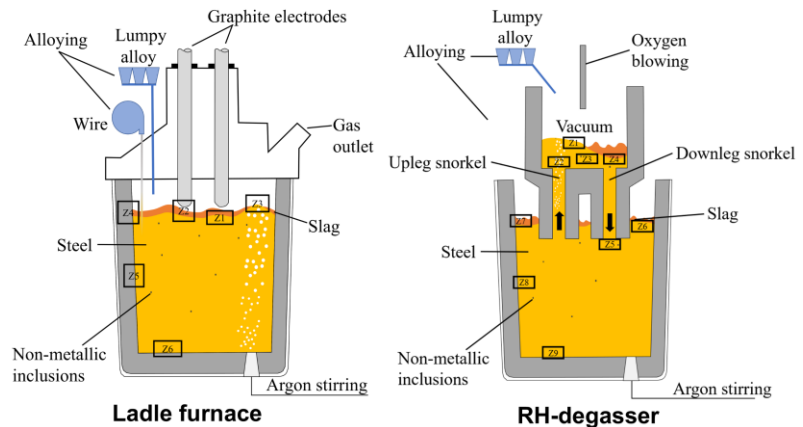


**K1-MET SusMet4Planet
Competence Center of
Sustainable Digitalized
Metallurgy for a Climate Neutral
and Resource Efficient Planet**

Programme: COMET – Competence
Centers for Excellent Technologies

Programme line: COMET-Centre (K1)

Type of project: Project 1.5 WP2,
July 1st, 2023 - June 30th, 2027,
multifirm



Reaction zones within the different refining stations (©K1-MET)

HYBRID MODEL DEVELOPMENT IN SECONDARY METALLURGY: OPPORTUNITIES AND POTENTIALS

I-CLEAN: A THROUGH-PROCESS SIMULATION TOOL FOR PRECISE QUALITY CONTROL TO OPTIMIZE LADLE METALLURGY

In the context of the steel industry's decarbonization, the development and implementation of innovative technologies to ensure future-proof production processes is becoming increasingly important. In particular, secondary metallurgy (SecMet), as the final processing step before continuous casting, poses a central challenge. This refining step adjusts the final alloy composition and the optimal casting temperature, and also involves targeted optimization of steel cleanliness through modification of non-metallic inclusions. Due to these key functions, the SecMet process is especially significant for the overall process quality. Against this background, it is necessary to analyze new input materials early on using detailed process simulations and to comprehensively characterize their impact.

Within the scope of the present project, the software "i-clean" was designed and implemented. This application models the three main process phases (converter tapping, ladle furnace treatment, and Ruhrstahl-Heraeus degassing treatment) and takes into account the most important metallurgical phenomena in the respective units, including temperature prediction. The models are based on a combination of various methodological approaches. Depending on the process step, thermodynamic databases (FactSage™ and ChemApp™) are coupled with tank-in-series models and Fick's first law to accurately represent chemical reactions and their kinetics. Additionally, data-driven statistical methods are applied to precisely describe the thermal boundary conditions.

SUCCESS STORY

During a SecMet treatment, numerous process parameters and sequences can vary, including, for example, different tapping temperatures, changing initial compositions of steel and slag, addition of novel alloying agents, setting of various minimum pressures in degassing units, as well as different heating and purging amounts in the ladle furnace.

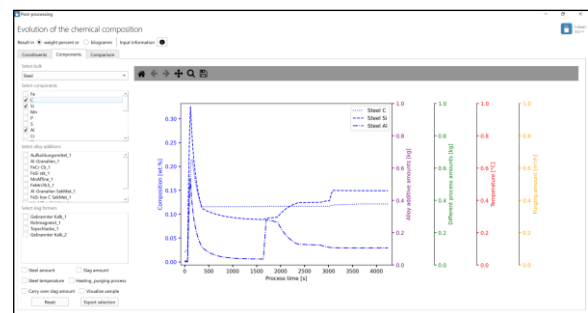
Scientific Awards and Recognitions



CALPHAD LI Best Poster Award (left); the AISTech 2024 Ladle & Secondary Refining Best Paper Award was presented by Abhishek Bhansali (Nucor Steel Berkeley) to Daniel Kavić (right) (©K1-MET).

Impact and Effects

The mentioned parameter changes significantly affect the steel cleanliness, final alloy composition, and temperature control. Therefore, the development of a comprehensive simulation tool to represent, analyze, and subsequently optimize these complex process interrelations is of high scientific and economic interest. Thus, such software will support and promote the decarbonization efforts of the steel industry in many ways.



Post-processing module of the developed “i-clean” software enables detailed examination of the simulation results (©K1-MET)

Project coordination (Story)

Dipl.-Ing. Daniel Kavić, M.Sc.
PhD Researcher
K1-MET GmbH
T +43 (0) 3842 402 2288
daniel.kavic@k1-met.com

K1-MET GmbH

Stahlstraße 14
4020 Linz
T +43 (0) 732 6989 75607
office@k1-met.com
www.k1-met.com

Project partner

- voestalpine Stahl GmbH, AT
- voestalpine Stahl Donawitz GmbH, AT
- Primetals Technologies Austria GmbH, AT
- RHI Magnesita GmbH, AT
- Technical University of Leoben, AT

This success story was provided by the centre management and by the mentioned project partners for the purpose of being published. K1-MET is a COMET Centre within the COMET – Competence Centers for Excellent Technologies Programme and funded by BMIMI, BMWET, Upper Austria, Styria and Tyrol. The COMET Programme is managed by FFG. Further information on COMET: www.ffg.at/comet