Advanced Core for Energetics, Hiroshima University Vol. 40

HU-ACE NEWS LETTER

Advanced Core for Energetics, Hiroshima University

Vol. 40
2020.4

Activities of the Core

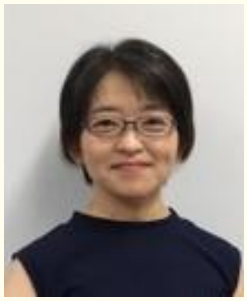
Apr. 21, 2020 The 44th HU-ACE Steering Committee Meeting

Professor promotion

Thanks to support and help from the related people, our staffs could make considerable achievement, which led to the promotion of two associate professors to professors as of April 1, 2020. We are glad to report this promotion, and would like to ask for your continuous support. Prof. Johzaki is conducting fundamental study on nuclear fusion, and Prof. Okamura, who established a new advanced core and not a core member of HU-ACE now, is supporting us through researches including oil production microorganisms.

Prof. Tomoyuki Johzaki

I have been promoted to Professor in the Mechanical Engineering Program at the Graduate School of Advanced Science and Engineering this April. As the leader of Nuclear Fusion Group at HU-ACE, based on the international research network I have established with researchers at universities and research institutes, I will promote research activities for the early realization of the practical use of nuclear fusion energy, and also promote educational activities to train the next generation researchers. I appreciate your continued support and encouragement.



Prof. Yoshiko Okamura

I have been promoted to Professor in the Biotechnology Program at the Graduate School of Integrative Life Sciences this April. I would like to appreciate all of my collaborators for their cooperation and guidance. I intend to pursue our research and education on biomass utilization in the future as well, in order to contribute to the achievements of HU-ACE and to ensure the sustainability of the Earth in the future. Thank you for your continued relationship in advance.

Issued by Advanced Core for Energetics, Hiroshima University
HU-ACE Secretariat, URA Division, Office of Research and Academia-Government-Community Collaboration, Hiroshima University 1-3-2 Kagamiyama, Higashi-Hiroshima, 739-8511 Japan
e-mail: hu-ace-info@ml.hiroshima-u.ac.jp, tel:+81-82-424-4425
URL: https://home.hiroshima-u.ac.jp/hu-ace/

HU-ACE NEWS LETTER Advanced Core for Energetics, Hiroshima University Vol. 40 No. 17

Research Topics

Microscopic characteristics of multiple droplets during the fuel spray and impingement

Hongliang LUO

Assistant Professor, Energy Transform Engineering, Graduate School of Advanced Science and Engineering, Hiroshima University

Research fields: Energy engineering, Fluid engineering

Keywords: Spray, Droplets, Microscopic behaviors, Fuel adhesion

Abstract

Background

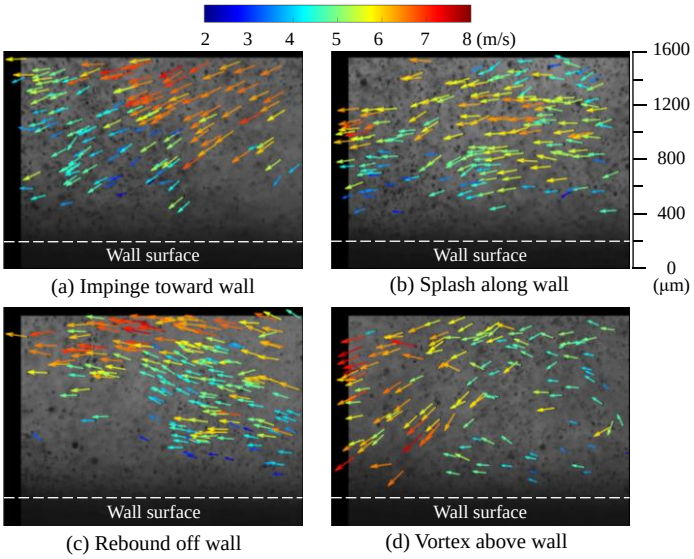
It is well known that two outcomes can be involved: fuel adhesion and splashing, when fuel droplets impinge on the piston head and cylinder wall in the direct-injection spark-ignition (DISI) engine. The liquid adhesion hinders the engine combustion efficiency and increases the particular matter (PM) emissions. Although numerous investigations were done on it, including fuel adhesion and impinging spray, it is still blur for the scholars owing to the complicated droplets-wall dynamics.

Methods

Particle image analysis (PIA) technology was applied in the current research. A Nd: YAG laser was applied as the light source to illuminate the spray. A CCD camera with a microscope was used to observe the micro impinging spray. Four teleconverters were used to amplify the micro-image. The scale plate was employed to get the resolution being 1.01 μm/pixel. As the frame size of the image taken by the CCD camera was 1600 × 1200 pixels, the view field was finally calculated at 1.62 × 1.21 mm^2.

Results

It is proved there are still droplets impinging to the wall after the end of spray, which is the main reason for fuel adhesion increase. Moreover, the Mie scattering effect of these small size droplets on the fuel adhesion measurement can be ignored as they are hardly detected by Mie scattering. Different droplet morphologies can be observed such as impinging toward wall, splashing along the wall, rebounding off the wall and vortex above the wall. Furthermore, droplet velocity directions are defined by four quadrants. With time elapse, droplets number decreases sharply, but velocity direction is almost the same, suggesting that most droplets impinging to the wall locate in the first quadrant. With spray development, droplet velocity direction changes dramatically, but the number is similar. For each location, the mean velocity decreases more rapidly with time when compared with different locations.



(a) Impinge toward wall (b) Splash along wall

(c) Rebound off wall (d) Vortex above wall

Fig. 1. Droplet behaviors after impact

References

[1] **Luo H***, Wang C, Nishida K, Ogata Y, Chen R. Characteristics of Droplet Behaviors after the End of Injection in a High-Pressure Constant Volume Chamber. *Fuel*, **267**: 117291, 2020.

[2] **Luo H***, Nishida K, Ogata Y. Evaporation characteristics of fuel adhesion on the wall after spray impingement under different conditions through RIM measurement system. *Fuel*, **258**: 116163, 2019.

[3] **Luo H***, Wang C, Nishida K, Ogata Y, Long W, Zhang W, Hara R, Fujikawa T. Droplet Behaviors of DI Gasoline Wall Impinging Spray by Spray Slicer. **SAE-2020-01-1152**, World Congress Experience (WCX 2020), Apr. 21-23, 2020, Detroit, MI.