

Z2 – Development of a continuous process chain for mechanical separation of EnAM from solidified metal slags

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Overview

Cell phones, laptops or solar cells are becoming more and more important in the last decades and it is hard to imagine today's life without them. Crucial components of such electronic devices are rare elements and technology metals. To meet their demand in the coming years, recycling processes, especially pyrometallurgical ones, are steadily gaining in significance. In this context, a slag with a high proportion of metal oxides and sulfides is produced as a waste stream. A subsequent crystallization step enables the generation of so-called EnAMs (Engineered Artificial Minerals) from it, which in turn can be recovered mechanically and reused in recycled form.

The focus of subproject Z2 is on the development of a process chain for the selective recovery of these EnAMs. Initially, the wet comminution of the solidified slag by an agitated ball mill is envisaged. Thereafter, the crystals are present as primary particles suspended in water and will be separated selectively from each other by a continuous two-phase flotation ("solvent sublation"). The various surface charges of the particles at different pH values are utilized in this process. The fractionated EnAM crystals reside in a solvent are then filtered and washed with the aid of a belt filter. The final step is drying of the formed filter cake. In addition to demonstrating the basic feasibility, the project is also dealing with the selection and integration of suitable (online) measurement technology and the modularization of the overall process. The latter ensures high flexibility and allows rapid adaptation to changing process conditions or changing stock systems. A schematic of the planned process chain is shown in Figure 1.

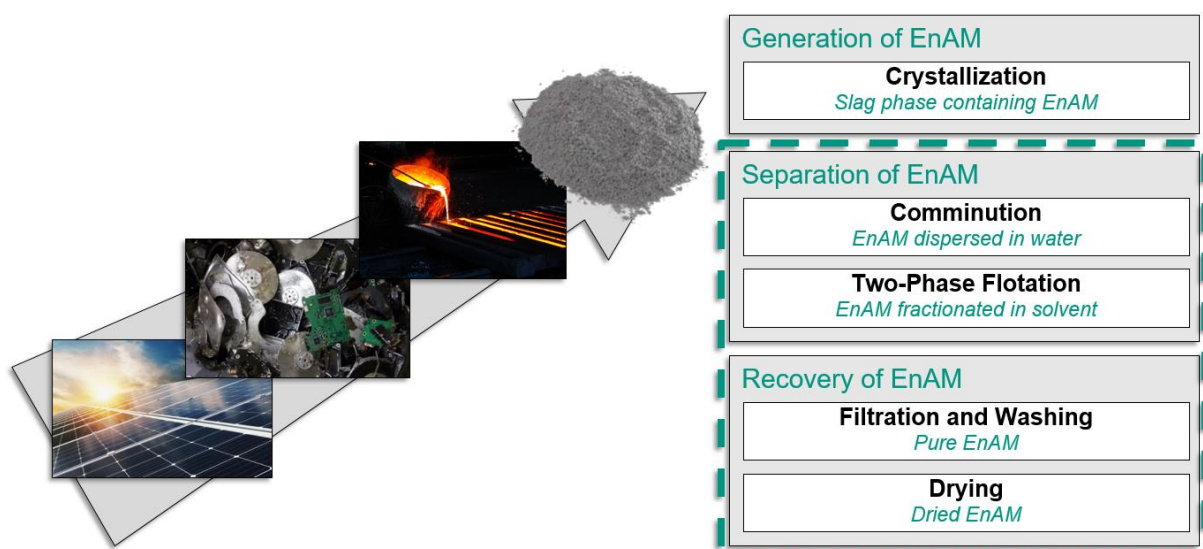


Figure 1: Process chain to recycle rare elements and technology metals. The focus of the subproject Z2 is on comminution, two-phase flotation as well as filtration, washing and drying.

Particle system

Defined mixtures of indium and gallium oxide along with silicon dioxide are initially used to demonstrate the basic functionality of the concept. This is followed by tests with real EnAM metal slags.

Characterization

Particles

Relevant properties of the initially present primary particles are their size and their surface charge. Among other things, laser diffraction and zeta potential measurements serve to obtain these characteristics.

Overall process

Important factors to evaluate the overall process are the separation efficiency and the selectivity. These parameters are detected by UV-vis spectroscopy and X-ray scattering. In addition, the usage of a refractometer is conceivable to assess the washing quality.