Preliminary Study on the Granulation of the Molten Slag

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Abstract

In the present work, the granulation of molten slag by using the rotating disk-drum atomizer was studied, in which the influence of the surface shape of disk and the flow rate of the cooling water on the characteristics of granulated slag, such as the size and crystal structure, was mainly examined. Molten slag was first poured center of the disk at various rotating speed and atomized by centrifugal force. Slag granulation was observed by camera and finally, the particles were collected for physical and chemical analyses.

Introduction

The molten slag produced in steel making industry has been treated by conventional water-cooling method without any recovery of heat in spite of its big potential.(1-2) Lately, some researchers have reported that it is posssible to recovery heat of slag by dry granualtion method.(3-4) This method means to atomize the molten slag into the small droplets before the heat recovery process. However, there is lack of information regarding the properties of the granulated slag produced. Therefore, the purpose of this study is to investigate the possibility of granulating the molten blast furnace and steel making slag by the rotating disk and drum atomizer, in which the influence of disk and drum speed, slag viscosity and colling water flow rate on the characterisics of granulated slag particles was mainly examined.

Materials and Methods

Figure 1 shows a schematic diagram of the rotating disk and drum atomizer equpiment used in this experiment. It mainly consist of three parts: (1) A slag feeder; (2) Slag melting burner; (3) Rotating disk and drum. The diameter of disk is 130 mm and there are two different types of disk shape; flat disk and grooved disk. In the present study, molten blast furnace and steel making slag having a temperature over 1400 °C were employed. The viscosity of blast furnace and steel making slag are 20 and 10 poise for 1400 °C respectively. During the experiments, the molten slag was poured into the center of the rotaing disk and granulation process was visualized by using the high speed camera. The granulated slag particles were collected and then classified based on their dimension.

Results and Discussion

Figure 2 (a) and (b) show the particle size distribution collected under different rotating velocity conditions of disk and drum respectively. The diameter of granulated slag particles decreases as increasing the velocity of the disk. However, the diameter variation by increasing the rotating velocity of the drum is smaller than that of the disk. This phenomenon is attributed that the granulation of molten slag is mainly governed by the centrifugal force of rotating disk. Figure 3 show the effect of the slag viscosity on the particle size distribution. The particle size of granulated steel making slag is smaller than that of blast furnace slag with same rotating condition. Also, the results of analyses demonstrate that effective slag mass ratio (defined as the ratio of the granulated slag mass to the solidified slag mass) becomes bigger with increasing in the mass flow rate of the cooling water and the value increase when the disk with grooved surface was used instead of the flat disk.

Acknowledgement

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References

[1] Kasai, E., Italia, T., Akiyama , T., Yagi, J., and Saito, F., *ISIJ International* 37:1031-1036 (1997).
[2] Shimada, T., Kochura, V., Akiyama , T., Kasai, E., and Yagi, J., *ISIJ International* 41:111-115 (2001).
[3] Mizuoci, T., Akiyama , T., Shimada, T., Kasai, E., and Yagi, J., *ISIJ International* 41:1423-1428 (2001).
[4] Purwanto, H., Mizuoci, T., Takagi, M., and Akiyama , T., *Materals Transactions* 45:3286-3290 (2004).

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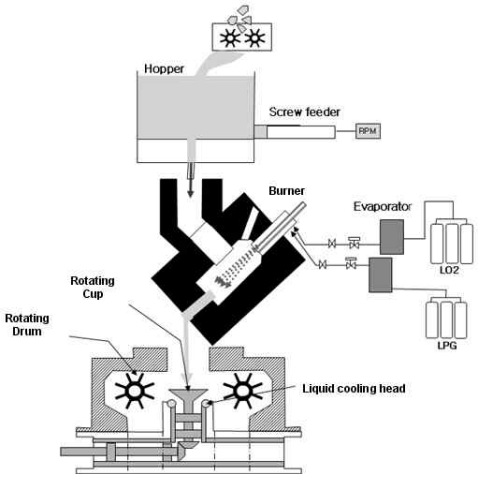

Figure 1. Example of a figure appearing at the end of the paper

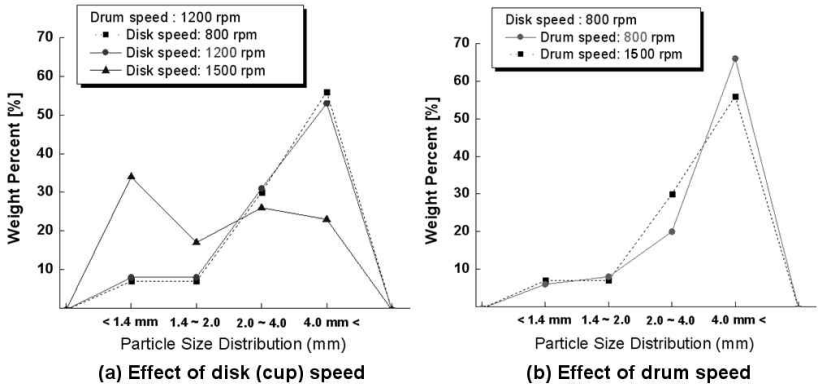

Figure 2. Effect of d on the particle size distribution

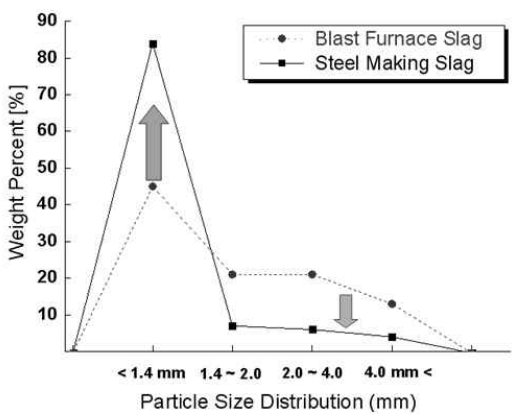

Figure 3. Effect of slag viscosity on the particle size distribution (disk speed: 1500 rpm, drum speed: 1200 rpm)