Effect of Dissimilar Valve Lift on a bi-fuel CNG Engine Operation

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Abstract

The combustion of spark ignition engines converted to bi-fuel CNG is unstable and proper air and fuel mixing strategy is a concern. Also, CNG fuel causes the coefficient of variation for indicated mean effective pressure (COV_{imep}) higher than 10% which is into the region of unstable combustion. In order to create stable combustion more turbulence is required. This paper studies the valve movement with dissimilar valve lift (DVL) to increase swirl in the engine. The intake valve is the last point of airflow entry into an engine and the modification of the movement can contribute to increase turbulence. Three DVL setting simulated via computational fluid dynamics (CFD) gave improvement in peak pressure by 4% and a 32.2% improvement in flame propagation speed compared to baseline CNG. Engine testing shows that, the engine COV_{imep} improves up to 8.7%, while efficiency improves by 5.7% and BSFC is reduced by 5.4% respectively with the 1 mm DVL at 4000 rpm compared to baseline CNG. The rate of heat release (ROHR) also shows early heat release of the fuel. The novelty is better mileage for future CNG engine design.

Keywords: CFD; Compressed natural gas; Spark ignition engine; Swirl number

DOI: 10.1016/j.energy.2016.06.116