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Development of Degradation Model for Sinter Ore Considering Particle Size Distribution

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In recent years, reducing CO2 emissions in the steel industry has been demanded from an environmental conservation perspective. As a partial substitute for coke, a reducing agent injected into the blast furnace, the injection of H2 is being considered. The reduction reaction of ore by H2 is an endothermic reaction, and there is concern about a decrease in the temperature inside the blast furnace. If this occurs, there is a risk that the degradation of ore particles will worsen in the low-temperature region inside the blast furnace. Therefore, this study aims to estimate the size distribution of ore during reduction based on population balance model. Until now, prediction models for sinter ore after reduction have mainly been evaluated using only CO as the reducing gas, and the relationship between the harmonic mean diameter and the reduction rate has been studied. However, with prediction methods based solely on the harmonic mean diameter, it is not possible to estimate the amount of fine ore, which has a significant negative impact on the permeability inside the blast furnace. Therefore, an attempt was made to understand the amount of disintegration through the formulation of particle size distribution after reduction. Sinter ore was used for the experiments, and the reduction atmosphere was set as CO-H2-N2. The reduction temperature was set at 450-800℃. Additionally, the influence of H2 gas on degradation was also studied by conducting experiments under CO gas, CO-H2 mixed gas, and H2 gas. By organizing the data using the Gaudin-Meloy distribution, it was possible to calculate parameters that indicate the particle size distribution after reduction, regardless of the gas composition and temperature.

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