第５号様式

論文審査の要旨

博士の専攻分野の名称	博　士　（　工学　）	氏名	FAN Chengyuan
学位授与の要件	学位規則第４条第[1]・２項該当		

論　文　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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〔論文審査の要旨〕

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. This study was performed in a rapid compression and expansion machine with a two-dimensional piston cavity installed inside. Several optical diagnostics were applied to facilitate the deep observation on ambient air flow motion, spray development, mixture formation, and mixture distribution in combustion cylinder from later side view. Meanwhile, various types of high accuracy and high response sensors were used to effectively capture and analyze the combustion information, such as the combustion pressure, apparent heat release rate, soot temperature, and KL factor. Furthermore, the dynamic heat flux on the typical locations of piston cavity and cylinder wall was also studied simultaneously in spray and combustion process to clarify the cohesive correlation and mechanism between diesel spray/flame and heat transfer.

Chapter 1 is the introduction of current and future energy situation, efforts have been conducting 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.

Chapter 8 are the main findings of this study and the future work.

以上，審査の結果，本論文の著者は博士（工学）の学位を授与される十分な資格があるものと認められる。

備考：審査の要旨は，1,500 字以内とする。