Simultaneous reduction of particulate matter and NO*x* in a diesel engine by compressed gas injection: macroscopic study at residual load

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Abstract

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A modified pre-chamber of an indirect injection (IDI) diesel engine was used to elucidate the influence on emissions of compressed air injection into the pre-chamber during combustion. The test parameters were air injection timing and arrangements of gas injection. This paper presents the experimental results for two types of injection arrangements; I- and Y-type. The I-type is arranged such that the gas injection jet and fuel injection nozzle are in opposite directions, while the Y-type is such that it forms a 'Y' shape with the nozzle and the passageway. Results obtained reveal that the Y-type arrangement is superior in combustion characteristics and emissions reduction to the I-type. A remarkable reduction in both particulate matter (PM) and NO*x* is realized at air injection timings during 35° and 65° after top dead centre (ATDC). The reduction mechanism can be explained as due to the induced turbulence which improves mixing and heat transfer. The effect of the modifications on the performance of the engine was evaluated based on the fuel economy and efficiency. This evaluation has shown that the test cylinder approximates closely to the normal cylinder of the original engine.