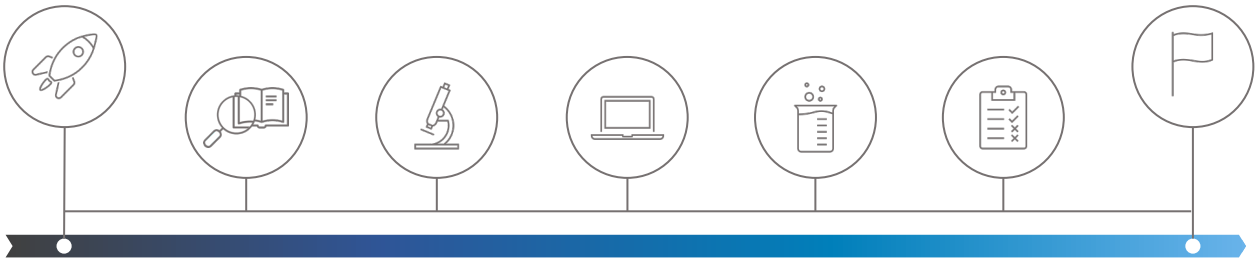
Hydro Stäube

Hydrometallurgische Rückführung von versorgungskritischen Metallen aus Stäuben der Eisen- und Stahlindustrie

Hydrometallurgical recovery of supply-critical metals from dusts of the iron and steel industry



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MOTIVATION

The production of steel generates 10–70 kg dust per ton of steel produced at exhaust gas systems of various processes. Based on the input materials (steel scrap, alloying agents), this dust contains numerous valuable metals, including iron, chromium, nickel, vanadium, tungsten, and zinc representing valuable secondary raw materials. The recycling of steelmaking dust is primarily focused on the recovery of the zinc, which is contained in high quantities; the recovery of the other valuable metals accounts a smaller interest and was mostly neglected in the past. At present, expensive landfilling of the dusts with an iron content of approx. 25% takes place. The valuable materials contained are thus withdrawn from the value chain.

To return metals contained in the scrap materials to the supply chain in terms of circular economy, sustainable processes are required to be climate neutral, resource-saving and energy-efficient. Most dusts from metal production undergo pyrometallurgical treatment in high-temperature processes. In general, these involve the addition of carbon carriers and hence contribute to CO_2 emissions. The current research project HydroStäube will analyze various hydrometallurgical leaching steps or combinations thereof for the treatment of steel mill dusts. Subsequently, the method should also allow the recovery of other dusty residues produced in steel mill processes which currently lack a specific treatment process.

OBJECTIVES

The recycling of steel mill dusts is currently focused on the recovery of zinc and does not consider all other valuable metals. In this project, the investigation of iron hydrolysis as well as alternative precipitation methods and the associated distribution of targeted elements in different sub-fractions is planned. Assessment of valuable metal recovery is accomplished, either by recovering them separately leaving the iron content of the dusts in the residue fraction, or by producing a ferroalloy depending on the valuable metal content.

EXPECTED RESULTS

In this project, a hydrometallurgical process will be developed for the recycling and recovery of the metals contained in the dust. It focuses on the critical elements nickel, chromium, vanadium and tungsten, as well as zinc and iron. In addition, the process should ultimately be applicable to other dusty residues produced in steelworks processes which currently cannot be fed into a dedicated sustainable recycling system. The expected results of the project are as follows:

- Recovery of the valuable metals
- Energy consumption rates of the new process should be considerably lower than those of the established processes
- Lower CO_2 emissions due to elimination of carbon-based reducing agents
- Avoidance of landfilling scrap and by-products

INVOLVED PARTNERS

The **Montanuniversität Leoben** (MUL) founded in 1840 has its core competence centered around the cycle of product genesis, ranging from the exploration and extraction of raw materials, to their processing, material and product design, process and energy technologies, industrial environmental protection, as well as the recycling in order to introduce them into the value life cycle as secondary raw materials again and thus closing loops and reducing environmental impacts. The university has 13 departments subdivided in numerous chairs, one of them being the Chair of Nonferrous Metallurgy.

The **Chair of Nonferrous Metallurgy** is the only university research institution in Austria working in this field. The focus lies on basemetals, such as Al, Cu, Zn, Pb, Mg and Sn, but also precious, refractory, special metals (technology metals) and ferroalloys.

K1-MET GmbH is a competence centre for metallurgical and environmental process developments and conducts research on sustainable digitalised metallurgical processes for a climate-neutral and resource-efficient society with the focus on the iron and steel industry. The scientific orientation concentrates on enhancing process efficiency and product quality through analytics and the processing of raw and secondary materials. Regarding decarbonisation and sector coupling as second research area, solutions are developed for low-CO_2 metallurgical processes and for sector coupling (CO_2 from metallurgical processes as source for energy-intensive industries. The third research area applies modelling approaches to existing and new technologies to improve process knowledge and to increase process efficiency via combination with data analysis methods.

voestalpine is a leading global steel and technology group with expertise in materials and processing. The globally active concern of companies has around 500 Group companies and locations in more than 50 countries on all five continents. With its high-quality product and system solutions made of steel and other metals, it is one of the leading partners of the European automotive and household appliance industries as well as of the oil and gas industry worldwide. voestalpine is also the world market leader in turnout technology and in the special rail sector, as well as in tool steel and special profiles.

ANDRITZ is an Austrian mechanical and plant engineering concern with more than 250 production sites and service and sales companies worldwide. The group is a globally leading supplier of plants, equipment, and services for hydropower stations, the pulp and paper industry, the metalworking and steel industries, and for solid/liquid separation in the municipal and industrial sectors. In addition, ANDRITZ offers technologies for certain other sectors including automation, the production of animal feed and biomass pellets, pumps, machinery for nonwovens, steam boiler plants, biomass boilers and gasification plants for energy generation, flue gas cleaning plants, plants for the production of panelboards (MDF) and thermal sludge utilization.

This project is funded by the province of Styria
(Zukunftsfonds Steiermark) (funding contract PN 1506).