JFE TECHNICAL REPORT
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JFE Ash Melting Furnace Technology†

1. Introduction

Incineration residue (incineration ash and fly ash) generated from waste treatment facilities is mainly subjected to melting treatment that can simultaneously achieve the triple purposes of volume reduction, detoxification, and resource recycling. JFE Engineering newly established through business consolidation of the engineering divisions of NKK and Kawasaki Steel has two distinctive types of ash melting furnace technology; i.e., electric-resistance type and plasma type.

2. Features of Each Type of Ash Melting Furnace

2.1 Electric-Resistance Ash Melting Furnace[1)]

The structure of this type of furnace is shown in **Fig. 1**. This three-phase alternating current electric-resistance ash melting furnace uses carbon electrodes and performs the reduction melting treatment of ash in a fully closed structure. Molten slag and molten metal are separated by the difference in specific gravity and each has a separate discharge port. Molten slag is discharged utilizing the head pressure. As a whole, this is a unique melting system employing various new technologies developed by JFE Engineering. Its main features are as follows:

(1) The reducing atmosphere suppresses the generation of HCl and NOx, eliminating the need for slaked lime injection and catalytic denitrification treatments of off-gas.

(2) Heavy metals that have low boiling points are easily separated from slag by reducing volatilization, and gravity-separated slag is independently discharged from a dedicated slag discharge port installed at a mid-point in the furnace wall, making it possible to obtain high-quality slag free of heavy metals.

(3) Radiation heat loss is small because the melt is covered with ash, and heat loss through off-gas is small because of its low temperature and small volume, making the overall thermal efficiency extremely high.

(4) As the melting process progresses gently and the off-gas volume is small, the volume of ash entrained in the off-gas is small and the zinc concentration in molten fly ash is high, creating advantageous conditions for resource recycling.

(5) As the entire volume of slag surrounded by the electrodes is heated by Joule heat, a large volume of slag is heated, which allows the furnace to be increased in scale.

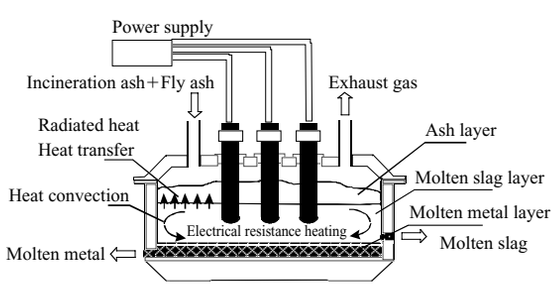

Fig. 1 JFE electric-resistance furnace

2.2 Plasma Ash Melting Furnace[2)]

The structure is shown in **Fig. 2**. It is also a unique melting system that employs various new technologies developed by JFE Engineering such as a transfer-type plasma torch, gravity separation of molten slag and molten metal, continuous water granulation of molten slag and molten metal, tilting metal discharge, and NOx reduction by adding coke. Its main features are as follows:

(1) Low ionization plasma with an ionization level of about 1% is employed, making a high temperature easily obtainable.

(2) The material charged into the furnace is melted by the high temperature generated by the radiation from the plasma flame, Joule heat from the molten slag, and convection in the slag layer. This high-temperature melting method simplifies the pre-treatment of the material to be charged into the

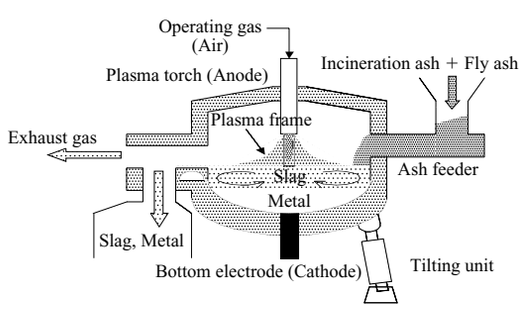

Fig. 2 JFE plasma melting furnace

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Table 1 JFE ash melting furnaces in operation

	Site	Capacity × Units	Treated material
Electric-resistance type	Tobuki, Hachioji City	18 t/d × 2	Bottom ash
	Kanazawa, Yokohama City	60 t/d × 1	Bottom ash (with an alternative furnace)
	Kasugai City	40 t/d × 2	Bottom ash, fly ash, crushed non-combustibles
	Haebaru-Cho-Naha City	26 t/d × 2	Bottom ash, fly ash (under construction)
Plasma type	Kitayatsu, Chiba City	24 t/d × 1	Bottom ash, fly ash (operation is suspended)
	Tohokubu, Kyoto City*	24 t/d × 1	Fly ash only, glass cullet
	Shinminato, Chiba City*	36 t/d × 2	Bottom ash, fly ash (with an alternative furnace)

* The main contractor is Kawasaki Heavy Industries, Ltd.

furnace. Heavy metals that have low boiling points are easily separated from slag by volatilization. Fly ash generated from a stoker furnace generally has high concentrations of salts and heavy metals. This method can melt this type of fly ash without adding any other material.

(3) The slag-metal layer separation facilitates resource recycling.

(4) The electrodes made of metal (copper) have an extremely long life and allow a stable operation.

3. Track Record of JFE Ash Melting Furnaces

Table 1 lists the JFE ash melting furnaces constructed to date. Recently, the need for fly ash mixed melting furnaces and fly ash single melting furnaces has increased remarkably. JFE ash melting furnaces operate in a stable manner, fully exhibiting their unique features.

4. Closing Remarks

The need for ash melting as a technology that can reduce environmental loads generated from municipal waste treatment is increasing. It is expected that the JFE's highly integrated ash melting technology developed to meet these needs will be widely applied in the future.

References

1) Shibuya, E. et al. NKK Technical Report. no. 166, 1999, p. 7–15.
2) Yamashita, S. et al. Kawasaki Steel Giho. vol. 32, no. 4, 2000, p. 300–306.

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