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The effects of variable excess air ratio and ignition timing on the performance and exhaust emissions in a direct injection Hydrogen-CNG fueled engine

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Abstract

This study investigates a direct injection (DI) engine fueled with compressed natural gas (CNG) enrichment with hydrogen blend (HCNG) in counter from the conversion of the port injection gasoline engine. The intention of the investigation was to examine the performance and exhaust gases from the effect of excess air ratio and timing angle changes in consequence of hydrogen increment to natural gas in comparison to gasoline engine performance and exhaust gases as a single fuel. The compression ratio was set at 14:1 with varying load at 3000 rpm, and the ignition timing was applied at −17, −19, −21, and −34°bTDC at WOT, and the amount of hydrogen enrichment to natural gas was applied at 10%, 20%, 30%, and 40%. The conditions on torque, power, heat release rate, brake specific fuel consumption, CO, and NOx were studied. Results showed that the power and torque increased by 8% with increasing the hydrogen content to 40% in fuel composition and advancing ignition timing and heat release rate as well as decreasing λ from 1.4 to 1.2 relative to the stoichiometric state. Also, the specific fuel consumption decreased by 18.5% in the optimal condition.

Keywords

Hydrogen addition, excess air ratio, ignition timing, performance and exhaust emission

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