# An ultimate engine: based on supermulti-jets colliding with pulsation

## - Forth Report -

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**KEY WORDS**: **heat engine, new combustion principle, thermal efficiency, supermulti-jets colliding, pulse**

Our previous reports (Naitoh et al, 2010-2015) on thermo-fluid dynamic theory, combustion computations, and experiments without combustion showed that the single-point auto-ignition engine based on the supermulti-jets colliding with pulse (Fugine) has a high potential on thermal efficiency, power, noise, and emissions for several purposes such as automobiles, airplanes, and huge electric plants.

Theories and three-dimensional computations indicate a possibility of silent auto-ignition for gasoline and high thermal efficiencies over 60%. This is possible because supermulti-jets encase burned gas around the center of combustion chamber, which leads to air-insulation effect, and also because sipermulti-jets produces high compression only at the chamber center, which results in weaker pressure at chamber wall.

Here, for a small prototype engine of about 25cc having supermulti-jets colliding of 8 nozzles (octagon type) and strongly-asymmetric double-piston system, we have done combustion experiments at the constant engine speed of 2,000rpm with A/F ratios between 14.8 and 40.0.

The experiments (Fig. 1) showed that auto-ignition of gasoline is possible, even though this very small engine has a weak homogeneous compression ratio of only 8:1, because supermulti-jets colliding will produce a hot spot inside the combustion chamber. Then, while cheap gasline injectors for port-injection are used, the gasoline combustion experiments of auto-ignition at lean buring conditions without slottle valves show thermal efficiencies fairly larger than that of traditional gasoline engines, which will often be comparable to that of conventional diesel engines.

It is stressed that pressure increase rate due to auto-ignition of gasoline is comparable to that of usual spark ignition, which will lead to less combustion noise. This will occur because of single-point ignition and also because of turbulent flame propagation at the later stage of heat release.

Although we do not measure emissions, we think that port-injection of gasoline fuel and auto-ignition in the present prototype engine will imply less NOx level.

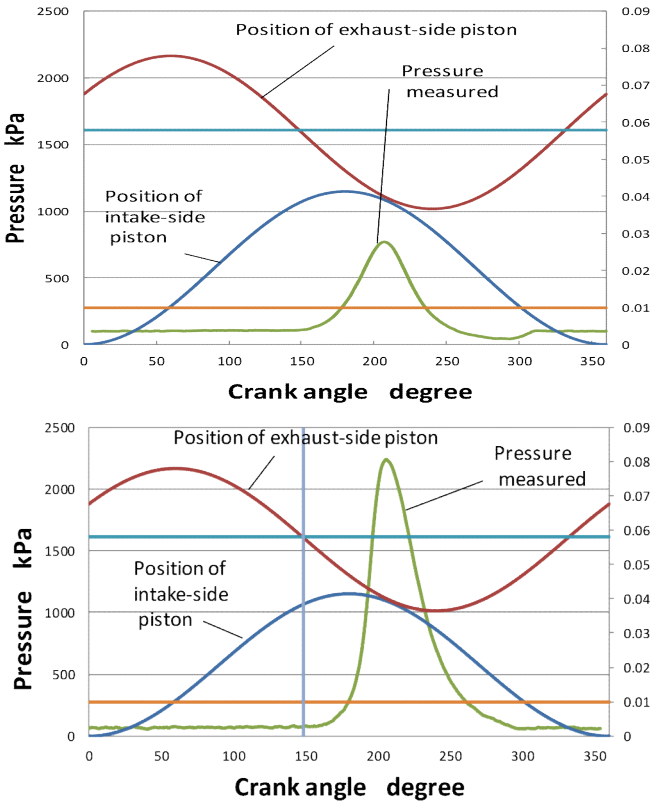


Fig.1 Pressure histories. (Upper: motoring case without fuel supply. Lower: combustion case with fuel supply.) Compression end =210 degree CA.