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Improvement of heat pattern and sinter strength at high charcoal proportion by applying ultra-lean gaseous fuel injection in iron ore sintering process

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Abstract

Using biomass for partial replacement of coke breeze in iron-ore sintering process is an effective technique as a countermeasure against global warming. However, the sinter strength would be weakened due to the damaged heat pattern at high biomass proportion. In this paper, the gaseous fuel injection method was experimentally investigated with the aim at solving this problem. Eleven cases were arranged to examine the ultra-low concentration of methane combustion and its effect on the improvement of heat pattern at high charcoal proportion. The temperature in the sintering bed was recorded by both thermocouples and infrared thermography. The thermocouple data indicated that the melt quantity index was significantly increased by employing the gaseous fuel injection method. Moreover, the infrared images show that the red-hot region was expanded at each moment in the methane injection cases. The influencing mechanism of gaseous fuel injection on the heat pattern in sintering process was revealed in this paper. As the premixed methane/air approaching to the solid fuel combustion zone, it was preheated by the hot sintered ores, then ignited and self-sustained near the solid fuel combustion zone. A newly generated gaseous fuel combustion zone coupled with the solid fuel combustion zone was used to control the heat pattern in sintering bed. The results showed that the heat pattern and sinter strength kept increasing until the methane concentration increased to 0.4-0.5% under the lab conditions. The stable interval of secondary combustion zone in the sintering bed was also analyzed. Finally, comprehensively considering the sinter strength, yield, productivity and sintering time, the recommended equivalent methane concentration at high charcoal proportion
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