Design of a Sintering Heat Profile for Accelerating Oxidation of Magnetite Ore

Y.Konno[1], *M.Matsumura*[2], *T.Takayama*[3]

1. Master's student, Tohoku University, 20-1 Shintomi Futtsu, Chiba, 293-8511, Japan, yuki.konno.r7@dc.tohoku.ac.jp
2. Visiting Professor, Tohoku University, 20-1 Shintomi Futtsu, Chiba, 293-8511, Japan, masaru.matsumura.d6@tohoku.ac.jp
3. Researcher, Materials Characterization Research Laboratory, Advanced Technology Research Laboratories, Nippon Steel Corporation. 20-1 Shintomi Futtsu, Chiba, 293-8511, Japan takayama.9fy.toru@jp.nipponsteel.com

Keywords: sintering, magnetite ore, heat profile, oxidation

ABSTRACT

The steel industry accounts for 14% of domestic CO_2 emission in Japan, and iron ore sintering process occupies approximately 3%. While iron ore quality used as raw material is getting gradually worse. So, the amount of concentrated iron ore will increase in the future. We have focused on magnetite as sinter materials, because magnetite can be easily magnetically beneficiated. However, in the case of high blending ratio of magnetite ore, Fe^{2+} in the iron ore sinter increase, which results in lower reducibility. Therefore, promoting the oxidation reaction from magnetite to hematite is important in the sintering process. In addition, this promotion means increase of oxidation heat, which results in high sinter strength and the reduction of coke. It is assumed that the oxidation of magnetite tends to proceed in the cooling stage, where the oxygen partial pressure increases after the combustion of fine coke, but there are few studies on the effect of heat profile, especially cooling path. The purpose of this study is to design the effective sintering heat profile to promote oxidation of magnetite ore, especially, to investigate the effect of cooling path on sintered ore microstructure. In this study, magnetite ore and magnetite reagent were respectively mixed with calcium carbonate reagent. Then the mixed samples were pressed and formed into cylindrical tablets for simulating the adhesive layer of a pseudo particle. Through examining influence of maximum temperature and cooking rate on oxidation reaction of magnetite, we confirmed that the oxidation reaction of magnetite is suppressed at above 1350℃ for maximum temperature, compared to 1300℃. Sintering at lower temperature is desirable because hematite is stable below 1350℃ in the Fe_2O_3-CaO phase diagram.

In the presentation and proceedings, we will report the results for cooling path.