Reaction model to estimate accompanying carbonaceous material amount in carbon-core fired pellet and a few considerations of its high reducibility

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ABSTRACT

Since the global steel demand increases and the quality of iron ore deposits are deteriorating, concentrated iron ores beneficiated from low-grade ore bodies have to be mixed in the sinter mix to maintain the sinter quality. On the other hand, the ferrous burden for blast furnace which can further reduce the reduction agent rate (RAR) is strongly desired due to the soaring coking coal prices and the measure against greenhouse gas emission. To cope with such a situation, fundamental examinations were performed on the carbon core pellet (CCP) produced by sintering double-layered pellets which consist of a coke core and concentrated iron ore shell. First, the chemical composition and structure of the double-layered green pellet was studied. With an unreacted-core-based reaction kinetics model, appropriate conditions to achieve carbon-accompanying pellet even after sintering in oxygen atmosphere and high temperature were examined. As a result, 5 mm coke core size, 5 mm iron ore shell thickness and less than 5% CaO content in shell were preferred design. Second, according to the reduction analysis, the high reducibility mechanism of CCP derives from follows. The improvement of reaction rate constant due to the accompanying carbonaceous material and the improvement of diffusion coefficient due to blending burnt lime in the iron ore shell. Furthermore, with the softening-melting property test, the maximum pressure drop of the mixture bed of CCP and ordinary sinter decreased up to 1/3 compared with the conventional sinter. And melting temperature of mixture of CCP and ordinary sinter shifted to higher temperature. Therefore, CCP can serve as a resource expansion method and blast furnace burden which can lower RAR furthermore in ironmaking process.

Key Words: Composite pellet; Carbon core pellet; Sintering; Reaction model; Reducibility