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# To improve performance of Internal combustion engine with an aid of neodymium-doped yttrium aluminium garnetLaser Ignition System

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**Abstract:**Nowadays, combustion engines and other combustion processes play an overwhelming and important role in everyday life. As a result, study of ignition of combustion processes is of great importance. In most cases, a well-defined ignition location and ignition time is crucial for an IC engine. Spark plugs are well suited for such tasks but suffer from disadvantages, like erosion of electrodes or restricted positioning possibilities. Over the conventional ignition systems, ignition of combustible materials by means of high power laser pulses could be beneficial. Due to market demands aimed at increasing the efficiency and the power density of IC engines, existing ignition systems are rapidly approaching their limits. To avoid this, IC engine manufacturers are seeking new technologies. The thermodynamic requirements of a high compression ratio and a high power density are fulfilled well by laser ignition. Through this paper, the objective is to present the current state of the relevant knowledge on fuel ignition and discuss selected applications, advantages, in the context of combustion engines. Sustainability with regard to internal combustion engines is strongly linked to the fuels burnt and the overall efficiency. Laser ignition can enhance the combustion process and minimize pollutant formation. This paper is on laser ignition of sustainable fuels for future internal combustion engines. Ignition is the process of starting radical reactions until a self-sustaining flame has developed. In technical appliances such as internal combustion engines, reliable ignition is necessary for adequate system performance. Ignition strongly affects the formation of pollutants and the extent of fuel conversion. Laser ignition system can be a reliable way to achieve this. Fundamentally, there are four different ways in which laser light can interact with a combustible mixture to initiate an ignition event. They are referred to as 1. Thermal initiation, 2.Non resonant breakdown, 3. Resonant breakdown, and 4. Photochemical ignition. By far the most commonly used technique is the non-resonant initiation of combustion primarily because of its freedom in selecting the laser wavelength and ease of implementation. Optical breakdown of a gas within the focal spot of a high power laser allows a very distinct localization of the ignition spot in a combustible material. The hot plasma which forms during this breakdown initiates the following self-propagating combustion process. At the end we have discussed some experimental results regarding measurements of fuel consumption and emissions which prove that laser ignition has important advantages compared to conventional spark ignition systems.

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

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