Development of Technique for Evaluating Coal Adaptability to Power Plants — Evaluation Method for Grindability and Emission Characteristics of NOx and Unburned Carbon in Fly Ash in Partial Load Combustion —

Background

In pulverized coal thermal power, it is important to keep the coal supply stable and to control the fuel cost. For that purpose, the use of coal of various properties up to now, without the experience is necessary, the adaptability to the power plant of these coals is appreciable beforehand, and the technology that the operation indicator corresponding to the coal property can be presented is indispensable. Therefore, "evaluation system of coal adaptability to power plants which can make clear the adaptability of new coal from the coal properties and the combustion condition was developed for the case of non-blended and blended full load combustion [*1,*2]. However, enhancing the functions to further raise accuracy and the partial load combustion is indispensable to improve the practicality of this system.

Objectives

To make the high accuracy system to be able to predict the pulverized coal particle size for grindability evaluation, and to enhance the evaluation system for the grindability and emission characteristics of NOx and unburned matter in fly ash into the partial load combustion.

Principal Results

1. Improvement of the accuracy on the grindability evaluation system and extension of it into the partial load combustion

The HGI [*3], fuel ratio, coal feed amount and rotation number of rotary classifier were able to be extracted as the main factor that influenced grindability of coal (power and rate of 200 mesh pass [*4] of the mill) based on the data of a real power plant. By the analysis on correlation of these influence factor and grindability (Fig.1), the technique to evaluate the grindability in various load conditions was built with sufficient accuracy as a function of HGI, coal feed amount and rotation number of rotary classifier (Fig.2, 3).

2. Extension of the evaluation systems for emission characteristics of NOx and unburned matter in fly ash into the partial load combustion

The applicability of the evaluation system for the NOx and unburned matter in fly ash under full load combustion to the partial load combustion was examined and its possibility recognized for the unit, whose combustion condition was wide for full load (Fig.4). On the other hand the evaluation accuracy was reduced in the units, whose combustion conditions at the partial load were much different from that of the full load combustion. In this case, by deriving the new formula that applied the rate of partial load, evaluation on them was enabled with the same accuracy as the full load combustion (Fig.5).

The above-mentioned result is added, and a whole of the system that has constructed it so far is shown in Fig.6. The coal adaptability evaluation system, which can make clear the adaptability of coal to power plants in various operation conditions from the evaluation items of spontaneous combustion, grindability, emission characteristics of NOx and unburned matter in fly ash and ash properties was completed.

Future Developments

The shape and adhesion of the ash and trace element emission characteristic will be added as an evaluation item of coal adaptability, and higher performance of the system will be aimed at in the future.

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Reference

Hiromitsu Matsuda, 2004, "Evaluation of coal adaptability to power plants (Part5) -Evaluation method for grindability and emission characteristics of NOx and unburned carbon in fly ash in partial load combustion-" , W03306 (in Japanese)

＊1：Coal adaptability evaluation system is the one to evaluate adaptability from 4 evaluation item of "spontaneous combustion", "grindability", "emission characteristics of NOx and unburned matter in fly ash" and "fly ash property" to the power plant., dentyukenhoukoku, W99302 (2000)

＊2：dentyukenhoukoku, W01302 (2002) dentyukenhokoku, W03038 (2004)

＊3：Hardgrove grindability index

＊4：Weight ratio of pulverized coal that passes the 200meshes sieve (correspond to particle diameter 75 μm or less)

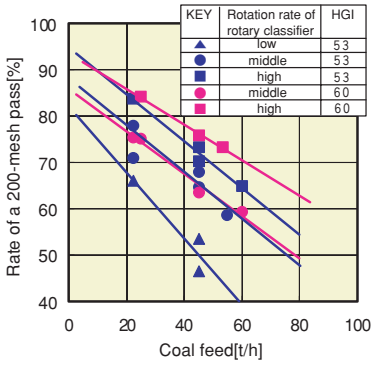

Fig.1 Relation of coal feed and rate of 200-mesh pass

Grindability condition's (It is coal feed in figure)influence on rate of 200 mesh pass was clarified

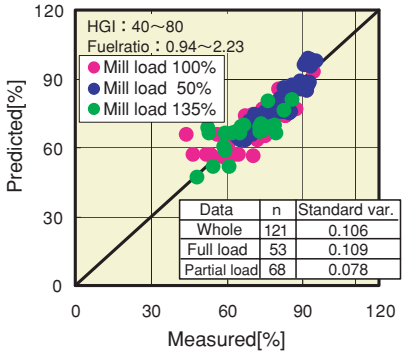

Fig.2 Evaluation accuracy of 200-mesh pass rate

It was clarified that rate of 200 mesh pass could be accurately predicted from HGI, coal feed, and rotation number of rotary classifier.

