D f E -S S S †

OKUYAMA Goro[*1] KISHIMOTO Yasuo[*2] MIKI Yuji[*3]

Abstract:

The converter-type chromium ore smelting reduction method has been adopted for the stainless steel refning process at JFE Steel. Since chromium ore is used as a substitute for ferrochromium alloys in this process, this process is consistent with JFE's strategy of main raw materials for reasonable refning of stainless steel. To increase the feeding rate of chromium ore and decrease the amount of carbonaceous material used as a heat source, a burner lance for heating and feeding chromium ore was developed. Ore particles heated by the fame function as a medium of heat transfer from the fame. As a result, it is possible not only to improve the fexibility of the main raw material (chromium source), but also to achieve an energy saving due to the 17% reduction in supplied energy realized by this technique.

1. Introduction

JFE Steel has adopted the converter-type chromium ore smelting reduction method[1ï3)] as its stainless steel-making process. Since chromium ore is used as a substitute for ferrochromium alloys in this process, it is important to increase unit utilization of chromium ore so as to improve flexibility in the selection of chromium raw materials. Because carbonaceous material is used as a reducing agent to reduce the chromium oxide in the chromium ore in the smelting reduction process, and this is a large endothermic reaction, it is essential to increase the heat supply to the furnace in order to increase the amount of reduction of chromium ore. For this reason, the smelting reduction process also consumes a large amount of carbonaceous material as a heat source. Heat is supplied by combustion of carbon with top and bottom blown oxygen. As measures for increasing the furnace heat supply, the oxygen supply rate was increased and high post-combustion techniques were developed, but both of these approaches have drawbacks. Increasing the oxygen supply rate increases the decarburization reaction, mainly by the reaction between C in the hot metal and oxygen, but because the amount of dust generation from the furnace also increases, yield of Fe and Cr is decreases. On the other hand, as high post-combustion techniques, practice of raising the lance height and development of a lance nozzle which realizes soft blowing of the oxygen jet have been conducted[4ï6)]. High post-combustion operation increases the amount of heat generated in the furnace, but because post-combustion occurs in the space in the furnace, the efficiency of heat transfer to the region where the chromium ore reduction reaction occurs is poor. For this reason, high post-combustion operation increases the thermal load on con

powdery raw material, to the converter through the burner flame. Based on the results of that work, a burner lance for heating and feeding chromium ore was introduced at the actual smelting reduction furnace. The results of operation with the developed burner lance are

† Originally published in *JFE GIHO* No. 38 (Aug. 2016), p. 53ï57

[*1] Dr. Eng.,
Staff General Manager,
Overseas Business Planning Sec.,
Corporate Planning Dept.,
JFE Steel

[*2] Dr. Eng.,
Fellow,
Steel Res. Lab.,
JFE Steel

[*3] Dr. Eng.,
Principal Researcher Executive Assistant,
Steel Res. Lab.,
JFE Steel

smelting reduction process.

5. Conclusion

A burner lance for addition of heated chromium ore using a hydrocarbon gas as the burner fuel was developed at the smelting reduction furnace at JFE Steel East Japan Works (Chiba). In the burner lance for addition of heated chromium ore, because the ore functions as a medium of heat transfer for the combustion heat of the burner, the new burner lance dramatically improves the efficiency of heat transfer. Introduction of this technology not only enhanced flexibility in the selection of main raw materials, including chromium sources, but has also reduced unit supplied energy by 17% in comparison with the conventional method, achieving a substantial energy saving in the smelting reduction process.

References