

Research Article

Performance and Analysis of Two Stroke Dual and Triple Spark plug Single Cylinder SI Engine with Gasoline fuel

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Abstract

In two stroke spark ignition engines due to some losses there is high exhaust emissions and low brake thermal efficiency and some time it will be occur because of incomplete combustion, which has an effect on the engine as a high load in operating condition. By improving some parameters we can improve the engine's efficiency i.e. specific fuel consumption rate and Thermal Efficiency of the engine. This performance is achieved by using dual spark plug in two stroke gasoline also its effect on the engine parameter is analyzed. For experiment a spark-ignition engine was used to study the effects of spark plug location on a four spark plug SI engine performance. Constructed simulation can be used for either single- or four-spark plug configuration. Here we consider arrangement that the plug is located center of the head. To make a comparison, property of single spark plug were also considered on different spark plug locations.

Keywords: 1-Twin spark plug and Tri spark plug, 2- S.I engine, 3- Combustion chamber

Introduction

The fossil fuel which based on Hydrocarbon consumes in motor vehicles is one of the major sources of urban air pollution. For Normal combustion process some products are used in automobile, i.e CO₂, H₂O and N₂ Hydrocarbon based fuel. The products are not works as pollutants, since they do not responsible for direct health hazard. But, during the actual combustion process, some additional gases, such as carbon monoxide, unburned HCs, nitrogen oxides and particulate matters also appear in the engine exhaust, which can direct effect on human health and subject to exhaust emission legislation. The quantity of these harmful pollutant emissions are about five times greater for a typical spark ignition (SI) engine than that of the corresponding compression ignition (CI) engine. Most of the gases are responsible for pollution, some of them (CO and some unburned gases). This colorless poisonous gas is mostly generated in an engine when it is operated with a fuel rich equivalence ratio. When the requirement of oxygen is too high and supply is too low to convert CO₂ then some unburned gases covert in CO which is indirectly harmful for a fast combustion. Nitrogen gas is responsible for 13% pollution and most of them is nitrogen oxides compounds with a small amount of nitrogen dioxide (NO₂). NO_x is also responsible for photochemical fog. In the combustion chamber NO_x is also responsible for convert the air in Nitrogen. Due to high temperature in combustion chamber NO is responsible for create the NO_x

Methods for controlling the emission

For the efficient combustion, Design is the important consideration and some other considerations are also play important role which is as follow:

1. Optimize the operating parameter.
2. Equivalence ratio.
3. Spark timing

There are some other methods to reduce the atmospheric pollutant emission:

- A. Destroy the pollutants after the combustion with some extra work.
- B. By changing the design of engine, fuel injectors, spark plug location, cooling system and ignition system
- C. Modifications in the gasoline.

Some useless pollutants which should be reduced in petrol engine are CO, HC and NO_x. In SI engine to control the crankcase emission some methods are used as Evaporative Emission, gas recirculation etc. by the suggest method leakage can also be controlled in crankcase. Cylinder pressure is very high in the combustion chamber because piston changes their position, near of top dead centre. The rings gap increases and piston cylinder clearances also increases because of some significant part of gases leaks which is called crank blow. The engines which has

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homogeneous charge also has have high crank blow by gas. Blow by gases have a partially burnt mixture because rings stored small gases. This unbalanced system may responsible for 25% hydrocarbon which is emitted by an uncontrolled car. A positive pressure drop between the crankcase and manifold can easily control the emission. This is possible when engine is running and intake manifold is at a lower pressure.

Some important method which control the emission:

1. By using exhaust manifold reactor.
2. To keep lower compression ratio.
3. By reducing the thermal efficiency.
4. Catalytic converter plays an important role to control the pollutant emission.

Basically this study is use to improve the combustion process by using four spark plugs as a design parameter. Quarter sparks are one of the important design parameters for SI engines. Quarter sparks are used to achieve a stronger and faster combustion. This system not allows the engine on operating a low rating mixture.

There are some already some experiment which shows the performance of the dual SI engines, Which is completed on the bases of theoretical concept and some studies are completed practically and investigate on each and every point which play an important role combustion chamber.

