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Analysis of Spray Characteristics of Direct Injection SI Engines under Low Temperature Conditions (Third Report)

- Momentum of Wall Impingement Droplets and Fuel Film Formation -

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In a direct injection spark ignition engine, strict control of pollutant emissions at cold start is required to comply with new regulations. Since the injection timing is different from the conditions during warm-up and acceleration, and behaves differently when the wall impingement distance changes, it is necessary to assume the difference in the injection timing during the intake process in actual engine. The purpose of this study is to clarify the mixture and fuel film formation process by wall impingement spray under different impingement distances and wall temperatures. 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. In this paper, the impingement distance was controlled from 14 mm to 57 mm and the wall temperature from 293 K to 253 K to investigated film formation process during spray injection. The results showed that the droplets scattered from the liquid film by impinging on the wall with high momentum under the conditions from the wall impingement distance: 57 mm to the wall impingement distance: 28 mm, but the amount of adhesion increased due to the increase of the wall impingement amount relative to the injection amount. For the conditions from 28 mm to 14 mm wall impact distance, the droplets impinged on the wall with high momentum, resulting in a decrease in the amount of adhesion.

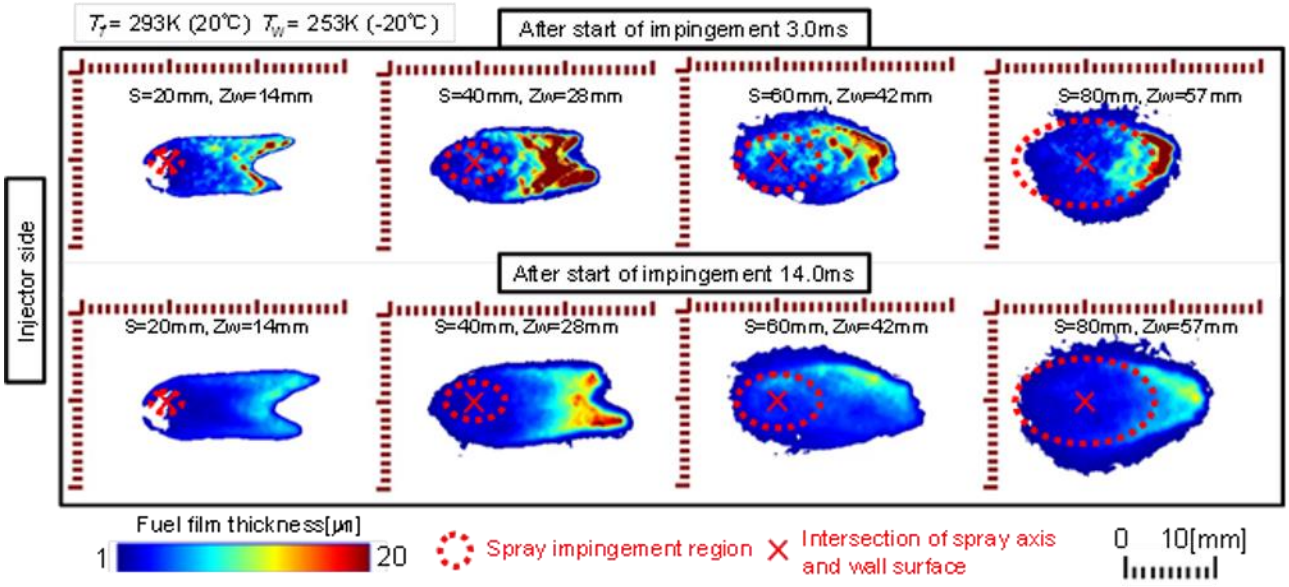

Fig.1 Analysis results of fuel film thickness at time after start of impingement 3.0 and 14.0 ms (ΔP_{inj}:10 MPa, t_{inj}: 3.3 ms, Q_{inj}: 3.45 mg, α_w: 45 deg., Z_w: 57 mm. T_a: 293 K, ρ_a: 1.16 kg/m^3, T_f: 293 K, T_w: 253, 263,273, 283, 293 K,)