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Effect of fuel injection timing of hydrogen rich syngas augmented with methane in direct-injection spark-ignition engine

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ABSTRACT

The product of gasification of solid biomass, also called syngas is believed to be good fuel for internal combustion engines in the move from the carbon based fuel to zero emission fuels. The only problem is its lower calorific value which is placed at one third of that of compressed natural gas (CNG). There are latest efforts to enhance the hydrogen rich syngas by augmenting it with methane so that the calorific value can be improved. This paper presents experimental results of the effect of the start of fuel injection timing (SOI) on the combustion characteristics, performance and emissions of a direct-injection spark-ignition engine fueled with a 20% methane augmented hydrogen rich syngas of molar ratio of 50% H_2 and 50% CO composition. The engine was operated at fully open throttle and the start of fuel injection (SOI) was varied at 90, 120 and 180° before top dead center (BTDC). The experiment was conducted at lean mixture conditions in the low and medium engine speed ranges (1500–2400 RPM). The spark advance was set to the minimum advance for a maximum brake torque in all the test parameters. The methane augmented hydrogen rich syngas was observed to perform well over wide range of operation with SOI = 180°CA BTDC. However, SOI = 120°CA BTDC performed well at lower speeds recording improved performance and emissions. Limitation of operable load was observed for both SOI = 120°CA BTDC and 90°CA BTDC due to an insufficient time for complete injection of fuel at lower relative air–fuel ratio (λ) with higher speeds.

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