Effect of injector nozzle flow number on injection evolution in a transparent diesel engine operating with pure RME fuel

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Abstract

The present paper describes an experimental investigation over the impact of diesel injector nozzle flow number on both injection and combustion evolution in transparent compression ignition engine equipped with modern Euro5 light-duty diesel engine head and the production common rail injection system. The research activity is devoted to understanding the basic operating behavior of low flow number nozzles, which are showing promising improvements in diesel engine behavior at partial load. In fact, because of the compelling need to push further emission, efficiency, combustion noise and power density capabilities of the last-generation diesel engines, the combination of high injection pressure fuel pumps and low flow number nozzles is popular among major OEMs. Therefore, aim of this paper is to provide a deeper understanding about the link between the nozzle flow number, the spray and mixture formation and the consequent combustion behavior for nozzle geometries and engine operating conditions that are typical of last-generation diesel engines operating with pure RME fuel. This will generate guidelines for the balanced nozzle flow number selection based on engine targets as well as will generate reference spray for upgrading 3D-CFD simulations models. Spray opening angle, break-up length and tip penetration are evaluated for three different nozzle flow numbers for a 2.0L diesel engine in various operating conditions. The results confirm that by reducing the flow number, for low injected quantities typical of low load and speed engine operating conditions, better fuel/air mixing improves the emissions/fuel economy trade-off.

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