Implementation and Designing the Process on Hydrogen Gasoline Powered Si Engine.

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ABSTRACT

The threat posed by climate change and the striving for securities of energy supply are issues high on the political agenda these days. Governments are putting strategic plans in motion to decrease primary energy use, take carbon out of fuels and facilitate modal shifts. Taking a prominent place in these strategic plans is hydrogen as a future energy carrier. Energy stored in hydrogen would be available at any time and at any place on Earth, regardless of when or where the solar irradiance, the hydropower, or other renewable sources such as biomass, ocean energy or wind energy was converted. The fundamental variations in the times and places of solar energy supply and human energy demands can be overcome using hydrogen. Hydrogen gas combined with the standard air/fuel mixture increases the mileage. This form of alternative fuel is provided by a hydrogen generator mounted in the vehicle. Once set up is ready, the hydrogen gas (fuel) will be produced from water, an electrolyte compound, and electricity supplied from a battery provided. Here we are designing a mixed fuel two wheeler engine in a conventional SI engine we are incorporating traces of hydrogen along with gasoline in order to minimize the consumption of gasoline as well as to increase the power of vehicle. Here in addition, a hydrogen generating unit is made to produce hydrogen. It is actually an electrolysis unit having high grade stainless steel/graphite/semiconductors as electrodes in a closed container and mixture of distilled water & suitable ionic solution (KOH or NAOH) as electrolyte. Power for electrolysis is taken from an additional battery provided (12V). This battery can be recharged from a dynamo/alternator/motor provided on the vehicle. Recharging process is in such a way that a circuit is provided which includes dynamo/alternator/motor and the battery and which completes only when the brake applies while running. In spite of using the energy from the bike alternator directly here waste energy is used for the process of electrolysis.

INTRODUCTION

Toyota launched its first production fuel cell vehicle, the Toyota Mirai, in Japan at the end of 2014 and began sales in California, mainly the Los Angeles area, in 2015. The car has a range of 312 mi (502 km) and takes about five minutes to refill its
hydrogen tank. The initial sale price in Japan was about 7 million yen ($69,000). Former European Parliament President Pat Cox estimates that Toyota will initially lose about $100,000 on each Mirai sold. Many automobile companies have introduced demonstration models in limited numbers (see list). Charles Freeze, GM's executive director of global powertrain engineering, stated in 2010 that the company believes that both fuel-cell vehicles and battery electric vehicles are needed for reduction of greenhouse gases and reliance on oil.

PROPOSED PROCESS

The use of hydrogen as fuel in an automobile is problematic because of hydrogen's low density. In 2012, Lux Research, Inc. issued a report that stated: "The dream of a hydrogen economy ... is no nearer." It concluded that "Capital cost, not hydrogen supply, will limit adoption to a mere 5.9 GW" by 2030, providing "a nearly insurmountable barrier to adoption, except in niche applications". Lux's analysis concluded that by 2030, the PEM stationary market will reach $1 billion, while the vehicle market, including automobiles and forklifts, will reach a total of $2 billion.

Over the past decade, most of the world's major automakers have expended a lot research dollars and engineering resources on developing vehicles that burn hydrogen. While advocates like the idea of using hydrogen as an energy carrier because it's the most abundant element in the known universe and it can be used without emitting toxic or greenhouse gas emissions (disregarding, for the moment, any emissions from producing the hydrogen), not everyone agrees on how to use it. There are two basic approaches to using hydrogen in vehicles: the proton exchange membrane (PEM, also called polymer electrolyte membrane) fuel cell and the classic internal combustion engine (ICE).

The primary reason for using hydrogen in internal combustion engines is that they already exist and are comparatively inexpensive. Since hydrogen combusts fairly readily, it doesn't take much in the way of modifications, mainly new fuel injectors and a storage system, to make hydrogen work in an ICE. This is, of course, a bit of an oversimplification. While the basics are the same, the combustion properties of hydrogen are very different from gasoline or diesel. It burns much faster than those fuels, so getting the most out of hydrogen in an ICE requires optimizing the shape of the combustion chamber and calibrating the timing of the spark in order to avoid damaging knock.
The preferred approach to using hydrogen long term is the fuel cell. Fuel cells use a process that is essentially the reverse of electrolysis to combine hydrogen and oxygen in the presence of a catalyst to generate electricity. The only by-product of the process is water. Fuel cells are much more efficient than ICEs often topping 70 percent. The main problem with fuel cells is the cost. Until now, fuel cells have been largely handmade one at a time which greatly increases the cost of manufacturing. Now that the basic technology premise of fuel cells has been proven out, automakers are working to design fuel cell stacks that integrate ancillary systems such as cooling, water drainage and fuel delivery. These units, such as GM's latest fifth generation stack, are designed to be mass produced on automated equipment at much lower cost.

The other cost factor for fuel cells is the catalyst. The plates that make up the working part of a fuel cell stack are coated with platinum, which is of course very expensive. Most automakers are reluctant to give details of the internals of their stacks but GM recently revealed that its fourth generation fuel cell stack used in the Chevy Equinox for Project Driveway contained 80 grams of platinum. Its next-generation stack contains only 30 grams and the upcoming iteration is expected to need less than 10 grams, putting it on a par with catalytic converters.

