Engine speed and air-fuel ratio effect on the combustion of methane augmented hydrogen rich syngas in DI SI engine

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ABSTRACT

The main challenge on the fueling of pure hydrogen in the automotive vehicles is the limitation in the hydrogen separation from the product of steam reforming and gasification plants and the storage issues. On the other hand, hydrogen fueling in automotive engines has resulted in uncontrolled combustion. These are some of the factors which motivated for the fueling of raw syngas instead of further chemical or physical processes. However, fueling of syngas alone in the combustion chamber has resulted in decreased power output and increased in brake specific fuel consumption. Methane augmented hydrogen rich syngas was investigated experimentally to observe the behavior of the combustion with the variation of the fuel-air mixture and engine speed of a direct injection spark-ignition (DI SI) engine. The molar ratio of the high hydrogen syngas is 50% H2 and 50% CO composition. The amount of methane used for augmentation was 20% (V/V). The compression ratio of 14:1 gas engine operating at full throttle position (the throttle is fully opened) with the start of the injection selected to simulate the partial DI (180_ before top dead center (BTDC)). The relative air-fuel ratio (l) was set at lean mixture condition and the engine speed ranging from 1500 to 2400 revolutions per minute (rpm) with an interval of 300 rpm. The result indicated that coefficient of variation of the indicate mean effective pressure (COV of IMEP) was observed to increase with an increase with l in all speeds. The durations of the flame development and rapid burning stages of the combustion has increased with an increase in l. Besides, all the combustion durations are shown to be more sensitive to l at the lowest speed as compared to the two engine speeds.

KEYWORDS: Methane augmentation**;** Hydrogen rich syngas**;** Engine speed**;** Air-fuel ratio**;** Combustion

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