DME injection Strategies in a Hydrogen Compression Ignition Engine

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Abstract

The effects of dimethyl-ether injection strategy were investigated in a single cylinder compression ignition engine with common rail and port injection system fueled with hydrogen. The hydrogen was injected at intake manifold to make homogeneous charge, and the DME was injected directly into the cylinder at 30MPa of injection pressure. DME injection timing and quantity, hydrogen injection quantity were varied within the fixed total injection quantity of DME and hydrogen. DME injection quantity was varied from 5mg to 9mg. The injection timing of DME was varied from 240 crank angle degrees to top dead center. Indicated mean effective pressure, ignition delay, and emissions were tested under the same injection quantity. The results were compared with the DME single fueled engine.

Advanced injection timing of DME showed two stage ignition known as a premixed combustion characteristics of high cetane numbered fuel. As DME injection timing was advanced, combustion temperature was lowered, and the hydrocarbon and carbon monoxide emissions were increased due to the formation of lean premixed charge. When DME injection was retarded near the top dead center, carbon monoxide and hydrocarbon emissions were decreased, and indicated mean effective pressure was increased due to high pressure and heat release rate. DME injection quantity affects the characteristics of engine combustion and emissions. Larger amount of DME injection emitted lower hydrocarbon and carbon monoxide, and higher carbon dioxide and nitrogen oxide even the supplied total carbon was increased. The indicated mean effective pressure was also improved. Increased DME injection quantity assisted the hydrogen combustion. Hydrogen injection quantity affected the emissions. Increased hydrogen injection quantity resulted in lower carbon monoxide and hydrocarbon emissions. If the injection quantity of hydrogen was increased, the start of low temperature reaction was retarded due to the OH radical competition.

Keywords: Hydrogen, Dimethyl-ether, Premixed Charge Compression Ignition engine