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論文審査の要旨

博士の専攻分野の名称	博　士　（　工学　）	氏名	CHANG Feixiang
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論　文　題　目

Effects of Split Injection on Adhered Film Formation of Flat-Wall Impinging Fuel Spray

（平板壁面に衝突する燃料噴霧の液膜形成に及ぼす分割噴射の影響）

論文審査担当者

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〔論文審査の要旨〕

Due to engine miniaturization and high injection pressure, it is difficult to avoid spray/wall interaction in the direct-injection spark-ignition (DISI) engines, which causes the formation of fuel films. The fuel film on the wall has a negative effect on the combustion process and engine performance. To improve the high combustion efficiency and low emissions, split injection strategy and DISI system are widely applied to gasoline engines due to the pace of technological innovation. To date, the influence of the split injection strategy on the deposited fuel during the spray impingement process have not been adequately investigated. Therefore, in this study, the refractive index matching method (RIM) measurement method is applied to evaluate the effects of the split injection strategy on fuel film. In particular, the fuel film characteristics of single and split injection need to be compared under non-evaporation and evaporation conditions.

Chapter 1 presents the future energy situation and environmental problems. Moreover, a review of previous works on the development of DISI engines, split injection and spray/wall interaction as well as optical diagnostics are introduced.

Chapter 2 introduces the experimental setup in this work, such as fuel injection system, constant high-pressure chamber, impingement system and the investigation techniques applied in this work.

Chapter 3 observes the spray characteristics and fuel film evolution of split injection (Single, double and triple injections) experimentally under non-evaporation and evaporation conditions by the RIM method. Moreover, the mechanism behind the fuel film formation is figured out based on the experimental results.

Chapter 4 discusses the influences of split injection mass ratios (D25-75, D50-50 and D75-25) on the fuel film under non-evaporation and evaporation conditions, and the effects of ambient temperatures on the fuel film formation are studied by RIM.

Chapter 5 investigates and compares the microscopic characteristics of free and impinging sprays under different experimental conditions using the particle image analysis technique (PIA). According to the results of droplet size and velocity, the differences of droplet cluster between the free and impinging sprays at different penetration locations were obtained.

Chapter 6 investigates the behavior of splashing droplet cluster in the near wall region by PIA technique. The relationship between fuel film and droplets behaviors in the near wall was discussed at different locations. The difference in droplet behavior between different injection pressures was also detected.

Chapter 7 summarizes the main findings of this study and recommendations for future works.

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。