

The hydrogen gasoline engine engineering essay

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Introduction: Hydrogen gas inventor, generally it can be explain by the inventor electrolyze the water compounds into hydrogen gas and oxygen gas. The hydrogen gas is pump into the gasoline engine for better combustion to get better output energy. Basically the hydrogen gas are more flammable that oxygen gas. Diagram 1: Hydrogen Gasoline EngineThe diagram 1 showed the operation of a hydrogen engine and drawbacks, its benefits, its major components and how components can be adjusted or rearranges the position to reduce the drawbacks. In general, making the internal combustion engine to mix the hydrogen gas with the gasoline is not a hard job but that is more challenge to ensure that internal combustion engine. The earliest attempt at developing a hydrogen engine was reported by Reverend W. Cecil in 1820. Cecil presented his work before the Cambridge Philosophical Society in a paper entitled " On the Application of Hydrogen Gas to Produce Moving Power in Machinery." The engine itself operated on the vacuum principle, in which atmospheric pressure drives a piston back against a vacuum to produce power. The vacuum is created by burning a hydrogen-air mixture, allowing it to expand and then cool. Although the engine ran satisfactorily, vacuum engines never became practical. The process to produce the hydrogen from air need a large amount of energy and the energy needed was more that the energy produce by the internal combustion engine itself (shown in below calculation part) so the vacuum engine is never been accept. Contents: 1. Combustive Properties of Hydrogen Gas, H₂The properties of hydrogen gas that contribute to its use as a combustible fuel are shown following:

- low ignition energy
- wide range of flammability
- high auto ignition temperature
- small quenching distance
- high flame speed at stoichiometric ratios
- high diffusivity
- very low

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densityWide Range of FlammabilityHydrogen has a higher flammability range compare with all other gaseous such as nitrogen gas and oxygen gas. As a result, hydrogen can be burned and mixed in an internal combustion engine for a wider range of fuel-air mixtures. The advantage of this is that hydrogen gas can run on a lean mixture. A fuel-air mixture or lean fuel mixture mean it containing a lower percentage of fuel and a higher percentage of air, as its compared with a normal or rich mixture. A lean mixture is one in which the amount of gasoline(fuel) is less than the theoretical value it mean that chemically ideal amount needed for combustion refer to fuel-air ratio of the combustion engine. This is the reason why it is easier to get an engine start with hydrogen gas. Generally, fuel economy is higher and the complete combustion reaction occurs when a vehicle is run on a lean mixture condition. In addition, lower final combustion temperature proved it will reduce the amount of pollutants emitted in the exhaust. As lean operation will decrease the power output due to a decreases in the volumetric heating value of the air-fuel mixture therefore it is a limitation on how lean the engine can be run. Low Ignition EnergyHydrogen has very very low ignition energy compare to common gessesoes. The amount of energy required to ignite hydrogen gas is about one order of magnitude less than that required for gasoline fuel. This makes the hydrogen engines would ignite lean mixtures and shall occur prompt ignition after this. Unfortunately, the low ignition energy means that hot gases and hot spots on the cylinder can serve as sources of ignition, creating problems of premature ignition and flashback. Solution to prevent this is condition to happen is a challenges associated with a hydrogen running engine. Small Quenching DistanceHydrogen actually has quite small quenching distance, it <https://assignbuster.com/the-hydrogen-gasoline-engine-engineering-essay/>

even have smaller distance than gasoline. Theoretically, before hydrogen gas extinguish, the hydrogen gas flames travel closer to the cylinder wall than other fuels flames. Thus, this makes it more difficult to quench a hydrogen flames than a gasoline flames. Small quenching distance increases the tendency for backfire by the hydrogen-air mixture because it's more readily passes a closer near to the intake valve than a hydrocarbon-air flames. High Auto ignition Temperature Hydrogen has a very high auto ignition temperature. When a hydrogen-air mixture is compressed, it has important implications. In case, the auto ignition temperature is an important criterion in determining the ratio of the engine compression ratio can be use since the compression ratio are closely related to the temperature rise. The temperature rise can be calculated out by using the equation: The temperature may not reached hydrogen's gas auto ignition temperature without causing the premature ignition process. Thus, compression ratio is limited by the absolute final temperature. When the auto ignition temperature of hydrogen is high, compression ratios is larger. So, larger compression ratios to be used in a hydrogen gas engine compare with a hydrocarbon engine. This compression ratio is related to the thermal efficiency of the system. On the other way, hydrogen gas is quite hard to ignite in a diesel configuration or compression ignition due to the temperatures needed for ignition is relatively higher. High Flame Speed Hydrogen gas properties state it has higher flame speed at stoichiometric ratios. For this, the hydrogen flame speed is even faster than gasoline fuel flames speed. This means hydrogen engines more nearly reached the thermodynamically ideal engine cycle. However, the flame speed decreases faster at leaner mixtures condition, . High

