

PIV Study on Flow Fields of Spray and Surrounding Gas under Non-Evaporating and Evaporating Conditions

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Abstract

The measurements of spray induced surrounding gas motion and spray flow were carried out by using LIF-PIV (Laser Induced Fluorescence-Particle Image Velocimetry) and PIV technique, respectively. The behaviors such as spray flow and gas flow velocity distributions, the ambient gas mass flow rate into the spray were compared quantitatively in both non-evaporating and evaporating conditions. Two injection pressures (100, 300MPa) and a micro-hole nozzle with diameter of 0.08mm were used. The results show the significant difference in the gas flow characteristics between non-evaporating and evaporating conditions. The total ambient gas flow mass is restricted in the evaporating condition. By comparing the droplets flow in the non-evaporating spray and the vapor phase flow in the evaporating spray, even though there is no much difference of the mean velocity distribution, the stronger vortex motion and faster spray momentum depletion can be observed in the evaporating condition, which results in a more homogeneous fuel/gas mixture and restricted penetration length. Higher injection pressure enhances the mean flow velocity and the small scale vortex distribution in the whole region, which implies the promotion of the fuel/gas mixing process. The vorticity distribution inside the spray corresponds to the resultant heterogeneity of the fuel concentration distribution. The fuel parcel with different mass concentration determines flow velocity distribution and the spray development.

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