HELMHOLTZ-INSTITUT FREIBERG
FÜR RESSOURCENTECHNOLOGIE

Pilot-Scale Vanadium Recovery Campaign successful at HIF, HZDR

In our ongoing effort to develop sustainable extraction processes, process metallurgy team at HIF successfully conducted a pilot-scale vanadium recovery campaign using our in-house **100 L leaching reactor**. The process targeted **LD slag**, a steelmaking by-product rich in valuable elements.

Over the course of the campaign, we processed **30 kg of LD slag** in three batch operations. Each batch involved leaching **10 kg of slag** with **80 liters** of lexiviants in optimized conditions. The leaching process yielded **pregnant leach solution (PLS)** containing approximately **2 g/L of vanadium**, achieving an impressive **vanadium extraction efficiency of nearly 80%**. This confirms the effectiveness of our process on one of the largest demonstration scales in the EU at the moment. This solution feed will be used to recover V in next steps.

As a secondary outcome, each batch also produced **10 kg of gypsum ($CaSO_4 2H_2O$)** as a by-product. This gypsum was thermally treated to convert it into **hemihydrate ($CaSO_4 \cdot 0.5H_2O$)**, reducing the overall mass to approximately **26 kg** due to water loss—an important step toward value-added utilization in construction application.

In this way our LiDoVa research demonstrated circular economy process for the battery materials (V) and sustainable construction materials i.e. gypsum in decontaminated form. It is important to note that partners Nickelhütte Aue and University of Technology Chemnitz (TUC) are helping these developments.

Picture: Left to right: Large scale leaching of LD slag on 100 L scale; automated filtration of leachate containing valuable V; decontaminated residue for construction applications

Future Outlook:

Simultaneously, our team (HIF) is initiating in-house research on vanadium-selective recovery from the PLS. The upcoming phase will employ solvent extraction using a mixer-settler system

to isolate and purify vanadium, targeting the production of high-grade vanadium concentrate solutions suitable for advanced applications.

Looking ahead, our project partner (TUC) are actively exploring the use of the hemihydrate gypsum in the development of alkali-activated binders, aiming to create sustainable construction materials from industrial residues.

These integrated approaches not only enhance resource recovery from waste but also align with circular economy principles and green chemistry goals.

Contacts:

Dr. Norman Kelly, n.kelly@hzdr.de

Mr. Lakshmikanth Viswamsetty, l.viswamsetty@hzdr.de

Adj. Prof. Dr. Ajay B. Patil, a.patil@hzdr.de