Development of thermodynamic database and kinetic simulation model for pyrometallurgical processes

Min-Kyu Paek(min.paek@aalto.fi)
AALTO UNIVERSITY

Abstract

Recently, many steel and alloy manufacturers are trying to integrate their operational skill of pyrometallurgical processes into the concept of smart factory for the next industrial revolution. In order to implement the intelligent technique for the process industry, we have to overcome a variety of challenges at high temperature. Compared to the typical manufacturing processes, ferrous materials are produced by melting and refining processes with various reactions among alloy melt, oxide flux, compound, gas and refractory. Since the complex reactions of inorganic materials can only be predicted under the equilibrium state by using thermodynamic equations, there are many limitations for the description of the high temperature reactions; 1) lack of experimental data in complex multicomponent system, 2) experimental and analytical difficulties, 3) theoretical consistency of thermodynamic models, 4) non-equilibrium condition of the commercial processes. Therefore, the importance of fundamental experiment and accurate thermodynamic database will be discussed. The utilization of the thermodynamic database for the kinetic simulation model will be also described with a commercial pyrometallurgical process. Developed thermodynamic database and kinetic models can be used for a larger part of big data to achieve the true innovation for the industry 4.0 system on the high temperature pyrometallurgical processes.

Keywords: *thermodynamic database, process simulation, pyrometallurgy*

Biography

Dr. Min-Kyu Paek is a postdoctoral researcher at Aalto University in Finland. He received his master and PhD degrees in metallurgy in 2014 from Hanyang University, Korea. His work focuses on the development of thermodynamic database and kinetic simulation process model using FactSage thermochemistry software.