

Effect of High Ambient Pressure on Behavior and Structure of Diesel Spray

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Abstract

Characteristics of diesel spray depend on various conditions such as injection pressure, diameters of nozzle hole, and ambient temperature. Recently, boost pressure and EGR ratio are increased in DI (direct injection) diesel engine to improve engine performance. Consequently, pressure in cylinder become high compared with conventional one, and it is considered that the high pressure affects the behavior of diesel spray. Therefore, it is necessary to understand the effect of high ambient pressure on diesel spray. In this study, behavior of diesel free spray in a high pressure vessel was investigated experimentally. Moreover, tomographs of spray were taken using laser light sheet of Nd:YAG laser in order to investigate the internal structure of free spray. The distribution of excess air ratio in a spray was estimated from the video image. In the view point of spray shape, the side periphery of free spray was straight in a low ambient pressure condition. On the contrary, in a high ambient pressure condition, it was suddenly expanded at the middle spray part corresponding to the end of low excess air ratio area. This sudden expansion of spray was more obvious at higher ambient pressure and higher injection pressure conditions. From laser tomographs obtained in this study, a wavy motion of high density spray zone was clearly found in high ambient pressure condition. It seems that the wavy motion affected the development of free spray and was associated with the effect of ambient pressure on spray formation. As for the formation mechanism of wavy motion, we speculated that the earlier injected part of spray stagnated when the spray developed to some extent, and then the later injected part of spray developed with avoiding the stagnated spray, or the earlier injected part of spray blocked the later injected part of spray, therefore, the later part bent like backling.

Key words: Diesel Spray, Ambient Pressure, Excess Air Ratio, Behavior of Diesel Spray, Structure of Diesel Spray

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