Preface to the Special Issue on “Mathematical Modeling of Iron and Steel Making Processes”

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Advances in both computer speed and memory capacity have been remarkable, improvements of 1000 times and more have been realized in these 15 years and the growth is not likely to stop. Such a technology field is very rare, and computational continuum mechanics field has been received benefit from advances in computer ability. In particular, in computational fluid dynamics (CFD) and solid and structural mechanics, many stable and accurate solution methods have been developed and many practical applications have been done in many industrial fields.

Moreover, the development of the general-purpose analysis program codes (commercial codes) for the fluid dynamics is significant in recent years, and many physical models such as combustion, fluid flow in a packed bed, gas-liquid/solid-liquid two phase flow, fluid flow with free surface, etc. have been introduced and it makes possible to analyze the complex phenomena.

Numerical simulations for iron and steel making processes have been applied to blast furnace, coke oven, scrap melting furnace, ladle refining, RH refining, electric furnace, tundish, continuous caster, etc and rewarded with good results. Numerical process simulation technology in steel and iron making processes has been developed coupling the computational fluid dynamics with the physical model based on the chemical engineering.

A numerical simulation is indispensable technology for advances in iron and steel making industries and has been coming to be used widely for the analysis/optimization of the established processes and the scaling up simulation of new processes.

Although the computer power and numerical simulation technology have been improved extremely, it is the fact that we encounter with the difficulties when we want to analyze the iron and steel making processes. There is a little information about the mathematical modeling, method of analytical solution, setup of the boundary conditions, etc. Much information should be necessary to do a better analysis about the mathematical and physical modeling, details of the solution technique, properly boundary conditions, and so on.

Under these conditions, we planned a special issue dealing with the numerical simulation and the modeling about the iron and steel making processes with fluid flow, mass and heat transfer, chemical reaction, phase change, etc. We hope that this special issue is useful and helpful for the development of the numerical simulation technology in iron and steel making processes.