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Effect of Increased Injection Rate on Thermal Efficiency and Output-power under Supercharged Operation in Low-pressure Direct-Injection Hydrogen Engines

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That reducing injection pressure is one key to adopt wide hydrogen source and reduce cost of the fueling system in DI hydrogen engines and by combining optimized jet configuration with high injection rate, high thermal efficiency and output were achieved. In this study, increasing injection rate further is attempted.

Figure 1 compares the effects of increasing the injection rate on engine performance in a low-pressure injection hydrogen engine. The indicated thermal efficiency HFRI was lower than that of LFRI across the entire range. This is thought to be due to the increased cooling loss index, where HFRI consistently shows high values.

Furthermore, NOx emissions decreased across the entire range with HFRI. This is thought to be because the EOI (End of Injection) advancement due to HFRI prolonged the mixing time, promoting the homogenization of the fuel mixture.

Figure 2 shows the results of a high-power test using a high-injection-rate injector. Using the high-injection-rate injector achieved a high Gross IMEP exceeding 2000 kPa.

From these results, it became clear that with the combustion chamber shape and hydrogen jet specifications of the engine used in this study, further increasing the injection rate would reduce NOx emissions, but would decrease thermal efficiency due to increased cooling lossesΦ_w.

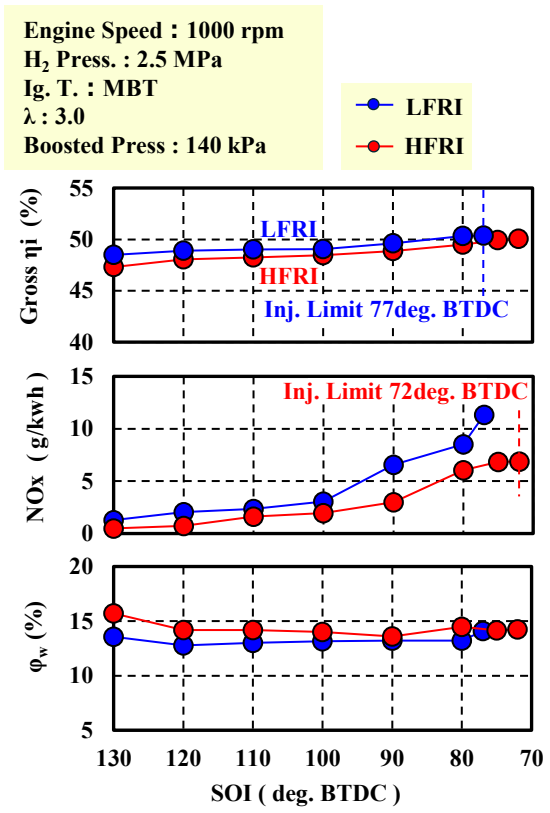

Fig. 1 Effect of High Injection Rate on Engine Performance

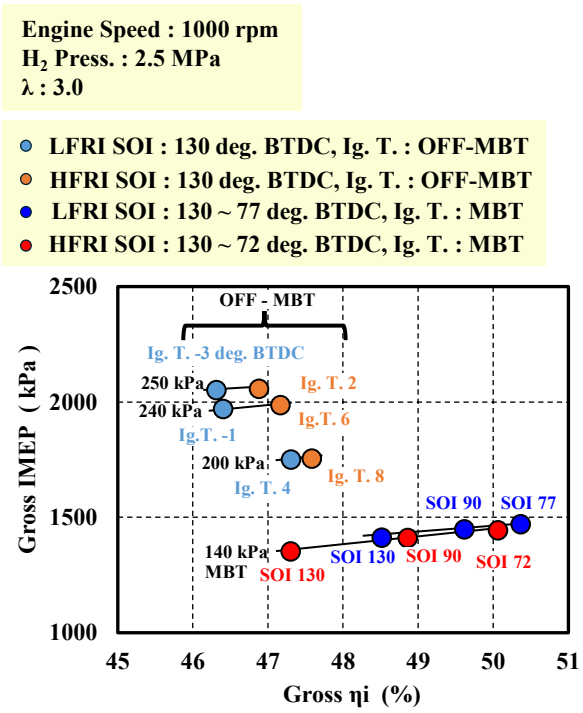

Fig. 2 Effect of Increased Intake Boosted Pressure on Output-power with HFRI