

Control of Combustion Oscillations in Premixed Combustor - Application of the Resonator for Reducing Combustion Oscillations -

YAMANAKA Susumu¹, MAEDA Fukuo¹, SHIODA Kazunori¹ and IWABUCHI Kazunori¹
Toshiba Corporation
TSUCHIYA Toshiaki² and OKAMOTO Masanori²
Tokyo Electric Power Company

1. Introduction

There is a possibility of combustion oscillation whenever combustion takes place within a combustion tube. There are few methods to reduce the combustion oscillation. In this paper, Helmholtz resonator, which can control the volume, was applied to the combustor. This paper describes the characteristics of reducing combustion oscillations by the resonator.

2. Experiments

Figure 1 shows the test rig. Combustion tests were performed by utilizing the premixed combustor which incorporated swirl stabilization under atmospheric pressure. The resonator was set around the pressure loop of the combustion tube. Volume of the resonator can be controlled with the piston. Effect of the resonator was evaluated with the pressure fluctuations at the inlet combustor.

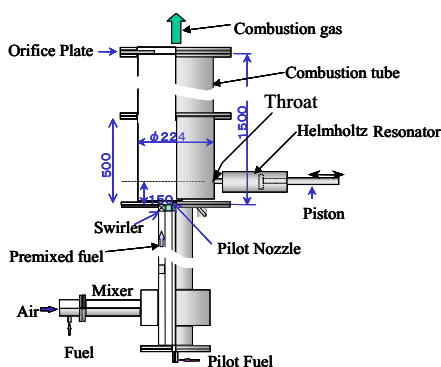


Fig.1 Test rig

3. Results and Conclusions

In the case of the acoustic type oscillation, large reduction of the combustion oscillation amplitude can be achieved by optimizing the resonator volume(Fig.2). In the case of the Helmholtz type oscillation, the acoustic type oscillation occasionally appears in the

process of reducing the Helmholtz type oscillation. In this case, it is possible to minimize the amplitude of dynamic pressure by using another resonator.

From the dynamic pressures in both combustion tube and resonator, it is found that dynamic pressure amplitude can be reduced when the following two conditions are satisfied(Fig.3).

- (1) The amplitude of dynamic pressure in the resonator should be larger than that of dynamic pressure in the combustion tube.
- (2) The phase difference of dynamic pressures in both the combustion tube and the resonator should be reversed.

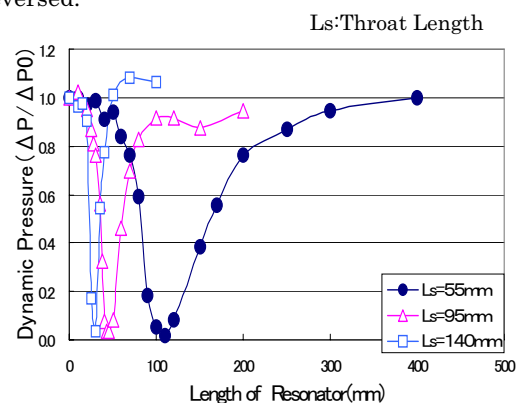


Fig.2 Effect of the resonator on dynamic pressure

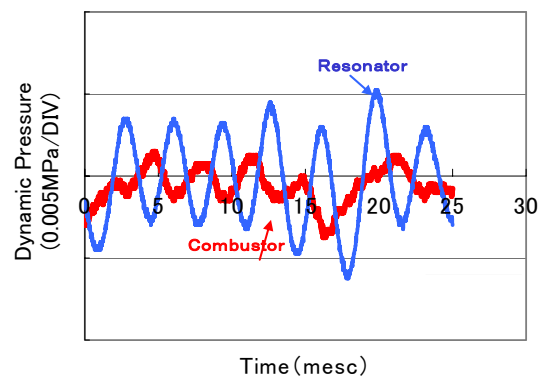


Fig.3 Pressure fluctuations in combustion tube and resonator

1. 2-4, Suehiro-cho, Tsurumi-ku, Yokohama 230-0045, Japan
Phone:+81-45-510-5925 Fax: +81-45-500-1973
2. 4-1, Egasaki-cho, Tsurumi-ku, Yokohama 230-8510, Japan
Phone: +81-45-613-4202 Fax: +81-45-613-7698