Contribution ID: **327** Type: **Oral Presentation**

Predicting the Reduction Kinetics of the Electric Arc Furnace Dust - A Machine Learning Approach

Tuesday 7 October 2025 14:50 (20 minutes)

The recovery of zinc from electric arc furnace dust is primarily carried out in the Waelz process. However, the reaction kinetics within the kiln remain largely unknown as direct measurements or sampling within the kiln are not possible. This lack of insight hinders a comprehensive understanding of the processes and prevents precise optimization of the kiln´s operation conditions.
This work aims to develop a predictive model for the reaction kinetics of electric arc furnace dust in a carbon- and hydrogen-based reduction system. Due to the numerous influencing factors and the complexity of the reactions, thermodynamically modelling the kinetics is mathematically challenging. To overcome this, a machine learning algorithm was employed to model the impact of various input parameters.
The machine learning model was trained using experimental data obtained from thermogravimetric analysis, where specific gas and temperature profiles were applied. These profiles included hydrogen and carbon monoxide as reducing agents. The gas and temperature profiles were systematically varied to aligned to conditions that are typically expected inside the Waelz kiln.
The developed model can be integrated into computational fluid and finite element method simulations to provide, for the first time, a reaction-based representation of the Waelz process using real experimental data. This approach offers a novel pathway for optimizing kiln operation and improving process efficiency.

Primary author: KEUSCHNIG, Aaron (Montanuniversität Leoben)

Co-author: Dr LEUCHTENMÜLLER, Manuel (Montanuniversität Leoben)

Presenter: KEUSCHNIG, Aaron (Montanuniversität Leoben)

Session Classification: Waste Processing & Byproduct Utilization

Track Classification: Environmental and energy aspects in iron and steelmaking