Environmental Engineering Division of JSME

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National Institute of Advanced Industrial Science and Technology

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Takuji NAKATA, Takasago Thermal Engineering Co., Ltd

[2022-1]

Improvement of acoustic absorption performance of perforated plate by bias flow

Hiromitsu HAMAKAWA, Oita University

ABSTRACT [2022-1]

The present paper focuses on improvement of acoustic absorption performance of perforated plate with background air space by bias flow. The frequency characteristics of the acoustic absorption coefficient showed a maximum value at optimal frequency. As the bias flow velocity passing through the orifices increased, the peak level of the acoustic absorption coefficient increased. The relation between flow field and acoustic absorption performance of perforated plate with bias flow was shown. Velocity measurements were performed around perforated plate by means of particle image velocimetry. If the peak level of the acoustic absorption coefficient increased by the bias flow, the vortices were formed clearly at the downstream of the orifices due to incident sound of pure tone. The effect of taper angle on acoustic absorption performance of perforated plate with bias flow was shown. The acoustic absorption performance has improved using taper orifices of perforated plate. The peak frequency of the acoustic absorption coefficient depended on the orifice cross-sectional shape of perforated plate.

FIGURES(inc.Japanese words) and CAPTIONS [2022-1]

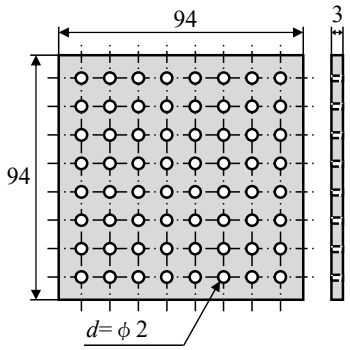

Fig.1 Geometry of the perforated plate

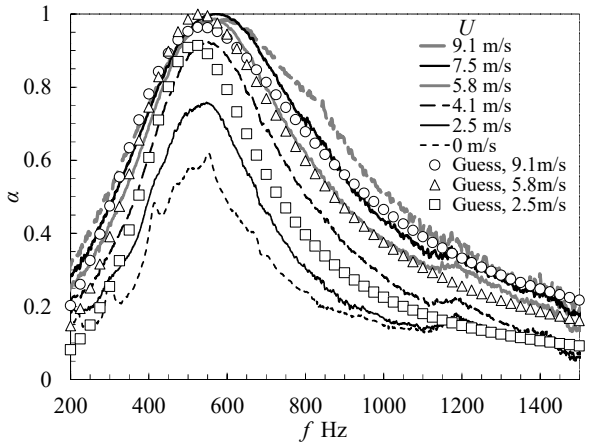

Fig.2 Effect of bias flow velocity on acoustic absorption coefficient

(a) No incident sound (U=6.4m/s)

(b) Pure tone of 432 Hz, 120dB(U=6.4m/s)

Fig.3 Vorticity distribution at the downstream of the orifice

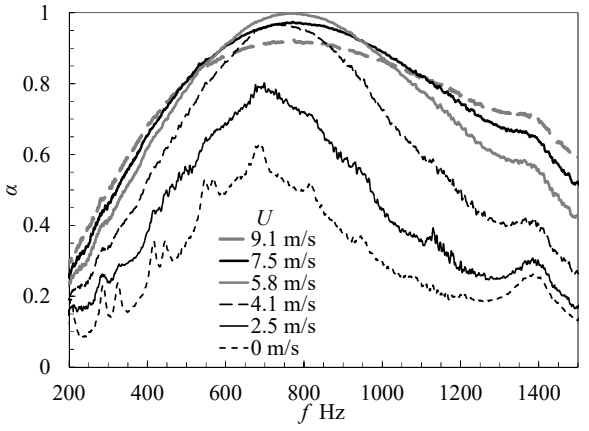

Fig.4 Effect of inlet taper angle on frequency characteristics of the acoustic absorption coefficient

