

Syngas (H₂/CO) in a Spark-ignition Direct-injection engine. Part 1: Combustion, Performance and Emissions Comparison with CNG

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ABSTRACT

The combustion, performance, and emissions of syngas (H₂/CO) in a four-stroke, direct-injection, spark-ignition engine were experimentally investigated. The engine was operated at various speeds, ranging from 1500 to 2400 rev/min, with the throttle being held in the wide-open position. The start of fuel injection was fixed at 180° before the top dead center, and the ignition advance was set at the maximal brake torque. The air/fuel ratio was varied from the technically possible lowest excess air ratio (λ) to lean operation limits. The results indicated that a wider air/fuel operating ratio is possible with syngas with a very low coefficient of variation. The syngas produced a higher in-cylinder peak pressure and heat-release rate peak and faster combustion than for CNG. However, CNG produced a higher brake thermal efficiency (BTE) and lower brake specific fuel consumption (BSFC). The BTE and BSFC of the syngas were on par to those of CNG at higher speeds. For the syngas, the total hydrocarbon emission was negligible at all load conditions, and the carbon monoxide emission was negligible at higher loads and increased under lower load conditions. However, the emission of nitrogen oxides was higher at higher loads with syngas.

KEYWORDS: Syngas; Directinjection; Sparkignition; Combustion; Performance; Emission

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