

Impact of Magnetic Flux by Halbach Array on Petroleum Hydrocarbon to Improve The Performance of IC Engines

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Abstract- The aim of this study is to investigate the effect of the fuel magnetization on the performance of IC engine. It has been observed that on magnetization viscosity of hydrocarbon fuel decreases due to de-clustering of the Hydrocarbon fuel molecules which results in better atomization of the fuel and efficient combustion of air fuel mixture. This enhances thermal efficiency and improves the fuel economy of I.C engine. The magnetic field applied along the fuel line immediately before fuel injector. The magnetic field of different intensity (E.g. 2000, 3000, 4000 Gauss) is applied with the help of permanent magnet and its effect on fuel consumption as well as on exhaust gas emission will be studied and compared with performance without application of magnetic field. At different load conditions the experiments are conducted to analyse the fuel consumption, thermal efficiency and exhaust gas analyser is used to measure the exhaust gas emission such as NO_x, HC, CO and CO₂.

Keywords- Halbach array, Magnetic field, fuel consumption, fuel economy, efficiency, emission.

Introduction

Today's hydrocarbon fuel leave a natural deposit of carbon residue that clogs carburetor, fuel injector, leading to reduced efficiency and wasted fuel. Pinging, stalling, loss of horsepower and greatly decreased mileage on cars are very noticeable. Most fuels for internal combustion engine are liquid, fuels do not combust until they are vaporized and mixed with air. Most emission motor vehicle consists of unburned hydrocarbons, carbon monoxide and oxides of nitrogen. Unburned hydrocarbon and oxides of nitrogen react in the atmosphere and create smog. Generally a fuel for internal combustion engine is compound of molecules. Each molecule consists of a number of atoms made up of number of nucleus and electrons, which orbit their nucleus. Magnetic movements already exist in their molecules and they therefore already have positive and negative electrical charges. However these molecules have not been realigned, the fuel is not actively interlocked with oxygen during combustion, the fuel molecule or hydrocarbon chains must be ionized and realigned. The ionization and realignment is achieved through the application of magnetic field. [1]

Halbach Array

Applications requiring specifically tailored magnetic fields are widespread in industry and research. The field sources for such applications come in a diverse variety of shape and form. A **Halbach array** is a special arrangement of permanent magnets that augments the magnetic field on one side of the array while cancelling the field to near zero on the other side. This is achieved by having a spatially rotating pattern of magnetization. The rotating pattern of permanent magnets (on the front face; on the left, up, right, down) can be continued indefinitely and have the same effect. The effect of this arrangement is roughly similar to many horseshoe magnets placed adjacent to each other, with similar poles touching. [2]

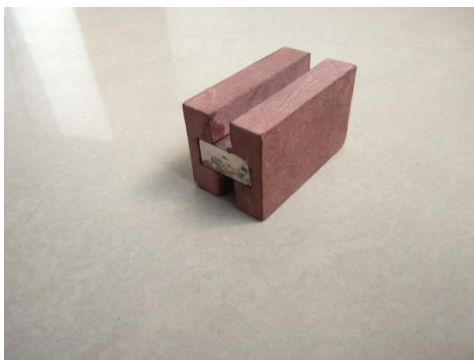


Fig 5. Construction of planar halbach array

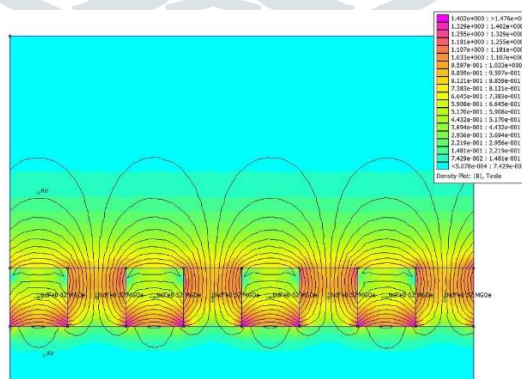


Fig2. Flux diagram of halbach array

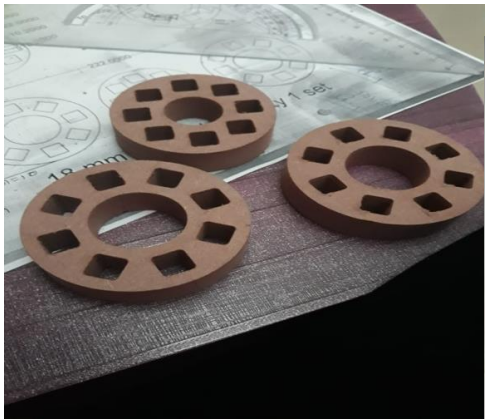


Fig5. Construction of circular halfbach array

Fig6. Construction of planar halfbach array

Effect Of Magnetism On Hydrocarbon Fuels

Hydrogen occurs in two distinct isomeric forms one is Para which is normally occurs in fuels, second is ortho which achieved by applying magnetic field. These two forms are characterized by the different opposite nucleus spins. The ortho state can be achieved by applying strong magnetic field along the fuel line [3]. In the para Hydrogen molecule, which occupies the anti-parallel rotation, the spin state of one atom relative to another is in the opposite direction, therefore it is diamagnetic. In the ortho molecule, which occupies the parallel rotational levels, the spin state of one atom relative to another is in the same direction as shown in Figure.1, therefore, it is paramagnetic.[2,3]