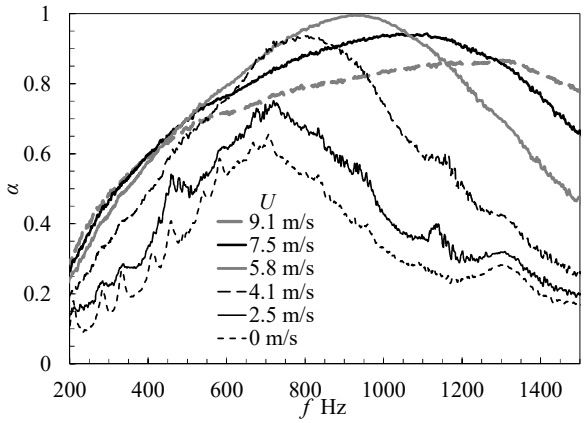

Fig5 Effect of outlet taper angle on frequency characteristics of the acoustic absorption coefficient

[2022-2]

Efforts to automate operation of incinerators in Waste-to-Energy Plants

Hiroshi KOJIMA, JFE Engineering Corporation

ABSTRACT [2022-2]

The main trend in the construction of new Waste-to-Energy (WtE) plants is now DBO (Design, Build, Operate) projects, in which a private-sector company undertakes a long-term operation and maintenance contract. For this reason, plant construction companies are working on various technological developments to provide stable and secure facility operations with fewer people in the operation business area.

As one of these efforts, JFE Engineering（JFE） have been developing technology to automate the monitoring operation work that requires the maximum time to operate plants and which has been performed for stable combustion management of the waste incinerator. In July 2020, JFE announced the industry's first fully automated incinerator operation utilizing AI and Big Data Analysis "BRA-ING" as a product. This technology is currently expanding to WtE plants where JFE operates.

This article introduces the background of the development of automatic operation

technology for WtE plants. It demonstrates that stable combustion management is possible without the need for operator monitoring and operation work in facilities that have introduced this technology in actual operation.

FIGURES(inc.Japanese words) and CAPTIONS [2022-2]

Fig.1 Image of incinerator operation of WtE plant

Fig.2 Concept of this system

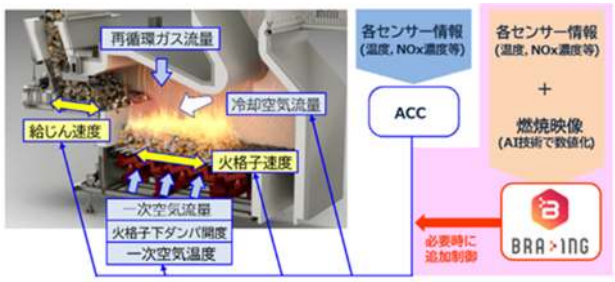

Fig.3 Control items automatically operated by this system

Fig.4 Number of manual operations before and after system introduction

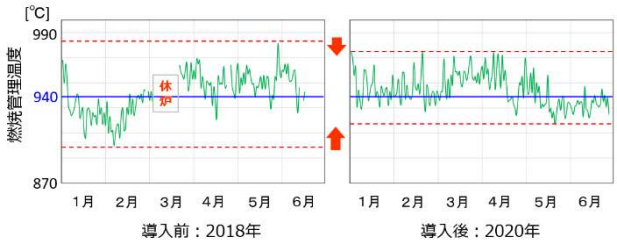

Fig. 5 Combustion temperature trend for half a year

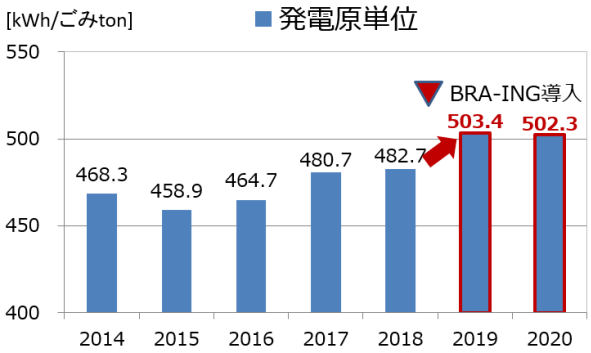

Fig. 6 Trend in power generation per waste disposal amount

[2022-3]