**HYDROGEN USE IN MOTORCYCLES**

Emission Neutral Vehicle develops electric motorcycles powered by a hydrogen fuel cell, including the Cross cage and Biplane. Other manufacturers as Vectrix are working on hydrogen scooters. Finally, hydrogen fuel cell-electric hybrid scooters are being made such as the Suzuki Burg man Fuel cell scooter and the Hybrid. The Burg man received "whole vehicle type" approval in the EU. The Taiwanese company APFCT conducted a live street test with 80 fuel cell scooters for Taiwan’s Bureau of Energy.

**HYDROGEN INTERNAL COMBUSTION ENGINES**

Hydrogen internal combustion engine bikes are different from hydrogen fuel cell bikes. The hydrogen internal combustion bike is a slightly modified version of the traditional gasoline internal combustion engine car. These hydrogen engines burn fuel in the same manner that gasoline engines do; the main difference is the exhaust product. Gasoline combustion results in carbon dioxide and water vapour, while the only exhaust product of hydrogen combustion is water vapour.

In 1807 Francois Isaac de Rivaz designed the first hydrogen-fueled internal combustion engine. In 1965, Roger Billings, then a high school student, converted a Model A to run on hydrogen. In 1970 Paul Dieges patented a modification to
internal combustion engines which allowed a gasoline-powered engine to run on hydrogen US 3844262.

Mazda has developed Wankel engines burning hydrogen. The advantage of using ICE (internal combustion engine) like Wankel and piston engines is the cost of retooling for production is much lower. Existing-technology ICE can still be applied for solving those problems where fuel cells are not a viable solution insofar, for example in cold-weather applications.

A hydrogen vehicle is a vehicle that uses hydrogen as its onboard fuel for motive power. Hydrogen vehicles include hydrogen fueled space rockets, as well as automobiles and other transportation vehicles. The power plants of such vehicles convert the chemical energy of hydrogen to mechanical energy either by burning hydrogen in an internal combustion engine, or by reacting hydrogen with oxygen in a fuel cell to run electric motors. Widespread use of hydrogen for fueling transportation is a key element of a proposed hydrogen economy.

Hydrogen does not occur naturally on Earth and thus is not an energy source; rather it is an energy carrier. As of 2014, 95% of hydrogen is made from methane. It can be produced using renewable sources, but that is an expensive process.

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\frac{A/F}{mass} = \frac{mass\ of\ air}{mass\ of\ fuel} = \frac{137.33\ g}{4\ g} = 34.33:1 \\
\frac{A/F}{volume} = \frac{volume\ (moles)\ of\ air}{volume\ (moles)\ of\ fuel} = \frac{4.762}{2} = 2.4:1
\]

As these calculations show, the stoichiometric or chemically correct A/F ratio for the complete combustion of hydrogen in air is about 34:1 by mass. This means that for complete combustion, 34 pounds of air are required for every pound of hydrogen. This is much higher than the 14.7:1 A/F ratio required for gasoline.

**DISCUSSIONS**

**MILEAGE COMPARISON WITH & WITHOUT HYDROGEN**

The connection from petrol tank is removed and the mileage tester is connected to the carburetor inlet connection for petrol. The vehicle is made to run with and without the presence of hydrogen supply to carburettor at the same time the distance covered in a
specific consumption of petrol it is observed that while the hydrogen generating unit or electrolyzing unit active the distance covered for the specified amount of petrol is increased.

From the above observations we observe that mileage of vehicle is increased in second case i.e. when vehicle is made to run with hydrogen petrol mixture. We can observe than on an average the mileage of vehicle is increased by 25 km/litre of petrol.

**CONCLUSION & FUTURE SCOPE**

Hydrogen is a fuel with heat content nearly three times that of gasoline. From our work we experimentally found out that the efficiency of an IC engine can be rapidly increased by mixing hydrogen with gasoline. We conducted two tests. Experiment with test rig and a road test with two wheeler in both cases we observed reduction in fuel consumption it is a clear evidence that addition of hydrogen along with petrol can results in increase in the power of the engine or increase in mileage. Moreover the various emissions normally produced from IC engines can be reduced. Thus use of hydrogen in IC engines as a fuel can be considered a huge leap in the field of automobile engineering.

In this project we have proved that the mileage of the bike can be increased up to 9-10% by adding hydrogen with the petrol. The study and analysis can be extended to the following levels:

- Variation in combustion characteristics on adding hydrogen including ignition delay, effect on knocking the effect on cylinder lining as a result of hydrogen combustion.
- Exhaust gas analysis which includes variations in the quantities of the various combustion products including nitrogen oxides, carbon monoxides, sulfur dioxides etc. When hydrogen is employed the harmful emissions can be reduced since the combustion product of hydrogen is water vapors only.

- Volumetric analysis of hydrogen including flow rate and variations in the amount of hydrogen with variations in the supply current. High sensitive flow rate measuring instruments are can be used for the measuring hydrogen flow rate. Quantity of hydrogen produced can be increased when the supply voltage is increased and the corresponding improvements in the mileage can be assessed. The recharging system can be also be modified by using solar energy.

- Efficiency of the electrolysis can be increased. The conventional modes of electrolysis have efficiency of about 50 to 80 %. PEM [polymer electrolyte membrane] electrolysis is a new method of electrolysis which have efficiency above 95%. Use of such methods increase the production of hydrogen.
REFERENCES


