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Effects of Internal EGR on Modern Diesel Engines Internal Equipped with VVA at Idle

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ABSTRACT

Vehicle emissions regulations are continuing to grow more challenging requiring near-zero levels of pollutant emissions. Nitric oxide (NO_x) emissions are heavily regulated with the emission limit expected to become 1/10th of its present limit by 2021. In order to meet the new regulations, improvements in both the engine and the exhaust aftertreatment system are required. Exhaust gas recirculation (EGR) is used to reduce the NO_x produced by the engine while the aftertreatment system converts most of the engine-out emissions to safer gases before releasing them to the atmosphere. One of the main challenges with the aftertreatment system is that it requires to operate at a certain minimum temperature before it is effective. Variable valve actuation (VVA) can be used to improve the thermal management of the aftertreatment system- first to accelerate the warmup following a cold start and then to maintain its temperature economically. Using VVA, negative valve overlap (NVO) was looked at as form of internal EGR, where exhaust gas is trapped inside the cylinder. Experiments showed a 70°C increase in exhaust gas temperature while maintaining engine out NO_x. A literature survey was performed on exhaust gas re-induction as another means of internal EGR. Internal EGR has potential to be an effective means of reducing NO_x and improving aftertreatment thermal efficiency in future diesel engines.

KEYWORDS

Diesel, Engines, VVA, Variable Valve Actuation, EGR, Internal EGR, NO_x, aftertreatment