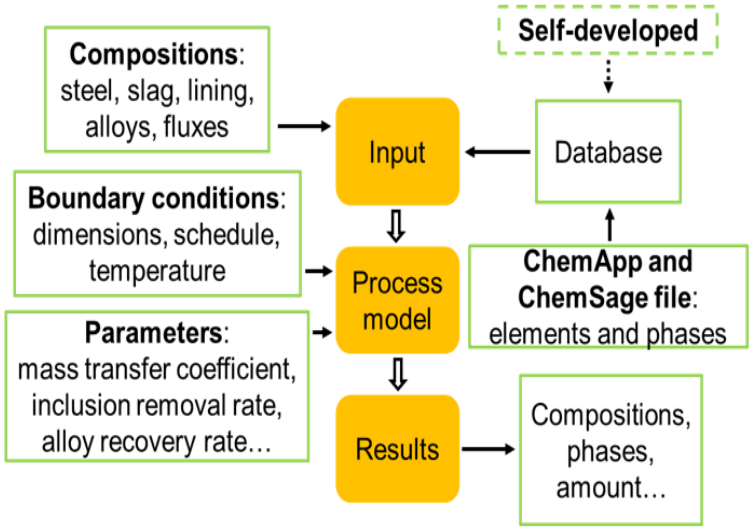
SUCCESS STORY

K1-MET
Competence Center for Advanced Metallurgical and Environmental Process Development

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Centre (K1)

Type of project: Project 2.2 "Interaction of thermodynamic and kinetics of LD steelmaking", 01.07.2019 - 30.06.2023, strat., multi-firm



Source: Chair of Ferrous Metallurgy, Montanuniversität Leoben

SIMULATION OF THE BASIC OXYGEN FURNACE (BOF) TAPPING PROCESS

THE MODEL OF BOF TAPPING PROCESS WITH ADDRESSING REACTIONS IN THE LADLE WAS DEVELOPED AND CALIBRATED BY THE INDUSTRIAL MEASUREMENTS

Ladle treatment is the core part of steel refining where the steel grade with specific properties is designed. Steel tapping from the basic oxygen furnace (BOF) into the ladle is the critical first step in ladle treatment. The tapping process is a kind of 'black box', as information from samples before the start of ladle refining is rarely available. To effectively control the steel refining process and achieve high quality steel, it is important and necessary to track the reactions and composition changes in the steel, slag and inclusions during the tapping process.

The model of the steel tapping process addressing the reactions in the ladle was developed at Chair of Ferrous Metallurgy, Montanuniversitaet Leoben within the frame of a project at the COMET center K1-MET. The schematic of the tapping model and the example tapping schedule are displayed in Fig. 1. In the model, the thermodynamic library is applied to link the thermodynamic databases from Factsage to the programmed metallurgical model. As shown in Fig. 1, the steel/slag interfacial reaction is described by the effective equilibrium reaction zone method whose validity of treating the interfacial reaction has been demonstrated by different researchers. Coupling of the thermodynamics and kinetics, the reactions of steel/slag/inclusion and steel/inclusion during the tapping process are simulated.

In the calculation, besides the steel tapping and carry over slag, the additions of alloys and slag formers, lining wear and air entrapment are also considered.

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The paramerization of the model were carried out by fitting the calculated results to the industrial measurements from two plants (Fig. 1), whose values are in the reasonable range when comparing to the values from other studies.

Impact and effects

The developed model is the first validated and comprehensive model on the tapping process. It can be applied to track the changes in the steel, slag and inclusions during the tapping process. Further, the model can simulate the influence of the various metallurgical parameters, e.g. carryover slag, alloy and slag formers additions, which is beneficial to the industrial partners to control the process and improve the steel quality. The detailed description of the present model was already published in the journal of Metallurgical and Materials Transactions B. The development of the tapping model is a part of the modeling activities within the frame of a work package of Project 2.2 aiming at the controlling of the total steel refining process.

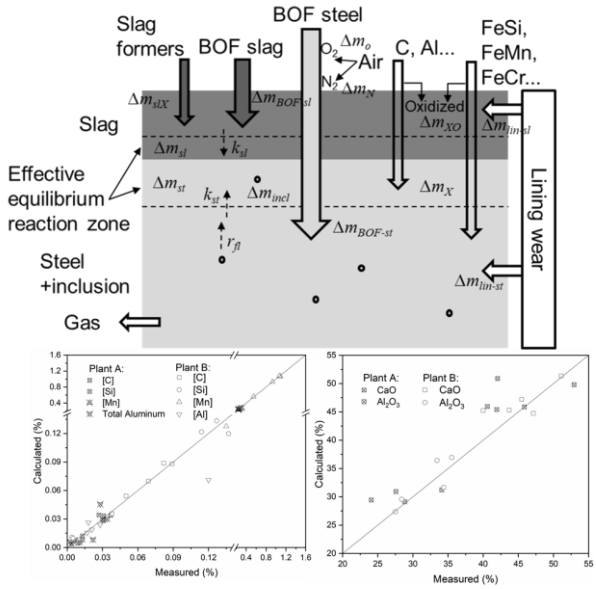

Fig. 1. Schematic of the tapping process model and the comparison of predictions and measurements.

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