Improvements and Recent Technology for Fluidized Bed Waste Incinerators

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Fluidized bed waste incinerators remain popular for industrial waste incineration, although the demand for these incinerators has been decreasing for municipal waste incineration. This is partly because the release of dioxins from waste incineration has recently become a significant social problem in Japan. NKK has continually improved fluidized bed technology to solve the dioxin problem, as well as to obtain heat recovery from waste combustion. Our most recently delivered fluidized bed incinerator for municipal waste incorporated these improvements and achieved very low dioxin concentrations of 0.00058ng(TEQ)/Nm^3 at the stack. This result is equivalent to that of very large-scale stoker type incineration plants. Furthermore, NKK developed technology for effectively recovering heat from the furnace bed to achieve highly efficient power generation. The estimated corrosion rate of the furnace bed boiler tubes is as low as 0.4mm/year.

1. Introduction

Orders for fluidized bed incinerators for the disposal of urban refuse have recently decreased as a result of problems with dioxin control and the development of gasification furnaces. At the same time, the ability of these incinerators to process industrial waste ensures that the demand will remain firm, both within Japan and overseas.

Within this context, NKK expended considerable effort large stoker furnaces (See **Table 2**). The carbon monoxide concentration is described in the following chapter as an index of stable combustion.

Table 2 Results of exhaust gas analysis

3. Improvements in supply of wastes

A stable supply of wastes has a major effect on the combustion efficiency because waste is immediately combusted within seconds of entering the fluidized bed incinerator.

NKK has used the feed mechanisms shown in **Fig.2**

Fig.2 Waste feed system

3.1 Bag breaker and pusher feed mechanism

The dioxin problem was not recognized during the early stages of development. The design of the feed mechanism therefore focused on minimizing power consumption, while minimizing the possibility of feeding unsuitable materials to the furnace.

This feed mechanism was suitable for waste supply items such as mattresses and motor vehicle tires[1]. NKK's proprietary incinerator bed design allows the discharge of large non-combustible objects such as motor vehicle wheels with absolutely minimal problems and remains in use in current designs.

3.2 Crusher and screw feed mechanism

Industrial waste incinerators handle a high proportion of the larger size waste items and must incorporate measures to handle dioxins. The guaranteed maximum dioxin concentration in the exhaust gas is 0.1ng, even for municipal wastes. The NKK feed mechanism was developed for this reason. The crusher is based on the twin axis shearing method.

Waste is pre-processed to an average particle width of approximately 50 mm. Particles produced with the bag breaker are approximately 120 mm in width.

Changes over time in the carbon monoxide concentration of the exhaust gas from general waste incinerators that use the two feed mechanisms noted above are shown in **Fig.3**. Along with the improvements in feed mechanisms, increased sophistication in combustion control[2] and the use of the crusher and screw feed mechanism have produced a dramatic increase in the stability of operation. This increase has been obtained in spite of differences in the properties of the waste materials used.

The design ensures that the waste material is not compressed between the feed shaft and the casing. While the conventional screw-feed mechanism consumes 15 kW of power at a processing rate of 3 tons/hr, this system consumes 2.2 kW at the same processing rate, a significant contribution to energy efficiency.

Fig.4 Spiral feed mechanism

4. Current status of heat recovery technology

Technology for recovering heat in fluidized bed incin-

The test pieces were SUS 310S and 625 Alloy. The atmosphere surrounding the test pieces was maintained at a temperature of 727 , while the temperature of the air

Fig.8 Erosion depth of samples during heat recovery

depth of SUS 310S tubing to approximately 1.6 mm/year