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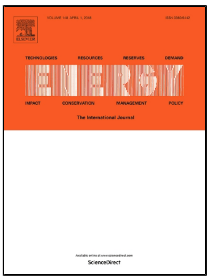

An exploration of utilizing low-pressure diesel injection for natural gas dual-fuel low-temperature combustion

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An exploration of utilizing low-pressure diesel injection for natural gas dual-fuel low-temperature combustion

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Abstract

It has been widely reported that natural gas dual-fuel combustion (DFC) can achieve much lower soot emissions in contrast to conventional diesel combustion (CDC). Thus, using low-pressure direct injection (LPDI) systems could be an alternative for current high-pressure common rail injection systems, which would significantly reduce the system cost. The present study aimed at exploring the feasibility of LPDI (low to 200 bar) for natural gas DFC in combination of the advanced low temperature combustion technology. The comparative study between natural gas DFC and CDC were carried out. For natural gas DFC, larger advanced injection timing was used to realize low temperature combustion and achieve long ignition delay in order to counteract the negative impact of relatively poor atomization quality caused by the low injection pressure. At DFC mode, higher CO and THC emissions were observed compared to CDC in the cases without EGR. However, DFC was much less sensitive to EGR rate and injection pressure. Natural gas DFC could break the trade-off between NOx and soot emissions, which could achieve low soot and NOx emissions (lower than Europe VI standard: 0.4 g/ kW•h) simultaneously at the 42% EGR rate and the 200 bar injection pressure.

Keywords: low-pressure diesel injection; low temperature combustion; natural gas; dual-fuel; trade-off.