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MAHLE Passive Jet Ignition for High Performance Engines

Vehicle manufacturers are facing increasing pressure by legislation and economics to reduce vehicle emissions and deliver improved fuel economy. Over the coming years, significant reductions in carbon dioxide (CO₂) emissions need to be achieved to meet fleet targets, whilst at the same time satisfying the more stringent forthcoming Euro7 emissions regulations. Since the introduction of RDE testing the engine operating region that is under scrutiny during compliance testing has significantly increased. Furthermore, manufacturers may be required to disclose their engine base emissions strategy (BES) and any auxiliary emissions strategy (AES), which may preclude the use of fuel enrichment for component protection in future engines. These combined demands increase the focus on the emissions performance of engines over their entire operating map, which is especially demanding for engine with a very high specific output.

The pre-chamber based Jet Ignition concept produces jets of partially combusted species that induce ignition in the main combustion chamber enabling rapid, stable combustion. The potential of passive jet-ignition to reduce the knock sensitivity, enabling the increased output at stoichiometric operation, will be demonstrated. Further extension of the stoichiometric operating boundary is also possible by combining it with external EGR. Measurements from MAHLE's high specific output downsizing demonstrator engine will be used to illustrate the benefits achievable through these technologies.