C5: Single particle analysis for predictive EnAM processing (SPA-4-EnAM)

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Overview

To establish a sustainable circular economy and to decrease our dependence on primary raw materials, recycling is essential. High-Technology products usually contain some concentration of diverse valuable raw materials and with current recycling processes these valuable elements are not fully recovered and thus lost in the waste stream (e.g., Slag produced during pyrometallurgical recycling). These slag systems can be tailored to produce known mineral phases (Engineered artificial Minerals - EnAM) containing valuable elements, eventually enabling us to treat them as a primary raw material resource. Thus, applying mineral processing operations should enable us to concentrate the valuable EnAM from the rest of the gangue phases.

The separation of particle systems into two or more products with different properties or compositions requires a difference in the characteristics of particles to be separated, e.g. size shape, morphology, density, and magnetic susceptibility. These particle properties will be investigated by using X-ray micro-computed tomography, automated mineralogy (MLA), X-ray diffraction (XRD), and magnetic susceptibility balance (MSB). These individual particle properties will then be utilized to optimize the separation process with the help of multidimensional partition maps and particle-based statistical modeling of mechanical processing operations.

Objectives and goals

The overarching goal of the project is to unleash the potential of using the full 3D properties of individual particles to describe and predict EnAM behavior during mechanical separation. This can be broken down into several individual goals:

1. To develop the first semi-automated standardized method to measure the 3D properties of large numbers (statistically representative) of individual particles (WP1).
2. To analyze statistically the link between particle 3D properties in feed, tailings, and concentrate for magnetic separation and density separation (WP2 and WP3).
3. To predict the separation of EnAM based on individual particle 3D properties (WP4)
4. To advise SPP partners on the ideal properties of EnAM crystals and EnAM carrying particles in order to improve separation using the most promising processing techniques and slag design systems (WP5)

The individual WPs and the connection between them are summarized in Figure 1 below.

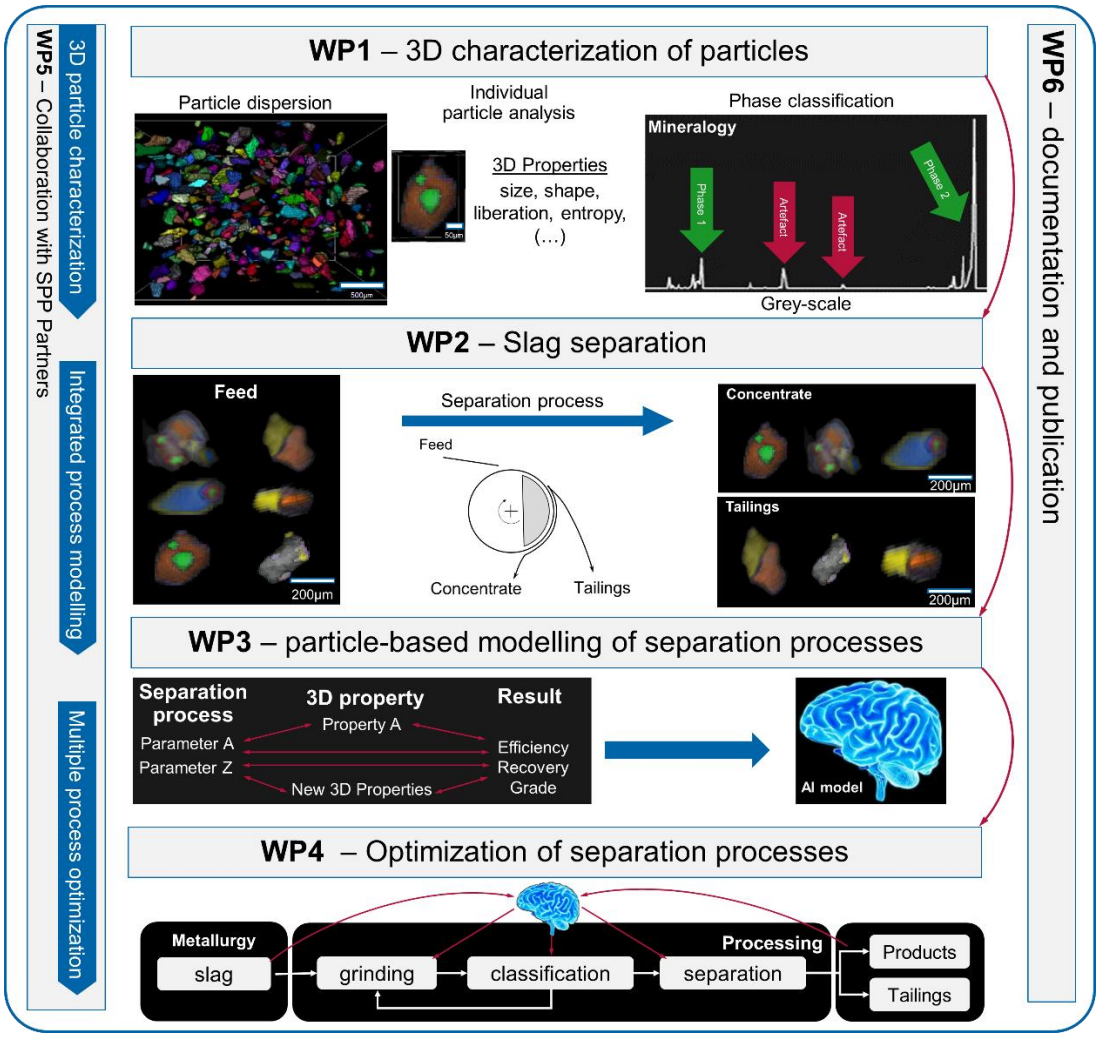

Figure 1: Schematic of the project workflow for the predictive processing of EnAMs.