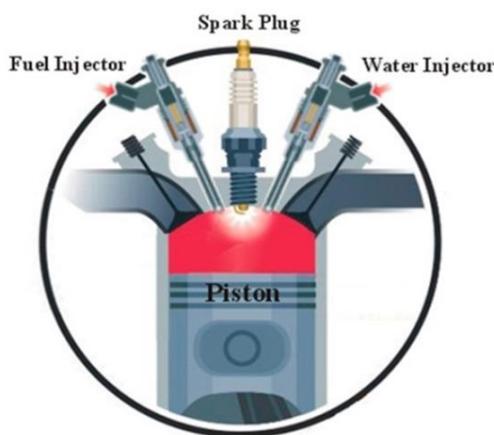


Fig. 1: Single SI engine with central located

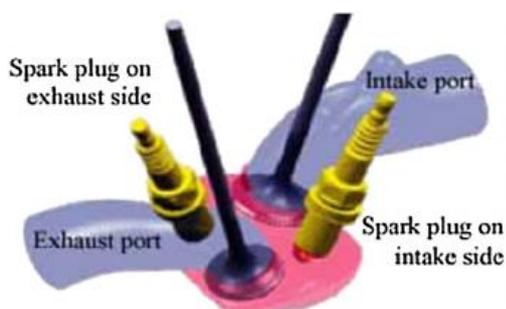


Fig. 2: Dual SI engine



Fig. 3: Tri SI ignition engine

Review of some researcher after a deep investigation

A. N.L.N. Murthy, S.R. Shankapal and S.N. Sridhara, Abdul Nassar

They made a research on dual spark ignition engine. In the first step of the research they find that the possibilities on dual spark plug in combustion chamber and validation of the plugs. In the second phase, the diagrammatically study was carried out to optimize the location of the spark plugs for improved performance in terms of higher specific power and reduced emission and knocking. In his research they said that some parameters are considered to get the best output:

1. Compression ratio
2. Swirl ratio
3. Advance

In the last they make a practically implementation of the project on the bases on investigation.

B. Ismail Altın & Atilla Bilgin

In this research paper the spark plug which is placed in the center has best performance in fuel economy and some other configuration. It is find that if the position of spark plug in center is difficult then twin spark plug can easily be used and give better result in comparison to the other locations of spark plugs. From the investigation it is clear that twin spark plug has better performance in comparison of single spark plug but it is less efficient in comparison to central location spark plug. By this investigation no heat losses is possible and provide a faster burning.

C. Atill Bilgin, Ismail Altin and Ismet Sezer

In this research the effect and possibilities of using dual spark plug and changes of spark plug location on the exhaust emission was investigated of an SI engine. And also the found Increase in CO and NO emissions

under some various conditions can be diminished by using dual spark ignition in SI engines. The centrally located single spark and mid radius located dual plug configuration gives almost similar and the best combustion with the lowest exhaust emission in comparison with all other configuration.

D. Narasimha Bailkeri, Krishna Prasad, Shrinivasa Rao

In this Paper the experiment has done under different condition, I.e. different locations and different load conditions and at three different compression ratios. After this consideration the results was compared with that of a single plug operation. This result is showing that performance dual spark plug is better in comparison to single spark plug on the bases of all three compression ratios and from the investigation some result has been found:

- 1) At the optimum compression ratio the brake Thermal Efficiency of dual spark plug is 2.5% more in comparison of single spark plug.
- 2) At the full load CO emission is 16% in dual spark plug.

Conclusion

From the above analysis it is clear that the effects of variations of spark plug locations on engine performance at different engine speeds is important factor for best performance and fuel economy. The performance of an SI engine having twin-spark ignition system is also investigated. For this purpose a Comparisons were also made to the single-spark engine configurations for the same conditions. If central location of spark plug is difficult or not possible because of the some design limitation then twin-spark plug can be preferred and gives better result in comparison to single spark plug. From the above It was obtained that the twin-spark plug give better performances and fuel economy than single-spark configurations for all spark plug locations, except only centrally located single-spark configuration. By this result we can say that there is no heat loss and a faster burning can be achieved. Design in which spark plug is placed in center will give the best performance and also provide a faster combustion in comparison to other spark plug position.

From the above investigation it can be says this technology will give the best result in power bikes and fuel efficiency and most important point that it will surely minimize the fuel economy in future.

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