講演番号	091

In-Cylinder Temperature Measurement of a Hydrogen Internal Combustion Engine Using Near-Infrared Two-Color Pyrometry

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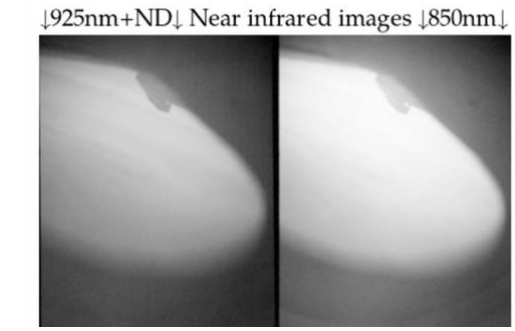
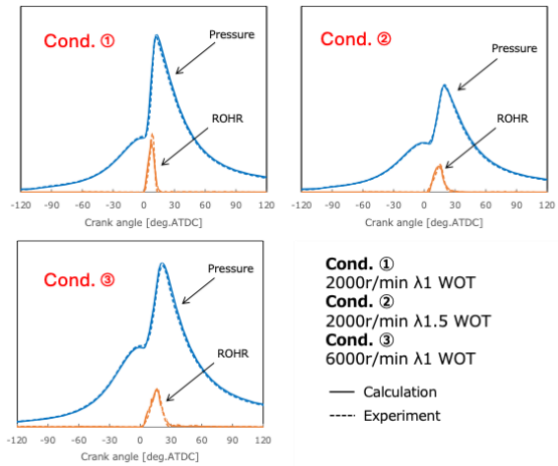
Hydrogen is a promising carbon-neutral fuel for internal combustion engines because of its fast flame propagation and wide ignitable range, which allow stable operation under lean and turbulent conditions. To understand the ignition and early combustion processes in hydrogen engines, it is important to experimentally evaluate the in-cylinder flame temperature distribution. In this study, ignition tests were conducted using a supercharged direct-injection hydrogen engine developed by HySE. Flame temperature distributions during the ignition process were measured by a high-speed camera and near-infrared two-color pyrometry based on water vapor emission below 1100 nm. Numerical simulations of the combustion process were also carried out and validated against the experimental data.

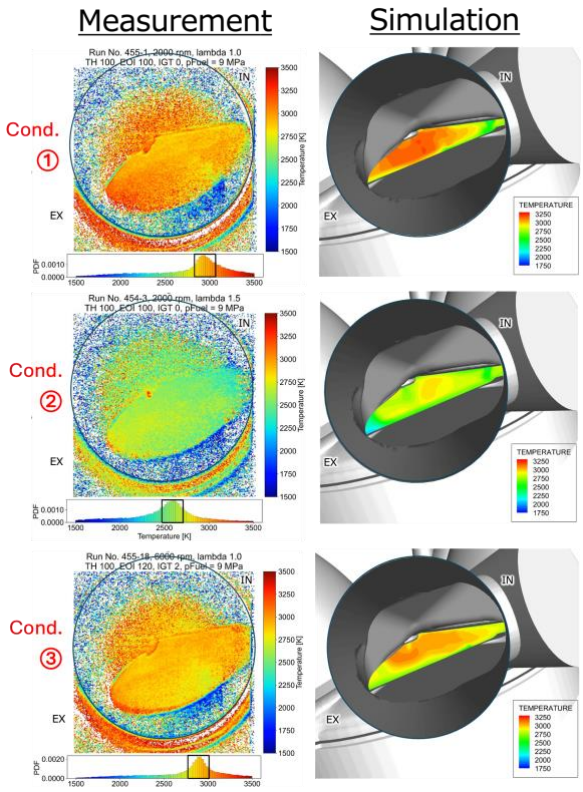
The calculated in-cylinder pressure and rate of heat release were in generally good agreement with the experimental results under the tested operating conditions. The measured two-dimensional flame temperature distributions clearly showed the formation and propagation of high-temperature regions after ignition. In addition, the calculated temperature distributions matched the main features of the measured flame temperature field. These results indicate that near-infrared two-color pyrometry is effective for analyzing in-cylinder ignition phenomena and that the simulation method can reasonably reproduce the ignition and early combustion behavior of the hydrogen engine.



Original water molecule emission image taken from the image doubler



Comparison of simulated pressure and heat release rate histories



Comparison of measured temperature field and simulation
Left: Measurement; Right: Simulation