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Effects of Cavitation in a Nozzle Hole on Atomization of Spray and Development of High-Efficiency Atomization Enhancement Nozzle

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Abstract

It is well known that cavitation in a nozzle hole is dominant factor on atomization of a liquid jet. In usual, observations in the nozzle hole and disintegration behavior of a liquid jet are used a magnified nozzle. Moreover, although cavitation number is used to represent cavitating flow, the physical quantity at the regions, where cavitation does not occur, is usually used. In this study, it was investigated about the mutual relationships of the liquid flow in the nozzle hole and atomization of the spray between the magnified nozzle and the scaled-up nozzle. Moreover, mutual relationships between the pressure distribution in the nozzle hole and behavior of the liquid flow in the nozzle hole were studied, and cavitation pressure coefficient, that is, cavitation number was newly defined by using the static pressure in the nozzle hole where cavitation occurs. Furthermore, the effects of kinematic viscosity of liquid on internal flow in the nozzle hole and atomization of the spray was studied. From these results, high-efficiency atomization enhancement nozzle, which excellent spray characteristics are obtained at low injection pressure independent of kinematic viscosity, was developed. The effects of this atomization enhancement nozzle on atomization of intermittent spray at high-ambient pressure condition and application to the actual Diesel injector were studied. Spread of the sprays of the atomization enhancement nozzle is wide considerably, compared with the single hole nozzle. It can be seen that although the spray tip penetration of the atomization enhancement nozzle is short, spread of the spray becomes large considerably compared with the single hole nozzle and high-dispersion spray was obtained at the intermittent injection.

Key words: Cavitation, Internal Flow, Liquid Jet, Spray, Spray Characteristics, Diesel Injector

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