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Passive MAHLE Jet Ignition: The Capability for Whole Area Operation and its Influence on Ignition System Requirements

Engine and vehicle manufacturers are facing increasing pressure from legislation to reduce vehicle emissions and deliver improved fuel economy. These requirements are increasing the interest in novel combustion technologies, including pre-chamber based ignition systems and dilute combustion in gasoline engines.

The pre-chamber based Jet Ignition concept produces high energy jets of partially combusted species that induce ignition in the main combustion chamber and enables rapid, stable combustion, even with dilute mixtures. Studies showing the potential of the passive MAHLE jet ignition (MJ) concept, combined with high geometric compression ratio, Miller cycle operation and exhaust gas recirculation to provide high efficiency engine solutions has been presented previously. These studies demonstrated the capability of the pre-chamber to enable whole map operation as well as comparable engine out emissions, idle stability and catalyst light-off capability to a conventional central spark plug (CSP). This present study summarises the latest results from this concept and discusses the specific requirements demanded from the ignition system. A novel new ignition system provided by Ambixtra, which allows both high energy and extended duration spark discharge is introduced and results showing its effects on combustion stability are discussed.