別紙様式８

研　究　主　論　文　抄　録

論文題目　　鉄反応器についての数値シミュレーション
（　Numerical Simulation on Iron Reactor　）

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主論文要旨

《本文》

High competition in industrial field requires an advanced process modification on iron plant in order to improve the product quality. Process modification can be carried out by analyzing the performance of iron reactor which in turn implies the profitable optimum condition of reactor. In general, iron reactor is used to produce sponge iron product from iron and the quality of the product is expressed by metallization degree.

Since the reactor analysis is difficult to be executed directly in the field plant, it will need a simulator as support instrument. This simulator can design an arrangement of heat, momentum, and mass transfer equation inside the reactor to reproduce reactor data from the field. By simulating the model, the effects of many variables on the performance of reactor can be predicted.

Mathematical model in iron reactor is employed in the gas and solid phase. Here kinetic equation of iron reduction, methane reforming, total carbon formation, and water gas shift reaction are taken into account in the model. Calculation of the model is executed by using finite element method.

Simulation results have a good agreement with the reference data from the real plant. Temperature, momentum, and concentration profiles both in gas and solid phases are successfully created. Gas mole balance reactions for all reactions already have an agreement.

Simulation result also shows that increase in H_2 or CO composition will produce higher metallization degree. Note that the increase in metallization degree is higher when CO is used as a reducer rather than H_2. Metallization degree will also increase as gas inlet temperature becomes lower. Here the gas inlet temperature should be below than 1246K to avoid the formation of sticky iron. Increase in production capacity will decrease metallization degree.