Analysis of the fuel adhering to a model engine cylinder by using time series LIF methods

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Abstract

In the gasoline engine, the adhesion of the gasoline droplets to the wall is an unexpected phenomenon that is the reason of a unburnt HC and oil dilution. It is important to analyze the behavior of the fuel adhesion to the wall because of improving the efficiency and decrease in the negative environmental impact material from the engine. The purpose of this research is to know an absolute measurement of the fuel adhesion thickness and amount by fuel spray in the model engine. In this study, for improving the accuracy of thickness measurement, using the ratio of fluorescence intensities is proposed. An improved LIF (Laser Induced Fluorescence) method, that is used the ratio of fluorescent intensity I/I_{ref} (I: fluorescence intensity, I_{ref}: fluorescent intensity of the fluorescent plate), is proposed and tried to measure. This technique is able to correct the influence of light source irregularity.

To examine the relation between the ratio of fluorescence intensity I/I_{ref} and the thickness t, the calibration experiment is carried out. Perylene ($C_{20}H_{12}$) is used for a fluorescent dye. It is dissolved by the toluene, and it mixed with n-heptane for surrogate fuel. UVLED (the emission peak wavelength: 375 nm) is used for the light source. As the result of this experiment, it is shown that there is a quadratic function relation to thickness and I/I_{ref}.

The fuel adhesion measurement using a model engine is performed by the improved LIF method. The improved LIF method and a high speed video camera are combined. A light source and surrogate fuel are same as a calibration experiment. The experiment is performed in the flow field of the model engine cylinder. The pictures are able to be converted to the fuel thickness distribution by an improved LIF method. The amount of fuel adhesion is calculable in thickness. As a result, the behavior of the fuel adhesion is able to be measured. The fuel adhesion thickness distribution and the amount by the difference of the injection conditions are presented in time series.

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