Business Development of AI-DOE for “Super” efficient Research and Development

Kotaro KAWAJIRI,

National Institute of Advanced Industrial Science and Technology

ABSTRACT [2022-3]

R&D is the necessary activity for human society to build a sustainable society in the future. On the other hand, R&D is inefficient activity from viewpoints of environment and cost. We have developed the methodology of Innovative Design of Experiment using Artificial Intelligence (AI-DOE) and the crowd-based web-software “Multi-Sigma” to implement AI-DOE. The effort for experiments was drastically reduced and the innovative results was gained by AI-DOE in a case study of artificial heart. Multi-Sigma is quite useful to implement AI-DOE for researchers and students who does not have backgrounds of AI engineering and programming. Now our business is highly promoted by the social needs of AI and DX. We develop our business to build a smart and sustainable society in which everyone can use such an innovative tools using AI.

FIGURES(inc.Japanese words) and CAPTIONS [2022-3]

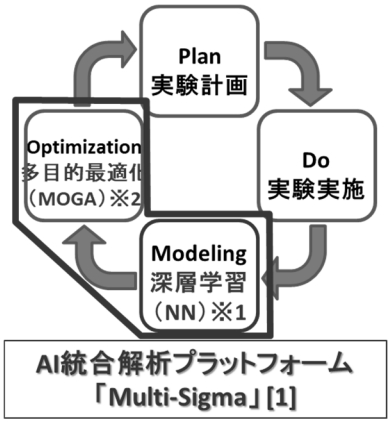

Fig.1 Concept of AI-DOE

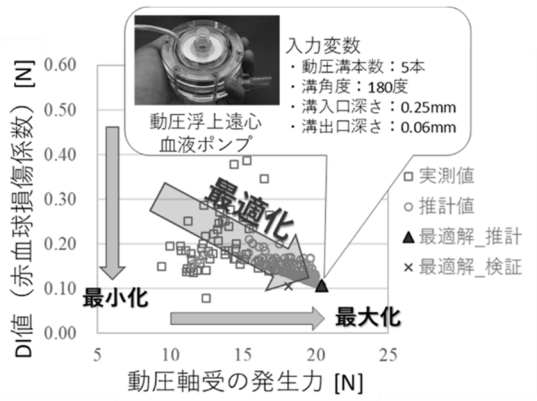

Fig.2 Multi-objective optimization of design of artificial heart

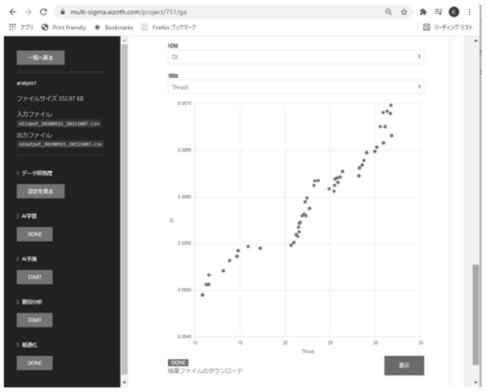

Fig.3 Console of Multi-Sigma

[2022-4]

Development of adsorption thermal storage system utilizing low-temperature waste heat

Takuji NAKATA,

Takasago Thermal Engineering Co., Ltd

ABSTRACT [2022-4]

We have developed an adsorption thermal storage system that can utilize low-

temperature waste heat using the adsorbent “HAS-Clay”. Because this thermal storage system applies an adsorption / desorption reaction by an adsorbent, it has features such as higher heat storage density and extremely lower heat loss than conventional heat storage materials such as PCM. This time, a trailer-sized thermal storage tank was manufactured, and demonstration tests of off-line heat transport were conducted throughout the summer, mid-season, and winter. In this test, waste heat from the co-generation system in the Hamura Plant of Hino Motors was charged in the tank, transported for about 2 km by a large trailer, and discharged in the Hamura Swimming Center to supply high-temperature and low-humidity air. This demonstration test of off-line heat transport confirmed the charging and discharging characteristics in adsorption thermal storage tank throughout the summer, mid-season, and winter. As a result, 90% or more of the amount of charged heat can be effectively used in the facility by using cascade, stability of heat supply is possible throughout the year, and 60% reduction in CO2 emissions can be expected.

