Performance Measurements of a GDI variable compression ratio engine fitted with a 2-stage boosting system and external cooled EGR

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ABSTRACT

Variable compression ratio (VCR) and gasoline direct injection (GDI) are both intended for reducing fuel consumption, in combination with high pressure engine boosting. The two strategies both aim at significantly increasing SI engines' torque and power density with an objective of optimum downsizing and downspeeding.

Although there exists a significant overlap between benefits expected independently from GDI and VCR, the way the results are obtained are different when using GDI or VCR. The benefit provided by the combination of VCR and GDI has been experimentally explored by the authors to quantify the resulting increase in fuel efficiency and reduction in pollutant emission on the NEDC. Experimental conditions are presented as well as the key results on the following topics: gain in thermal efficiency at part loads by increased compression ratio, exhaust enthalpy control and turbo matching, consequences on charge scavenging strategies, hard knocking control at extreme loads up to 40 bar BMEP, max torque capability, conditions for matching required combustion safety factors, combustion stability from idle to high loads, external cooled EGR ratios achievable at same COV, reduction in idle speed and FC, improvement of the catalyst heating phase, wall wetting control by control of piston/injector relative position and resulting reduction in soot and particulate number emissions, reduction in need for high load enrichment.

Conclusions are provided in relation to CO_2 emission targets and future evolution of pollutant emission standards.

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