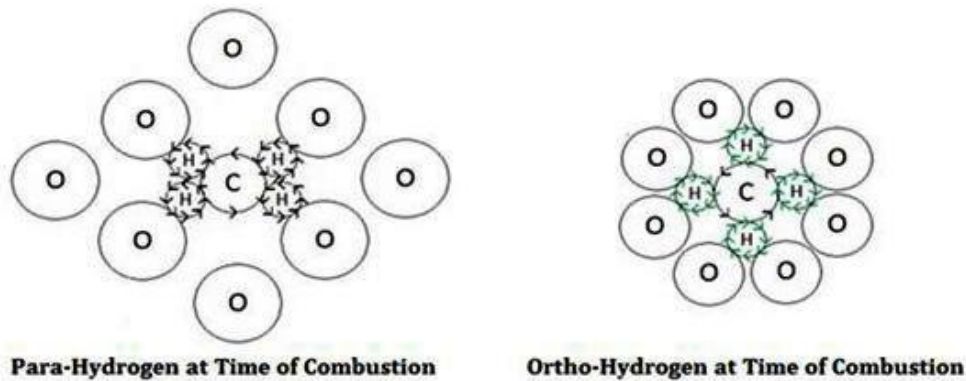


Fig.2 Schematic view of (a) Para state of Hydrogen and (b) Ortho state of Hydrogen[3.]

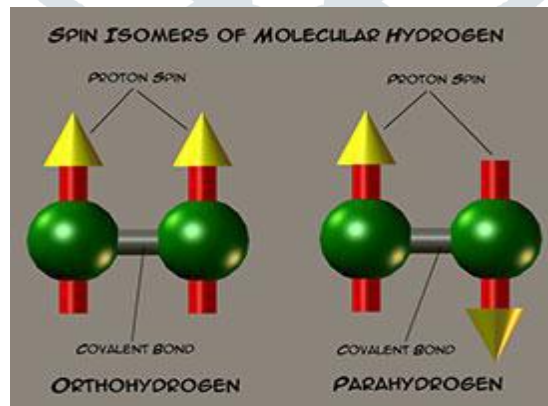


Fig.1 Schematic view of Spin isomers of molecular Para and Ortho state of Hydrogen[3]

When the fuel passes through a magnetic field, created by the strong permanent magnets, due to that magnetic field hydrocarbon change their orientation and convert from para state to ortho state[3]. In ortho state inter molecular force is considerably reduced and increase space between hydrogen. This hydrogen of fuel actively interlocks with oxygen and producing a more complete burn in the combustion chamber[3]. The magnetic field helps to disperse oil particles and to become finely divided. Figure.2 shows the schematic view of para state and ortho state of Hydrogen of clusters of hydrocarbons changed with the influence of magnetic field and they are more dispersed.

Experimental Set Up And Procedure

The performance tests were carried out on a single cylinder, four stroke petrol engine. The setup consists of a bike(100cc, 150cc), an halbach array, and digital computer for rpm counting(cateye7).

TECHICAL SPECIFICATION

Model	Unicorn 150	Model	
Make	Honda	Make	
Type	Four stroke petrol,air cooled	Type	
No.of cylinder	One	No.of cylinder	
Bore	57mm	Bore	
Stroke	57mm	Stroke	
Rear wheel size	1940mm	Rear wheel size	
Cubic capacity	149.1cc	Cubic capacity	
Transmission type	Chain drive	Transmission type	

PROCEDURE

- Various accelerated rotation of the engine r.p.m, were taken, which representing an initial speed and low, medium and higher than the other so as to know the amount of fuel consumption in each of these speed at all magnetic intensities.
- Start up the engine after putting a certain amount of fuel in the external tank, and set the selected speed for the experiment. Process will continue operating until the engine doesn't stall and the fuel is consumed fully.
- After that check the kilometer reading on the digital computer and also check the emissions and note is down. Repeat the same procedure of several iteration to get an accurate and constant reading.
- Install the halbach array on the fuel in as shown in the figure and repeat the same procedure as stated above.
- The amount of consumed fuel during operation were measured, as well as the emission after the end of the operation. The amount of consumed fuel after the installation of the magnetic device was deducted from the quantity before the installation of the magnet to know the quantity saved, and the same principle applies to the exhaust gases.
- Repeat the process for each magnetic intensity and also for the various speeds.

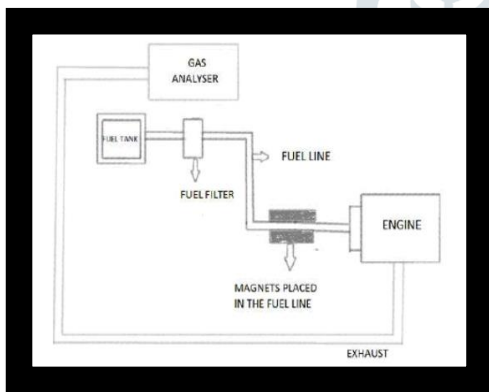


Fig5. Test Setup



Fig5. Digital computer



Conclusion

- When fuel is exposed to a magnetic field, we find that its properties are changed.
- Magnetic treatment does not need energy and thus be economically feasible.
- Change some properties of the fuel by the magnetic field, and take advantage of some of the applications that belong to the industry and the environment.
- Increase the efficiency of most equipment and machinery that using hydrocarbon fuel
- We can understand the mechanism of magnetization of fuel through the impacts of external magneticfield in the microscopic structure, which is the displacement and polarize the fuel molecules.
- Reduce the amount of environmental pollutants in the exhaust gases.

References-

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- [3] Effect of magnetic field on performance and emission of single cylinder four stroke diesel engine Piyush M Patel, Prof. Gaurav P Rathod, Prof. Tushar M Patel

