講演番号 | 152

文献番号 | 20225152

Analysis of Spray Characteristics of Direct Injection SI Engines under Low temperature Conditions

- Controlled fuel and wall temperature as experimental parameters -

Akira Adachi [1] **Fuma Maekawa** [1] **Dai Matsuda** [1] **Eriko Matsumura** [2] **Jiro Senda** [2] **Masahiro Okuma** [3] **Yusuke Saiki** [3]

1) Doshisha University, Graduate School of Engineering
1-3 Tatara Miyakodani, Kyotanabe, Kyoto, 610-0394, Japan
2) Doshisha University,
1-3 Tatara Miyakodani, Kyotanabe, Kyoto, 610-0394, Japan
3) DENSO Corporation,
1-1 Showa-cho, Kariya, Aichi, 448-8661, Japan

KEY WORDS: Heat engine, Spark ignition engine, Cold start, Fuel injection/fuel spray, Wall impingement spray (A1)

Continuous improvement of emission performance direct injection spark ignition engines(DISI engines) during cold start conditions is required due to new regulations. However, there are few studies on the effects of fuel properties on spray characteristics, wall impingement behavior, and fuel film formation processes in low temperature environments under the conditions assumed for DISI engines conditions. In this study, an experimental equipment apparatus simultaneously controlling fuel temperature and wall temperature was set up to clarify the fuel film formation process under low-temperature conditions. Total internal reflection laser induced fluorescence (TIR-LIF) method was applied to the fuel film formed by wall impingement spray. TIR-LIF method can measure fuel film thickness by fluorescence from fuel film during the spray injection without the influence of the spray droplet.

Figure 1 shows analysis results of fuel film at after start of injection 14.0 ms. The amount of fuel adhesion is 30 % lower at a fuel temperature and wall temperature of 253 K than at fuel temperature and wall temperature of 293 K. Atomization characteristics getting worse as fuel temperature decrease, and the ratio of the amount of spray droplets reaching the wall to the injection fuel amount increases. However, because the We number of the spray droplets increases, the amount of droplet splash that impingement on the dry wall increases. After the fuel film is formed, the high We number increases the amount of splash when the spray droplets impact the fuel film, and the amount of adhesion of the fuel film is reduced.

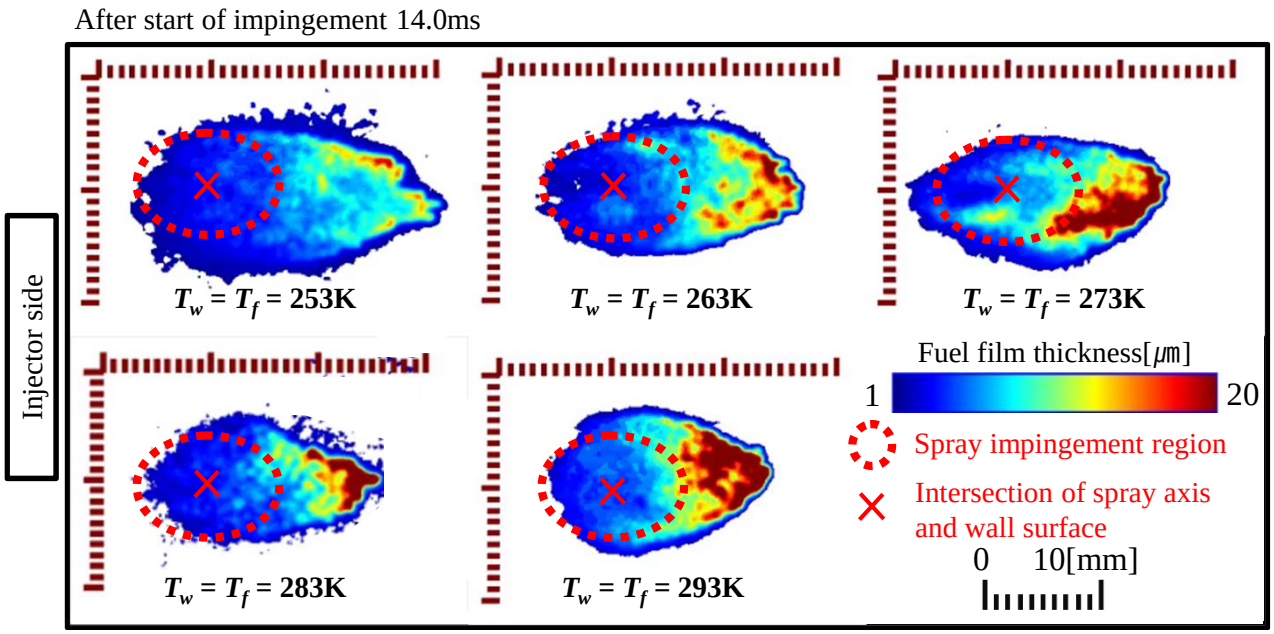

Fig.1 Analysis results of fuel film at after start of injection 14.0 ms (Δp_{inj}:10 MPa, t_{inj}: 3.3 ms, Q_{inj}: 3.45 mg α_w: 45 deg., Z_w: 57 mm. T_a: 293 K, ρ_a: 1.16 kg/m^3, T_f: 253, 263, 273, 283, 293 K, T_{wall}: 253, 263, 273, 283, 293 K,)