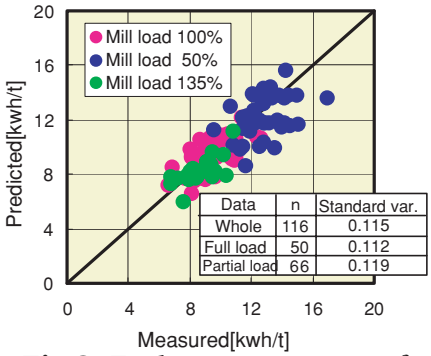

Fig.3 Evaluation accuracy of mill power

It was clarified that mill power couldbe accurately predicted from HGI, coal feed, and rotation number of rotary classifier.

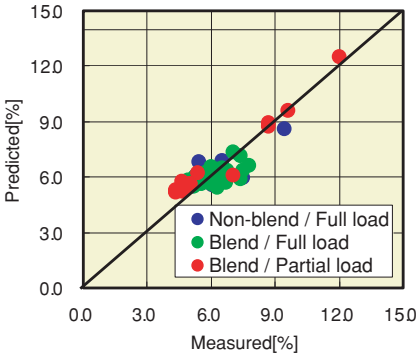

Fig.4 Evaluation accuracyof NOx formation

It was clarified that NOx formation in partial load combustion could be accurately evaluated from prediction equation for full load.

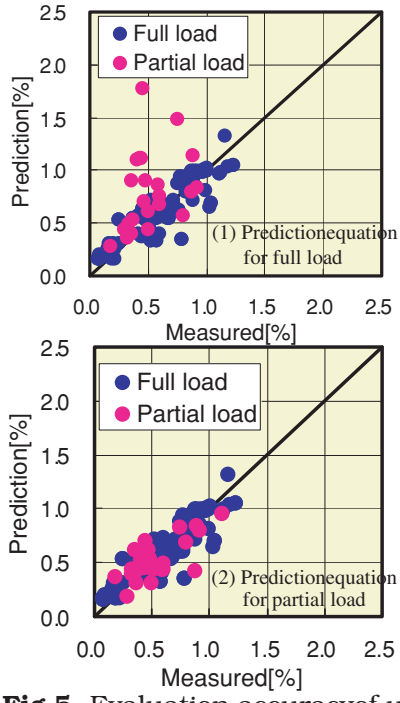

Fig.5 Evaluation accuracyof unburned matter

It was clarified that unburned matter formation in partial load combustion could be accurately evaluated from prediction equation, which applied the rate of partial load.

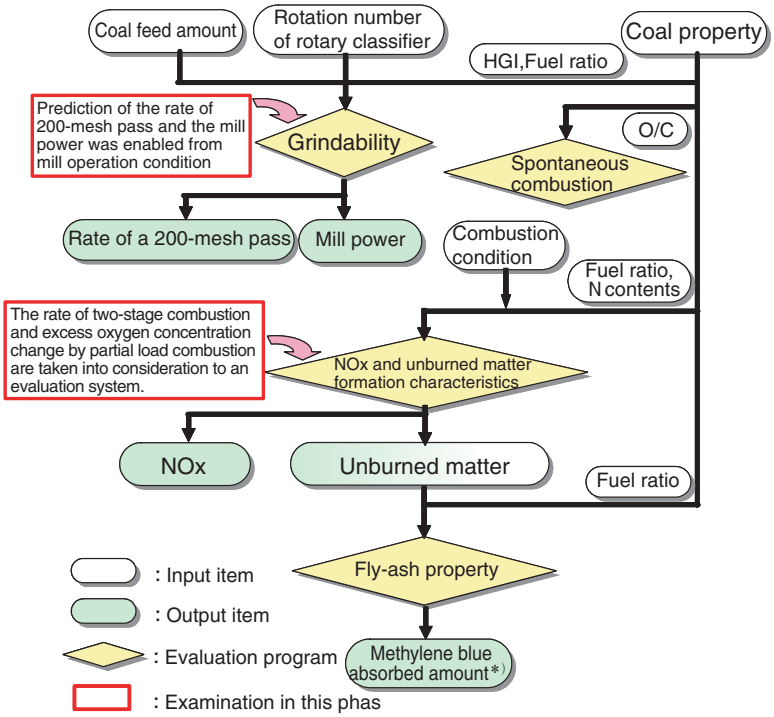

Fig.6 Evaluation system of coal adaptability to power plant

*) The amount of the MB adsorption: When it uses the coal ash as a concrete mixture material, the amount of the methylene blue adsorption is index of the amount of the surface-active agent adsorbed by the active carbon in the coal ash.

The evaluation system, which can predict the spontaneous combustion, grindability, emission characteristics of NOx and unburned matter in fly ash and ash properties in various operation conditions of power plant from the coal property and combustion condition was established.