学 位 論 文 概 要

題 目　Characterization of Diesel Spray and Combustion Processes of Multi-Hole Injector with Micro-Hole under Ultra-High Injection Pressure
（微小噴孔の多噴孔インジェクタから超高圧で噴射したディーゼル噴霧と燃焼過程の特性に関する研究）

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Owing to increasingly stringent emission standards, many efficient injection and combustion strategies have been proposed to improve the efficiency of ICEs and reduce emissions. Based on extensive research, it was discovered that highly dispersed spray is extremely important for achieving the desired combustion performance and emission from ICEs. Higher injection pressures and smaller hole diameters are beneficial for improving fuel atomization and mixing. Previous studies pertaining to ultra-high injection pressures or micro-hole primarily focused on single-hole injectors, whereas in actual engines, eight- or ten-hole multi-hole injectors are used. Some studies demonstrate that the internal flows of multi- and single-hole injectors differ owing to their different internal structures. Therefore, the novelty of this research lies in the systematic analysis of the effects of the spray and combustion characteristics of multi-hole injectors with micro-holes under ultra-high injection pressures. To present this work, the dissertation is organized as follows:

Chapter 1 is entitled as “Introduction”. Firstly, Introduced the energy and environmental issues. Meanwhile, a review of previous works on the development of diesel engine technology, spray and combustion process as well as experimental methods were presented.

Chapter 2 is entitled as “Experimental apparatus and procedure”. The experimental apparatus, optical measurement in this study are introduced in this chapter.

Chapter 3 is entitled as “Non-Evaporating Spray”. In this chapter, using the method of diffuser back-illumination imaging (DBI) to study the macroscopic development process of fuel jet atomization of injectors with different diameters when subjected to high pressure and ultra-high injection pressure conditions

Chapter 4 is entitled as “Evaporating Spray”. In this chapter, the current work mainly employed the DBI method to study the macroscopic development process of fuel-jet atomization of injectors with different diameters under evaporating conditions

Chapter 5 is entitled as “Natural Flame Luminosity and OH Chemiluminescence Imaging”. In this chapter, the characteristics of the combustion processes were studied using direct photographic method and OH chemiluminescence imaging.

Chapter 6 is entitled as “Flame Temperature and KL Value”. The effects of micro-hole and ultra-high pressure on the characteristics of spray and combustion via the two-color pyrometry method.

Chapter 7 is entitled as “Liquid Length, Lift-off Length and KL Value”. In this chapter, we have combined the previous Chapter results to discuss the relationship between the liquid length, the flame lift-off length, and the soot amount.

Chapter 8 is entitled “Closure”. The main findings of this study were summarized in this chapter.