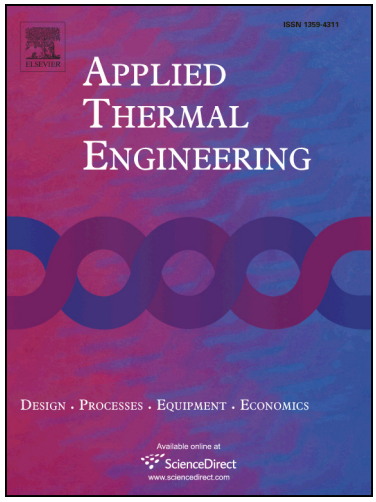

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Experimental investigation on effects of exhaust gas recirculation on flame kernel growth rate in a hydrogen fuelled spark ignition engine

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Abstract

This paper describes the experimental investigation on effects of exhaust gas recirculation (EGR) on flame kernel growth rate (FKGR) in a hydrogen fuelled spark ignition (SI) engine and correlation development for FKGR. A single cylinder, four-stroke, forced air cooled, bi-fuelled (i.e., gasoline and hydrogen) SI engine was selected for this study. The engine was fuelled by gasoline in carbureted mode and by hydrogen using timed manifold injection. The study was carried out for evaluation of FKGR in engine cylinder using gasoline fuel (brake power variation (1.0 to 2.1) kW), hydrogen fuel (equivalence ratio variation from 0.4 to 0.9) and hydrogen with EGR up to 18 % by volume in a SI engine at compression ratio of 7.2:1 and constant engine speed of 3000 rpm. It was found from experimental results that the engine operation with hydrogen at equivalence ratio of 0.8 and above caused to combustion knock. The FKGR increased from 6.7 m/s to 33.5 m/s with respect to increase in equivalence ratio from 0.4 to 0.9. But the FKGR decreased from 16.7 m/s to 6.6 m/s with respect to increase in EGR from 0 to 18 % by volume. In addition to this a correlation was developed for FKGR with equivalence ratio and EGR. The correlation was validated with experimental results, and then simulation study was carried out for simultaneous variation of equivalence ratio and EGR. The notable finding emerged from this study that increase in FKGR with equivalence ratio can be controlled by EGR and there is possibility of engine operation without knock and elimination of backfire at high equivalence ratio.