Effect of Injection Timing on Combustion, Performance and Emissions of Lean-Burn Syngas (H_2/Co) In Spark-Ignition Direct-Injection Engine

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ABSTRACT
This article is aimed at exploring syngas as an alternative fuel for the modern gas engines. It presents the experimental results on the effect of start of injection on combustion, performance and emissions of a direct-injection spark-ignition engine powered by syngas of H_2/CO composition. The engine was operated with wide open throttle at minimum advance to achieve maximum brake torque. Two different start of injections were selected to represent before and after inlet valve closing and the excess air ratio (λ) was set at 2.3. The engine operation at start of injection = 120° before top dead center was found to be best for combustion and performance at speed up to 2100 r/min. At engine speed higher than 2100 r/min, this start of injection does not permit maximum performance due to injection duration limitation. Hence, early injection at start of injection = 180° before top dead center was adopted at higher speed with better combustion and performance. Therefore, best performance of syngas in direct-injection spark-ignition engine could be attained by setting start of injection at 120° before top dead center for lower speeds and at 180° before top dead center for speed greater than 2100 r/min. Even though fast combustion of syngas suggested late injection for better combustion, performance and emissions, its lower calorific value resulted in operational limitations for direct-injection system particularly at higher speeds maintaining air–fuel ratio close to the stoichiometry.

KEYWORDS: Syngas; injection timing; direct-injection; combustion; performance; emission

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