LASER IGNITION IN INTERNAL COMBUSTION ENGINES – A REVIEW

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Abstract:- Stability in relation to the internal combustion engine is strongly connected to the aqueous fuel and the overall efficiency. With the help ignition combustion increases and pollution reduced.

In this paper for we focus on sustainable fuel for future. Basically, there are four methods in which laser light can interact with combustible mixture to start an ignition process. They are 1 thermal initiation, 2. Non-resonance breakdown, 3. Rupture of rupture, and 4. Known as photochemical ignition. The most widely used technology so far is the non-resonance of combustion, mainly due to the laser wavelength and the freedom to ease the implementation. The breakdown of gas within the focal spot of high power laser allows a very different localization of the ignition spot in a combustion substance.

Keywords: Nd: YAG Laser, Thermal initiation, Non-resonant breakdown, Resonant breakdown, Photochemical mechanism, Self-cleaning, Multi point Ignition.

1. Introduction

In technical equipment such as internal combustion engine, reliable ignition is required for adequate system performance. Fuel consumption and exhaust emissions of motor vehicles have also decreased in economic and environmental barriers. At the moment, direct fuel injection engines show the highest efficiency in reducing fuel consumption and exhaust emissions. Unfortunately, the traditional spark plug ignition shows one Ignition space cannot be selected because major damage with modern spray-guided combustion processes Better. From the viewpoint of gas engine R&D engineers, ignition of the fuel/air mixture by means of a laser has great potential. Especially the thermodynamic requirements of a high compression ratio and a high power density are fulfilled well by laser ignition. Additionally, the spark plug electrodes can influence the gas flow inside the combustion chamber. Ignition strongly affects the formation of pollutants and the extent of fuel conversion. Laser ignition system can be a reliable way to achieve this.

Literature Survey:

The conventional engine has been modified with a view to conduct feasibility Experiments using laser ignition. The engine has been modified replacing the conventional spark plug by a window installed into a cylindrical mount. The position of the focusing lens inside the mount can be charged to allow variations of the location of the initial optical breakdown. It has been observed that Compared to conventional spark plug ignition, laser ignition reduces the fuel consumption by several percent. Exhaust emissions are reduced by nearly 20%. Another important question with a laser ignition system is its reliability.

What is ignition?

Ignition is the process of starting radical reactions until a self-sustaining flame has developed. One can distinguish between auto ignition, induced ignition and photo-ignition, the latter being caused by photolytic generation of radicals.

Conventional Sparking Plug Ignition

Conventional spark plug ignition has been used for many years. For ignition of a fuel-air mixture the fuel-air mixture is compressed and at the right moment a high voltage is applied to the electrodes of the spark plug.

Drawbacks of Conventional Ignition System

- Location of spark plug is not flexible as it requires shielding of plug from immense heat and fuel spray.
- Ignition location cannot be chosen optimally.
- Spark plug electrodes can disturb the gas flow within the combustion chamber.

- It is not possible to ignite inside the fuel spray.
- It requires frequent maintenance to remove carbon deposits.
- Leaner mixtures cannot be burned, ratio between fuel and air has to be within the correct range.
- Degradation of electrodes at high pressure and temperature.
- Flame propagation is slow.
- Multi point fuel ignition is not feasible.
- Higher turbulence levels are required.
- Erosion of spark plug electrodes.

LASER

Lasers provide intense and unidirectional beam of light. Laser light is monochromatic (one specific wavelength).

Wavelength of light is determined by amount of energy released when electron drops to lower orbit. Light is coherent; all the photons have same wave fronts that launch to unison. To make these three properties occur takes something called "Stimulated Emission", in which photon emission is organized.

Types of lasers

- Ruby laser
- Chemical lasers
- Excimer lasers
- Solid-state lasers
- Semiconductor lasers
- Dye lasers

LASER Ignition

Laser ignition is the process of starting combustion by the stimulus of a laser light source. Laser ignition uses an breakdown of gas molecules caused by an intense laser pulse to ignite gas mixture. The beam of a powerful short pulse laser is focused by a lens into a combustion chamber and near the focal spot and hot and bright plasma is generated

Conclusion

The laser ignition system also allows almost free choice of ignition space within the fuel spray inside the combustion chamber. Due to significant reduction in fuel consumption, decrease in exhaust gases shows the possibility of laser ignition processing. Laser ignition is nonintrusive in nature; High energy can be accumulated faster, heat loss is limited, and able to ignite combustible charges. The most important thing is that it shows a better minimum ignition energy requirement than the electric spark system with lean and rich fuel / air mixture.

SUMMARY

Laser induced ignition of slow combustion processes has been investigated. The viability of laser-induced ignition systems on direct injection gasoline engines has long been proven in experiments. Key Benefits Inside the fuel spray, there is almost free choice of ignition location within the combustion chamber. Measurement show that the required pulse energy for successful ignition decreases with increasing pressure. Fast combustion processes show that much more violent character than slow

deflagrations. FEM simulations indicate that a well-designed beam entrance window can probably withstand pressure and temperature during detonation.

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