Advanced Core for Energetics, Hiroshima University Vol. 29

HU-ACE NEWS LETTER

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Activities of the Core

Apr. 1, 2019	Assoc. Professor, LUO Hong Liang joined HU-ACE
May 2, 2019	Article of Prof. Matsumura's SCWG technology was published in Yomiuri Newspaper Kagoshima Version
May 16, 2019	The 74th Hiroshima University Biomass Evening Seminar (co-organization)
May 21, 2019	The 33rd HU-ACE Steering Committee Meeting

Dr. Rahmat Iman Mainil from HU-ACE, gave an oral presentation at the European Biomass Conference.

The 27th European Biomass Conference and Exhibition was held on 27 to 30 May, 2019 in Lisbon, Portugal. This year, the Japan Small Gasification Seminar was held as a parallel event. Also, a tour of the South Tyrol gasifier was held as a related event the previous week. From HU-ACE, Prof. Matsumura and two students participated and gave a total of 4 presentations including orals and posters. Mr. Mainil gave an oral presentation about supercritical water gasification of palm oil mill effluent (POME).

Related information

The 3rd International Symposium on Fuels and Energy (ISFE2019) will be held on Jul. 8-10, 2019 in Higashi-Hiroshima City. We are looking forward to your participation.
https://home.hiroshima-u.ac.jp/~isfe/isfe2019/top-page/registration/

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Member Introduction No. 22

LUO, Hong Liang

Associate Professor, Graduate School of Engineering

Research field: Mechanical Engineering/Fluid Engineering
Keyword: Fuel Spray/Adhesion Formation /Gasoline Engine /Wall Impingement

Abstract

Background

Spray-wall impingement has been proved unavoidable in direct-injection spark-ignition (DISI) engines, which affects the fuel-air formation as well as combustion and exhaust emissions, making it difficult to meet the regulation of particle number (PN) in the future standards. Therefore, it is urgent to obtain a thoroughly clear understanding about the interaction between fuel spray and wall to improve the atomization in engine work process.

Methods

The RIM (Refractive Index Matching) technique was widely used to measure the thickness of the fuel adhesion, from which the adhered fuel area and mass can be calculated from each pixel. In this method, the difference in refractive index between the quartz glass and air results in the scattering of light from the rough surface that is modified by the presence of the fuel closely matching the refractive index of the impingement glass, as shown in the Figure 1.

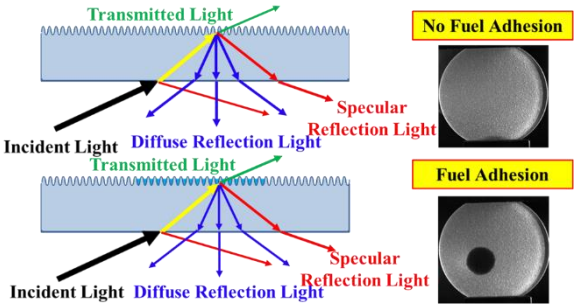

Figure1: The schematics of light transfer in the quartz glass

Results

Figure 2 shows that the fuel adhesion on the wall can be divided into regions I and II. Region I: Primary impingement region. The direct spray impinges on the wall, causing some fuel to stick on it to form the adhesion. Region II: Secondary impingement region. After impingement on the wall, most of the fuel splashes off it. The splashing droplets are re-deposited on the wall because of coalescence and air force to form the adhesion. As shown in Figure 3, under T_{amb} = 298 K, after initial impingement on the wall, some of the fuel on the wall forms region I and other fuel droplets splash off the wall. Nevertheless, the splashing droplets may collide and coalesce with others, resulting in a change in velocity and leading to the droplets being re-deposited on the wall to form region II. However, under high temperature condition, the fuel in region II is less owing not only to the decrease in impinging droplets but also the evaporation of the adhered fuel.

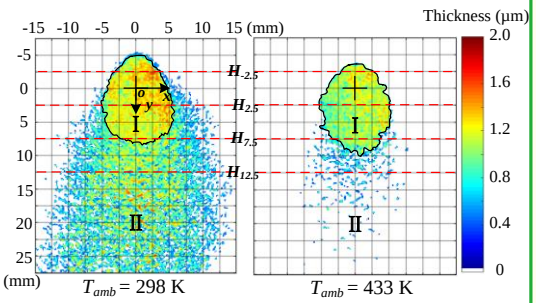

Figure2: Fuel adhesion on the wall

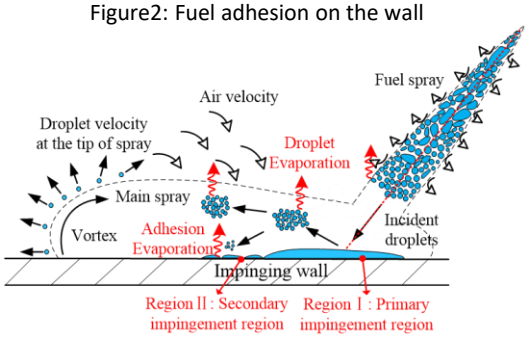

Figure3: Mechanisms of fuel adhesion formation

Patens, Paper, Awards

Luo, H., Nishida, K., Uchitomi, S., Ogata, Y., Zhang, W., & Fujikawa, T. (2018).
Effect of temperature on fuel adhesion under spray-wall impingement condition. *Fuel*, *234*, 56-65.