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Study of the reduction of a hematite pellet by CO-H2 mixture gas

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As the goal of achieving carbon neutrality by 2050 has emerged globally, great changes are being demanded in the iron and steel industry. Among these, the need for a direct reduction process of iron ore to reduce CO2 emissions is gaining attention. The reduction process using iron ore pellets and a shaft-type reactor has already reached the commercialization stage; however, little is known about the theoretical aspects of the reduction rate of iron ore. In particular, when hydrogen-containing gas is used as a reducing gas to lower CO2 emissions, significant changes in the reduction reaction mechanism and rate are expected.
In this study, experiments on the reduction of hematite ore pellets using a CO+H2 gas mixture were conducted to investigate the reduction behavior under varying reducing gas conditions. The reduction rate was determined using thermogravimetric analysis (TG), and exhaust gas analysis was performed to examine the reaction mechanism. The rate-determining step of the reduction reaction was identified using the reduction rate measurements over time, and the rate constant for the corresponding step was determined.

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