Study on Installation of Plasma Melter Refractory

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1. Introduction

Efforts are being made home and abroad to develop a processing method to satisfy the requirements for stable processing and disposal to treatment various radioactive wastes. KHNP-CRI have developed on Plasma Torch Melter(PTM) as a method for treating radioactive wastes with high temperature melting.

The plasma melter is composed of refractories. So, it is important to ensure the integrity of the refractory. KHNP-CRI studied building and curing of refractories to ensure integrity when installing plasma melter.

2. Conceptual Design of Melter Refractory

2.1 Plasma Melter

For PTM facility, which uses plasma torch, it is crucial to develop the technology for maintaining the integrity of plasma melter, a container for treating radioactive wastes in high-temperature plasma environments. Thus, the process of build and curing the refractory is important when installing the plasma melter.

2.2 Refractory

In the plasma melter, various refractories reflecting the thermal-flow characteristic of the melt inside are used [1]. Table 1 shows the properties of the refractories used in the plasma melter. The refractory materials used in upper inside, upper outside, lower inside and lower outside were CASTABLE, MgO-C, Al_2O_3-Cr_2O_3 and High Alumina, respectively as shown in Fig. 1.

Table 1. Properties of Refractory Materials

	Density (kg/㎥)	Cp (J/kg·K)	Thermal Conductivity (W/m·K)
CASTABLE	0.24	3.19	1.14
MgO-C	3000	0.24	3.19
Al_2O_3-Cr_2O_3	3300	0.24	3.2
High Alumina	3000	0.24	2.5

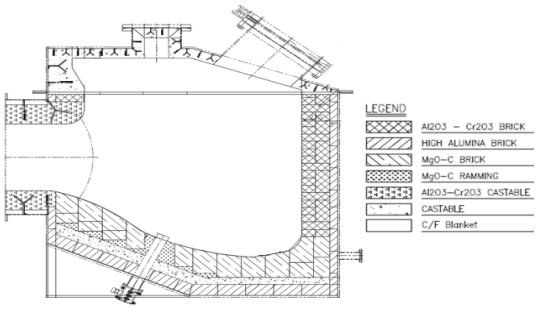

Fig. 1. Distribution of Plasma Melter Refractories.

3. Building of the Melter Refractory

3.1 Refractory Building Process

The plasma melter consists of lid, body and side discharge chamber. Among them, the lid and side

discharge chamber were built of a monolithic refractories and the body was built of a shaped refractories and a monolithic refractories.

The monolithic refractories of the lid and side discharge chamber were built using a model frame as shown in Fig. 2 and 3.

Fig. 2. Building Process of The Lid Refractories.

Fig. 3. Building Process of The Side Chamber Refractories.

The refractories of the body were built in order from the inside to the outside according to the layout as shown in Fig. 4.

Fig. 4. Building Process of The Body Refractories.

3.2 Refractory Curing and Drying

Curing and drying process are essential to ensure the physical integrity of monolithic refractories and safety in high temperature plasma environments.

The drying process was done through the process shown in Fig. 5.

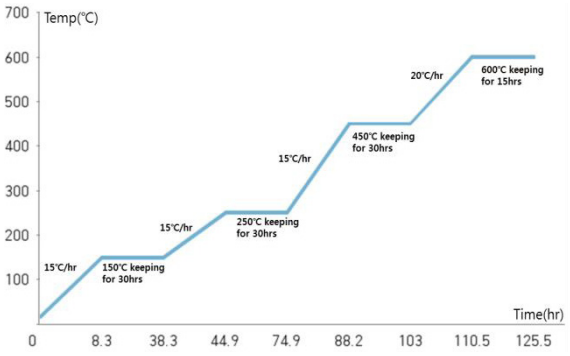

Fig. 5. Temperature Profile of Refractory Drying.

4. Conclusion

The installation process of the plasma melter refractory is very important for the stable treatment of radioactive waste in high temperature environment. Therefore, the quality of the refractories must be secured during buliding and curing process in order to ensure integrity of the plasma melter. Through this study, quality was secured during the building and curing process for the plasma melter integrity. Based on this study, KHNP-CRI plans to complete the installation of the PTM system in the near future.

REFERENCES

[1] S.J. Hwang and Y.H. Hwang, “Study on Thermal-Flow Analysis of the Plasma Melter”, Global 2017, Korea (2017).