

Methane Enrichment of Syngas (H₂/CO) in a Spark-Ignition Direct-injection Engine: Combustion, Performance and Emissions Comparison With Syngas and Compressed Natural Gas

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ABSTRACT

Syngas produced from gasification of solid fuels can serve best as transition fuel from the carbon-based to the hydrogen-based fuels in the internal combustion engines. The lone drawback is its low calorific value being between one tenth and one fifth of that of CNG (Compressed Natural Gas). This results in higher BSFC (brake specific fuel consumption) and limitation on the injection duration at late injection timings in the DI (direct-injection) SI (spark-ignition) engine. Recently, there have been efforts to enrich the syngas with methane so that the calorific value can be improved. This paper presents experimental results on the effect of methane-enrichment of syngas on the combustion, performance and emissions in the DISI engine. The result shows that the MES (methane-enriched syngas) has extended the operation excess air ratio (λ) compared to syngas and CNG at the same engine speed. Methane-enrichment has maintained the faster and smoother combustion, the lower brake emissions of carbon monoxide and total hydrocarbon, and higher brake emissions of nitrogen oxides observed with syngas. Besides, MES improved the maximum brake thermal efficiency and the BSFC of the syngas by 30.2% and 21.3%, respectively. Therefore, MES can be better replacement to CNG in the DISI engine at all load conditions..

KEYWORDS: Syngas; Methane-enrichment; Combustion; Performance; Emission

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