学位論文概要

題目　Characterization of Mixture Formation and Combustion Processes of Diesel Spray of Multi-Hole Injector with Split Injection Strategy
（多噴孔ディーゼルインジェクタ噴霧の分割噴射時の混合気形成と燃焼過程の特性解析）

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The fundamental concept of the Laser Absorption Scattering (LAS) technique is to understand the fuel concentration by attenuation of both visible and ultraviolet light. The intensity of visible light is only attenuated by the scattering of droplets, while that of ultraviolet light is attenuated by the scattering of droplets and the absorption of vapors. The conventional LAS uses the ND: YAG pulse laser, CCD cameras and one shot for one spray, which takes time and effort. Moreover, temporal variation measurement of a single shot spray is not possible by the conventional LAS. To record the distribution of the whole vapor phase in an injection event and measure the liquid and vapor concentration inside the spray, a high-speed laser absorption scattering (HS-LAS) technique was developed applying continuous diode light source, high-speed video cameras, and image intensifier for UV light, which can provide the temporal variation of a single shot spray.

Chapter 1 is the introduction of previous work on the multiple injection technique, mixture formation characteristics, direct injection diesel spray combustion techniques and the optical diagnostic techniques for spray and combustion.

Chapter 2 describes experimental apparatus such as the high-pressure high temperature constant volume chamber, fuel injection system, injection rate measurement system. Also, the principle of Laser Absorption Scattering technique, optical arrangement of the conventional LAS and the HS-LAS system are presented in this chapter.

Chapter 3 illuminates the vapor phase absorption spectrum of 1-methylnaphtalene and tracer fuel. The correlation between absorbance and concentration was found in this study. The molar absorptivity was found to have a low temperature dependence.

Chapter 4 clarifies the effects of split ratio and dwell time of diesel spray injection on mixture formation and combustion process. A laser absorption-scattering technique was adopted to examine the formation of mixtures with regarding to the equivalence ratio. A high-speed video camera was used to observe natural flame luminosity, and a two-color pyrometer system was employed to evaluate the temperature and soot concentrations in the flame.

Chapter 5 irradiates the high-speed laser absorption scattering (HS-LAS) imaging of evaporating diesel spray and mixture formation process. The injection amounts were set as 2.5 and 5.0 mg/hole to observe the effect of the injection mass on the diesel spray characteristics and mixture formation process by using this technique.

In Chapter 6, general conclusions on the mixture formation and combustion processes of the diesel spray with the split injection strategy and their temporal development / shot to shot variations are given.