論　文 の　要　旨

題　目：

Effects of Wall Impingement and Multiple Injection on Mixture Formation and Combustion Processes of Diesel Spray

(ディーゼル噴霧の混合気形成と燃焼過程に及ぼす壁面衝突と多段噴射の影響)

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The objective of this work is to get a better understanding of the effects of impingement and multiple injection on the mixture formation process, combustion and soot emission characteristics of D.I. Diesel sprays. The experimental study, focusing on the characteristics of impinging Diesel spray flames, was carried out in a high-temperature high-pressure constant volume vessel. A flat wall and a two-dimensional (2-D) piston cavity which has the same shape with small-bore diesel engine were employed to form the impinging spray flame. An ordinary injection pressure range (100-200 MPa) of current Diesel engines was selected. Various impinging distances (30, 40, 50, 60 mm and free) were selected to analyze the effect of impinging distance. Different injection amounts (0.27, 0.89 and 2.97 mg) which represent pilot injection, main injection of light load, and main injection of middle load respectively were used. The ambient gas density of 16 kg/m^3, which is representative of a low compression ratio Diesel engine at top dead center, was adopted. A single nozzle hole injector with conventional size (0.133 mm) and a three holes injector with liner arrangement were applied as the test nozzles in this study.

Mie scattering method and laser absorption-scattering (LAS) technique were employed to qualitatively and quantitatively characterize the spray development. The blend fuel of α-MN and n-tridecane with volumetric percentages of 2.5 and 97.5 respectively was used for LAS technique. The spray evolution characteristics such as spray tip penetration, ambient gas entrainment, evaporation and concentrations of liquid and vapor were paid attentions. The effects of shape of the impinging wall, injection pressure, impinging distance and injection amount were taken into account.

The characteristics of the combustion process of Diesel spray were investigated by adopting a color camera which directly perceived the flame natural luminosity, OH* chemiluminescence recording system, and two-color perometry techniques. The effects of the impinging wall shape, injection pressure, impinging distance and injection amount were also taken into account and the combustion behaviors were related to the previously measured spray mixture characteristics.

In addition, the combustion and soot emission behaviors were investigated in this study. Tiny amount (0.27 mg) and normal amount (2.97 mg) were selected as the pilot (as well as post) and main injections respectively. The effects of the intervals between pilot and main injections and between main and post injections and the pilot injection frequency on combustion and soot formation were taken into account.