FIGURES(inc.Japanese words) and CAPTIONS [2022-4]

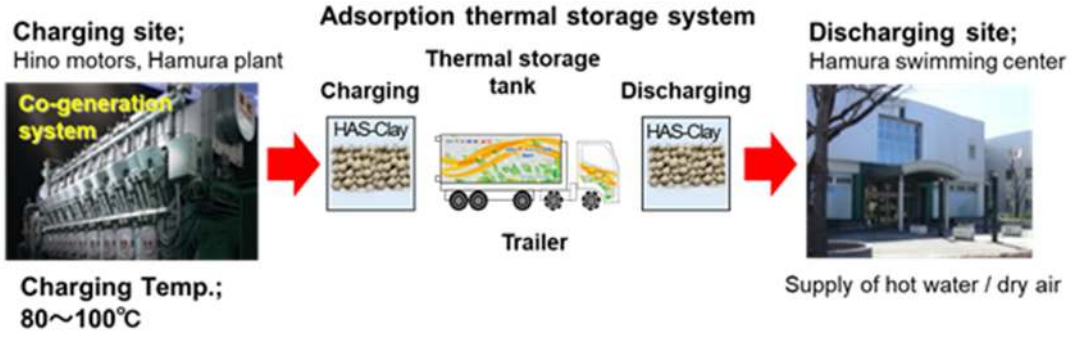

Fig.1 Outline of demonstration tests of off-line heat transport in Hamura city area by using adsorption thermal storage system

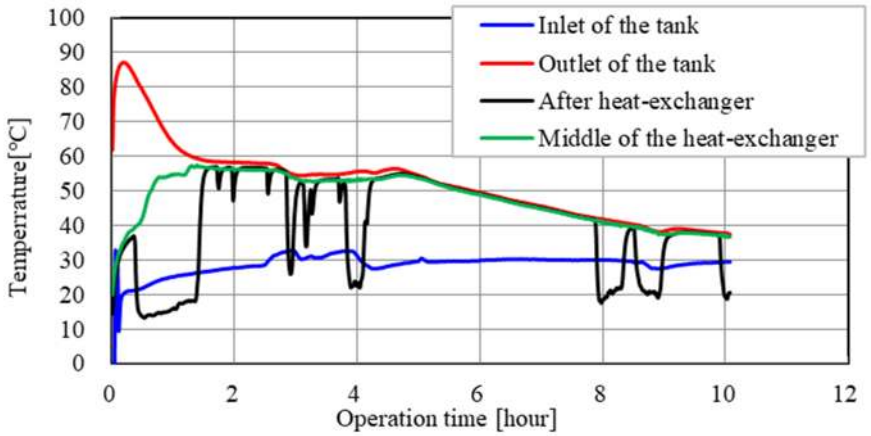

Fig.2 Time history on air temperature of demonstration test on discharging operation in adsorption thermal storage system

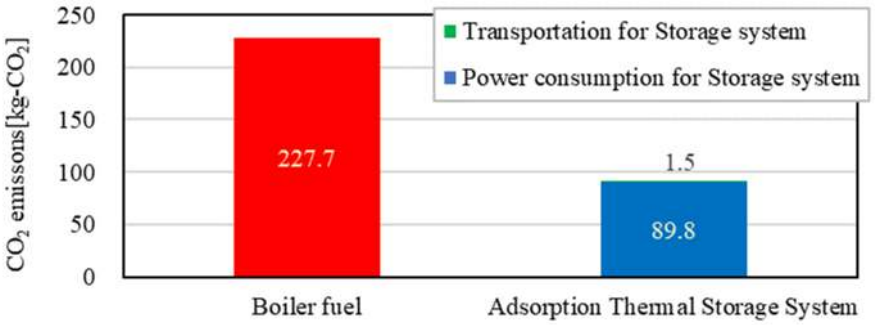

Fig.3 Difference in CO2 emissions of boiler system and adsorption thermal storage system