Development of a Multizone Melter-Gasifier Model in gPROMS with ChemApp Multicomponent / Multiphase Equilibrium Calculations

O. ALMPANIS-LEKKAS[1], W. WUKOVITS[1], B. WEISS[2]

[1]*Vienna University of Technology, Institute of Chemical Engineering, Vienna, Austria.*

[2]*Siemens VAI Metals Technologies GmbH, Ironmaking Technology–Smelting / Direct Reduction, Linz, Austria*.

ABSTRACT

The Corex® and Finex® processes are the main alternative options for hot metal production compared to the traditional blast-furnace iron-making route. Due to their more economical and ecological characteristics, their use has been gaining ground over the last two decades. The heart of these processes is the melter-gasifier (MG) device, where the iron oxides are reduced and melted by the use of generated reduction gas.

The nature of the physical and chemical processes that take place in the MG are complex, since heat and mass transfer occur in multicomponent/multiphase systems (gas, solid, liquid iron and slag). Therefore, the implementation of a MG kinetic model with high fidelity is a difficult task.

As a solution to this problem, the Gibbs minimisation approach can be used as part of a predictive model. ChemApp in combination with FactSage were chosen for this task due to their extensive component libraries that cover the field of iron making.

The first part of this work involved the development of a communication scheme between gPROMS and ChemApp. The evaluation of this scheme took place by comparing different metallurgical processes against literature (e.g. Boudouard, Water-Gas-Shift, Baur-Glässner diagram).

The next step was the implementation of the ChemApp calculation routines in an existing multi-zone model of the MG (MZMGM). The MZMGM consists of the dome, the upper charbed, the lower charbed and the raceway/hearth zones.

ChemApp was implemented in the raceway/hearth zone for determining the component elemental distribution between the hot metal and slag phases. In the simulation results good accordance was observed for the major components. However, deviation between the model and real plant data was observed for some minor components.