13th K1-MET Scientific Exchange Day

3 – 4 April 2024, voestalpine Stahlwelt, First Floor,
voestalpine-Strasse 4, 4020 Linz, in the neighbouring building BG 44

Main goal of the Scientific Exchange Day (SED) is to present current research activities and results of K1-MET and its partner network. Furthermore, the SED represents an opportunity to stimulate the interactions between the scientific and the company partners of K1-MET with plenty of time for discussions.

3 April 2024 Keynote and get together

17.00 – 17.30	Keynote: Prof. Michael Harasek (TU Wien) "Green hydrogen for industry – Transport, storage, and upgrading"
17.30 – 19.00	Get together 13th K1-MET Scientific Exchange Day

Abstract Keynote: Michael Harasek

"Green hydrogen for industry – transport, storage, and upgrading"

Future transition to large scale use of renewable hydrogen requires storage, transport, and upgrading infrastructure to meet quality and capacity needs for industrial applications. Recent achievements, technological developments, and current research along the hydrogen supply chain will be presented in this talk.

4 April 2024 13th Scientific Exchange Day

10.00 – 10.30	Come together, Registration
10.45 – 10.55	Welcome and Introduction (CSO Prof. Susanne Michelic)

Success Stories COMET and Non-COMET

Moderator: Prof. Susanne Michelic
(Maximum time target: 15 min presentation, 5 min discussion)

11.00 – 11.20	Success Story Area 1: DI Dr. Alexander Halwax (K1-MET) "Measurement of diffusion and activity coefficients in slags"
11.20 – 11.40	Success Story Area 2: DI Bernhard Adami (K1-MET) "Hydrogen plasma smelting revolution: Implementation of pre-reduction, pre-heating, and dust treatment for a cleaner, greener future"

Financially supported and coordinated by

11.40 – 12.00	Success Story Area 3: DI Maria Thumfart (K1-MET) "Making Ruhrstahl-Heraeus degassing fit for green steel production: a multi-method approach to process monitoring"
12.00 – 12.20	COMET Module FuLIBatteR: DI Dr. Sabine Spiess (K1-MET) "Biohydrometallurgical technologies to recover metals from spent Lithium-Ion batteries"
12.20 – 12.40	Coffee break with refreshments

Podium discussion

Moderator: MMag. Elisabeth Eidenberger

12.45 – 13.45	"Low-carbon steelmaking from low-quality raw materials to high-quality products"
Panel participants	Assistant Prof. Dr. Ing. Valentina Colla (Scuola Superiore Sant'Anna) DI Dr. Josephine Mueller (voestalpine High Performance Metals GmbH) DI Gernot Hackl (RHI Magnesita GmbH) Prof. Stefan Pirker (Johannes Kepler University Linz) DI Bernhard Voraberger (Primetals Technologies Austria GmbH)
13.45 – 13.55	Closing words (CSO Prof. Susanne Michelic)
From 14.00	Lunch and end of 13th K1-MET Scientific Exchange Day

Abstract Success stories

Research Area 1: Alexander Halwax (K1-MET)

"Measurement of diffusion and activity coefficients in slags"

Slag properties, such as viscosity, density, liquidus temperature, oxidation potential, foaming behavior, etc., have a significant influence on the efficiency of metallurgical processes and are largely defined by the slag composition. The slag composition is adjusted by the addition of usually CaO- and/or MgO-containing additives. Knowledge of diffusion coefficients of the respective oxide in slags is necessary to describe dissolution processes of additives in slags and therefore to optimize existing processes or develop new ones. Furthermore, the knowledge of thermodynamic activities of individual slag components is of great interest for understanding and optimizing metallurgical processes. The determination of these two parameters (diffusion coefficient and activity) in slags was the objective of this work.

Financially supported and coordinated by

Research Area 2: Bernhard Adami (K1-MET)

"Hydrogen plasma smelting revolution: Implementation of pre-reduction, pre-heating, and dust treatment for a cleaner, greener future"

The hydrogen plasma smelting reduction process has the potential to produce carbon-neutral steel in a single step process, thereby replacing the blast furnace, the basic oxygen furnace as well as the sinter and coking plant. A demonstration plant already exists at the site of voestalpine Stahl Donawitz GmbH in Leoben and is operated by K1-MET GmbH. To proof the economic feasibility of the process, the transformation of the current batch-wise operation into a fully continuous one is necessary. Therefore, a pre-reduction and pre-heating step should be integrated to increase the hydrogen utilization in the off-gas and lower the energy consumption as well as the refractory wear due to lower residence times of the pre-reduced ore in the plasma vessel. For the design of a pre-reduction and pre-heating reactor, the quantity as well as the physical and chemical properties of the off-gas dust are of uttermost importance. Therefore, a system for sampling this dust under varying process conditions is implemented at the demonstration plant. Furthermore, a system for studying the reduction characteristics of pre-reduced and hot-charged iron ores on a laboratory basis is constructed at the Montanuniversitaet Leoben.

Research Area 3: Maria Thumfart (K1-MET)

"Making Ruhrstahl-Heraeus degassing fit for green steel production: a multi-method approach to process monitoring"

In the upcoming years, the steel industry faces major challenges due to the demands of CO_2 reduction and a shift towards enhanced circular economy. These developments lead to a larger diversity in crude steel compositions and thus to increased throughput for secondary metallurgy including the Ruhrstahl-Heraeus (RH) degassing plant. To meet these increased demands, the accuracy and level of detail of the process monitoring at the RH plant needs to be improved. In Project 3.4 (and with a link to OpTwinFlow, Non-COMET Austrian funded project), this challenge is met with a large variety of methods. This comprises basics, like measurement error estimation as well as sophisticated data and image evaluation. The developments range from analytical flow models to a process linked recurrence CFD (rCFD) model to obtain real-time information on the process state.

COMET Module FuLIBatteR: Sabine Spiess (K1-MET)

"Biohydrometallurgical technologies to recover metals from spent lithium-ion batteries"

Spent Lithium-Ion batteries contain substantial amounts of critical raw materials, such as Copper (Co), Lithium (Li), Manganese (Mn), and Nickel (Ni), but up to now no efficient and encompassing recycling strategy exist. Biohydrometallurgy could provide an economic and environmentally friendly technology to recover metals from the battery black mass. In a first step, metals get solubilized from the solid material using microorganisms by a process called bioleaching. Applying direct bioleaching, high leaching efficiencies of up to 100 % of Li, Co, Ni and Mn were achieved using 1 % black mass pulp density. Furthermore, novel technologies to recover the solubilized metals, such as bioelectrochemistry, biosorption, and metal-binding peptides are investigated.

Financially supported and coordinated by