学 位 論 文 概 要

題 目　Experimental Study on Diesel Spray Combustion and Wall Heat Transfer by Means of Rapid Compression and Expansion Machine
（急速圧縮膨張装置を用いたディーゼル噴霧燃焼と壁面熱流束に関する実験的研究）

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Internal combustion engines operate at high-pressure and high-temperature conditions where there is a particularly strong need to improve the understanding of combustion phenomenon inside. One of the key factors in reducing heat loss is to precisely control the combustion process, which is a very complicated condition and significantly affected by the spray/wall interaction, mixture formation, flame development, etc. In addition, the potential of spray/wall interaction when applying multiple injections for highly premixed combustion could have impacts on engine performance resulting from the fuel injection events are going to target the squish region and cylinder liner which most likely lead to the locally rich mixture and deposit formation on crevices, and therefore show the potential to deteriorate the combustion performance.

Chapter 1 is the introduction of current and future energy situation, efforts have been conducing to improve the engine performance, and present difficulties in further increasing thermal efficiency and reducing the emission exhausts.

Chapter 2 is to discuss the Detailed characterizations of diesel spray and multiple injection strategy.

Chapter 3 is to introduce the optical diagnostic techniques for diesel spray evolution and combustion process are also involved. The theory of heat transfer, and parametric factors affected heat transfer in diesel engine.

Chapter 4 describes the experimental apparatus such as the rapid compression and expansion machine and two-dimensional piston cavity used. And the optical techniques such as the shadowgraph method, diffused back-illumination method, and two-color pyrometry are also illustrated. Besides, the heat flux measure, in-cylinder pressure measurement, piston location measurement and the analysis procedure are shown in this chapter.

Chapter 5 shows the in-cylinder information under motoring condition, and the ambient air flow is discussed. In addition, the equation for squish motion occurring in the two-dimensional piston cavity is derived.

Chapter 6 compares the effect of different injection pressure and interval in double injection on spray/wall interaction, mixture formation, combustion process. The flame temperature and soot generation analyzed by two-color pyrometry are also discussed in detail.

Chapter 7 is the cohesive correlation between spray/flame characteristic and heat transfer under two kind of triple injection strategies, and different injection pressures are compared and discussed.