Diffusivity Hydrogen gas has higher diffusivity properties. This ability to distribute in open air is significant greater than gasoline and beneficial for two important reasons. First, it forms of a uniform mixture between air and fuel. Second, hydrogen disperses rapidly if a hydrogen leak develops. Thus, it considers being more safer than other. Low Density Hydrogen gas has lower density than other gessesoes. These properties carry out two problems when it used in the internal combustion engine in vehicle. First, a huge large volume is needed to store the hydrogen gas to provide a vehicle an adequate driving range. Second, the energy density of a hydrogen-air mixture needed is increases accordingly and hence the power output is deceases accordingly.

2. Calculation Mass induced per cycle = $m = pV/RT$ kg VolEff =

$\dot{m}/(m \cdot N/120)$ For simplicity, assume VolEff = 100 % Then $\dot{m} = m \cdot N/120$

kg/s $x 0\% \text{Eff Ind} 0. 292 \text{N} 6000 \text{RPM} V 1 \text{litre} 0. 001 \text{m}^3 T 30 \text{degC} 303 \text{K} / \text{kmol} KUR 8.$

$314 \text{KJ} / \text{kmol} Kpv = RTpV/m = RT/Mp = mRT/VMp = RT/V [(m/M)1 + (m/M)2 +$

$(m/M)3 + (m/M)4]$ Formula : $x(2\text{H}_2 + \text{O}_2) + (1-x)[\text{C}_6\text{H}_{18} + 12. 59\text{O}_2 + 79/21\text{N}_2] =$

$x(2\text{H}_2\text{O}) + (1-x)(8\text{CO}_2 + 9\text{H}_2\text{O} + 12. 5 \cdot 79/21\text{N}_2)$ Electrolysis Power: 237 kW to

generate 1 mole per sec or 2gm/s of H₂.

Future Trend Hydrogen Internal Combustion Engine Vehicle A hydrogen internal combustion engine is using an internal combustion engine and hydrogen gas for its combustion medium. Hydrogen internal combustion engine, HICE are different from hydrogen-fuel cell which the HICE mainly use Hydrogen, H₂ + Oxygen, O₂ rather than Hydrogen, H₂ + Air in the combustion. As a summary, the HICE is a adjusted and improved version of the traditional gasoline-powered internal combustion engine. http://upload.wikimedia.org/wikipedia/commons/thumb/0/00/Wasserstoffeinfc3%BCllstutzen_eines_BMW.jpg/220px-Wasserstoffeinfc3%BCllstutzen_eines_BMW.jpg

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Diagram 2 : Filler neck for hydrogen of a BMW Like current gasoline-powered vehicles, the design of each hydrogen-powered vehicle will most likely vary from manufacturer to manufacturer and model to model. One model may be simple in design and operation, for example, a lean burning fuel metering strategy using no emission control systems such as EGR, catalytic converter, evaporate fuel canister, etc. Another model may be very sophisticated in design and operation, for example, using an EGR fuel metering strategy with a catalytic converter, multiple spark plugs, etc. Until such time that a hydrogen infrastructure exists, hydrogen/natural gas fuel blends provide a logical transition to fully hydrogen-powered vehicles. These vehicles can operate on either fuel, depending on availability.

Gasoline-electric Hybrid

A hybrid electric engine is a type of engine that combine hybrid engine and the electric engine mean its combines a traditional conventional internal combustion engine propulsion system with a newer eco-friendly technology electric power engine system. The presence of the electric power train is intended to achieve better fuel economy, more eco-friendly and create more power for most of the vehicles nowadays. The most common hybrid electric car brand in Malaysia such as Toyota, Honda and Nissan was launched few type of hybrid cars. Hybrid-electric trucks and buses are available in other country.

http://www.2carpros.com/images/articles/hybrid/engine/honda_hybrid_motor.jpg

Diagram 3:

Electric Motor Gasoline Engine <http://www.theautochannel.com>

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com/news/2002/10/28/149613. 1-lg. jpgDiagram 4 : Electric Motor Gasoline EngineConclusion: In a conclusion, although the hydrogen have high flammable properties but from the calculation from Figure 1 to 6, we can see that the nett engine power was reduce when the hydrogen gas percentage increases. From the figure 1 to 6, we calculated out when hydrogen gas percentage increases, the engine power increases. At the end, we can see that the electrolysis the hydrogen gas from the water is not the way to increase the engine output. The technology further improved to direct pump in the hydrogen gas in a gas tank in the car, this prevent the electrolysis process in the car and by this way, it can increases in engine power output. So the direct electrolysis from the water in the car is not usable and this makes the engine less power at the end.