

3D06: EFFECTS OF SPRAY TARGETING ON MIXTURE DEVELOPMENT AND EMISSIONS FORMATION IN LATE-INJECTION LOW-TEMPERATURE HEAVY-DUTY DIESEL COMBUSTION.

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Comment by Arjan Donkerbroek, Radboud University Nijmegen, Netherlands

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I think the temperature of the piston (especially the quartz glass) is lower than with a non-optical engine. How would this influence the results? You mentioned the formaldehyde fluorescence late in the stroke probably indicated that some fuel does not transition into the second stage of combustion. Have you looked whether this fluorescence correlates in some way with the IMEP?

Reply by Caroline Genzale

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With optical surfaces and skip-firing, the in-cylinder surface temperatures are almost certainly different than in a fully warmed up metal engine, and this can have a significant effect on some in-cylinder processes. However, the main conclusion of this work is that the spray targeting strategy can dramatically alter the fuel-vapor distribution, which directly affects the combustion and pollutant-formation processes. From our results, we conclude that the deflection of the jet flows by the piston bowl surface and by neighboring jets are the most important drivers for the observed changes to in-cylinder processes. We therefore expect that piston surface temperature plays a minor role for the particular phenomena that we studied. Based on your suggestion, we reevaluated our IMEP measurements to determine if they correlate with our speculations regarding the effects of late-cycle bulk flows on unburned mixtures near the center of the combustion chamber. Unfortunately, we are unable to find a statistically significant difference in IMEP between the configurations. The differences in the mean IMEP are quite small, and the transient nature of the short-duration runs in our optical engine increases the scatter in IMEP, especially for these low-temperature combustion operating conditions. Additionally, interpretations of the small changes in IMEP are affected by the combustion phasing, which varies with the included spray angle in our results (see Fig. 3 in the paper).

Comment by Morihiko Nagamine, Nissan Motor Co., LTD., Japan

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I have a question about optical engine. To allow the laser sheet to penetrate into the combustion bowl even when the piston was near TDC, a part of the piston-bowl rim changed the glass. How do you make a connection between the glass and the piston-bowl rim?

Reply by Caroline Genzale

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We cut a slot in the bowl wall so that the window can slide in from the side. Both the window and the slot are designed to capture the window so that it cannot fall out from vertical inertial forces (slot and window are narrower at the top than at the bottom). The clearance between the slot and the window is 0.25 mm on all sides. This clearance is filled with Dow Corning Silastic 2-part J-RTV to secure the window. For good adhesion, we coat the window and the metal surfaces with a primer, according to the manufacturer's recommendations [1].

Reference:

[1]<<http://www.dowcorning.com/applications/search/products/details.aspx?prod=01305816&type=PROD>>