuel (hydrogen) and oxidant without burning. There by dispensing with the inefficiencies and pollution of traditional energy conversion systems.

The PEM Fuel Cell: A fuel cell has three key parts similar to those in a battery. It has a positively charged terminal (shown here in red), a negatively charged terminal (blue), and a separating chemical called an electrolyte in between the two (yellow) keeping them apart. (Think of the whole thing as a ham sandwich. The two terminals are the pieces of bread and the electrolyte is the ham in between.)Here's how a fuel cell produces electricity: Hydrogen gas from the tank (shown here as big brown blobs) feeds down a pipe to the positive terminal. Hydrogen is flammable and explosive, so the tank has to be extremely strong. Oxygen from the air (big turquoise blobs) comes down a second pipe to the negative terminal. The positive terminal (red) is made of platinum, a precious metal catalyst designed to speed up the chemistry that happens in the fuel cell. When atoms of hydrogen gas reach the catalyst, they split up into hydrogen ions (protons) and electrons (small black blobs). In case you're confused: hydrogen ions are simply hydrogen atoms with their electrons removed. Since they have only one proton and one electron to start with, a hydrogen ion is the same thing as a proton. The protons, being positively charged, are attracted to the negative terminal (blue) and travel through the electrolyte (yellow) towards it.

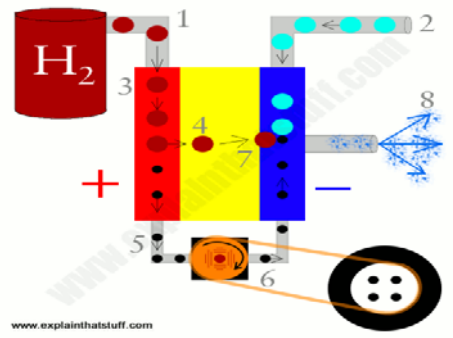


Fig 3. Block diagram of fuel cell

The electrolyte is a thin membrane made of a special polymer (plastic) film and only the protons can pass through it. The electrons, meanwhile, flow through the outer circuit. As they do so, they power the electric motor (orange and black) that drives the car's wheels. Eventually, they arrive at the negative terminal (blue) too. At the negative terminal, the protons and electrons recombine with oxygen from the air in a chemical reaction that produces water.The water is given off from the exhaust pipe as water vapor or steam. All fuel cells are made up of three parts: an electrolyte, an anode and a cathode. In principle, a hydrogen fuel cell functions like a battery, producing electricity, which can run an electric motor. Instead of requiring recharging, however, the fuel cell can be refilled with hydrogen. Different types of fuel cells include polymer electrolyte membrane (PEM) Fuel Cells, direct methanol fuel cells, phosphoric acid fuel cells, molten carbonate fuel cells, solid oxide fuel cells, reformed methanol fuel cell and Regenerative Fuel Cells. Hydrogen fuel cell stack: A single fuel cell produces only about as much electricity as a single dry-cell battery nowhere near enough to power a laptop computer, let alone a car. That's why fuel cells designed for vehicles use stacks of fuel cells linked together in a series. The total electricity they produce is equal to the number of cells multiplied by the power each cell produces.

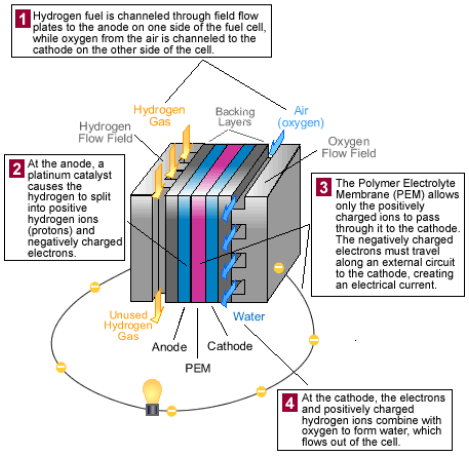


Fig 4. Fuel Cell Stack

Hydrogen fuel engine/motors:Hydrogen fuel engines are different from the regular engines in the way they work. Cars using hydrogen fueled engines usually need electricity to power the car. The hydrogen fueled engine is different from the normal internal combustion engine in that hydrogen produces electricity which is used to run a motor or engine. A hydrogen motor can be said to be a two motor engine.

4. Result And Discussion

In this paper, we demonstrate how an integrated photovoltaicelectrolyzer-fuel cell prototype can satisfy the electrical energy needs with consumers of small energy consumptions. The water electrolizer converts water to hydrogen and store it at low pressure. The fuel cell runs with the same hydrogen, converting it back to water and simultaneously electrical power to power a portable device. The solar-hydrogen-fuel cell technology will have an impact on the global energy scenario that it is presented as a renewable energy source of energy. In the solar and hydrogen fuel cell car comparing with hydrogen fuel cell car is emission free and it is eco-friendly. Comparing the cost it is less as hydrogen gas itself is very costly so since we are using renewable energy the cost will be reduced.

5. Conclusion

Solar Hydrogen Fuel cell vehicles are currently being researched for their feasibility of widespread usage in automobiles and other forms of transportation. However, it can be produced from a wide range of sources that are intermittent, too diffuse or too cumbersome to directly propel vehicles. Integrated wind-to-hydrogen plants, using electrolysis of water, are exploring technologies to deliver costs low enough, and quantities great enough, to compete with traditional energy sources. Many companies are working to develop technologies that might efficiently exploit the potential of hydrogen energy for mobile uses. The attraction of using hydrogen as an energy currency is that, if hydrogen is prepared without using fossil fuel inputs, vehicle propulsion would not contribute to carbon dioxide emissions. The drawbacks of hydrogen use are low energy content per unit volume, high tankage weights, very high storage vessel pressures, the storage, transportation and filling of gaseous or liquid hydrogen in vehicles, the large investment in infrastructure that would be required to fuel vehicles, and the inefficiency of production processes.

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