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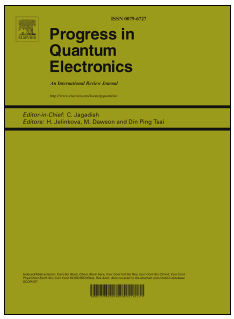


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# Laser Ignition - Spark Plug Development and Application in Reciprocating Engines

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## Abstract

Combustion is one of the most dominant energy conversion processes used in all areas of human life, but global concerns over exhaust gas pollution and greenhouse gas emission have stimulated further development of the process. Lean combustion and exhaust gas recirculation are approaches to improve the efficiency and to reduce pollutant emissions; however, such measures impede reliable ignition when applied to conventional ignition systems. Therefore, alternative ignition systems are a focus of scientific research. Amongst others, laser induced ignition seems an attractive method to improve the combustion process.

In comparison with conventional ignition by electric spark plugs, laser ignition offers a number of potential benefits. Those most often discussed are: no quenching of the combustion flame kernel; the ability to deliver (laser) energy to any location of interest in the combustion chamber; the possibility of delivering the beam simultaneously to different positions, and the temporal control of ignition. If these advantages can be exploited in practice, the engine efficiency may be improved and reliable operation at lean air-fuel mixtures can be achieved, making feasible savings in fuel consumption and reduction in emission of exhaust gasses. Therefore, laser ignition can enable important new approaches to address global concerns about the environmental impact of continued use of reciprocating engines in vehicles and power plants, with the aim of diminishing pollutant levels in the atmosphere. The technology can also support increased use of electrification in powered transport, through its application to ignition of hybrid (electric-gas) engines, and the efficient combustion of advanced fuels.