C15 - The Interaction of Stress conditions, Engineered Artificial Minerals Structure and Formulation in Wet Comminution and Separation

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Overview

SPP 2315 EnAM addresses the slag phase of metallurgical recycling processes as a significant basis for critical elements. Aspects of crystallization, thermodynamic modelling and further mechanical processing, i.e. comminution and separation, are investigated. For this purpose, project C15 deals with selective comminution by means of stirred media mills, as it is possible to control the liberation of a valuable component by controlling the grinding conditions. This should be realized by either selective grinding or selective separating the of the liberated valuable component- by enriching it in a desired particle size fraction or by adjusting the surface area. The lithium slag originated by the service project Z01 is used as slag. Accordingly, for the investigations on the individual model materials, material systems are to be selected which will be the main constituents of these slags. To examine the grinding and the corresponding breakage, liberation and chemical phase transformation mechanisms within the scope of pegmatitic composite particles the valuable component lithium aluminate was chosen as a model material. Lithium aluminium or aluminate compounds are typical lithium phases in pyrometallurgical processed slags [1] as well as an important hard rock mineral resource for lithium extraction [2]. In engineered artificial minerals or slags this lithium phase often occurs in paragnesis with quartz and alumina. Therefore, both materials are chosen additionally as model tailing materials (s. figure 1).
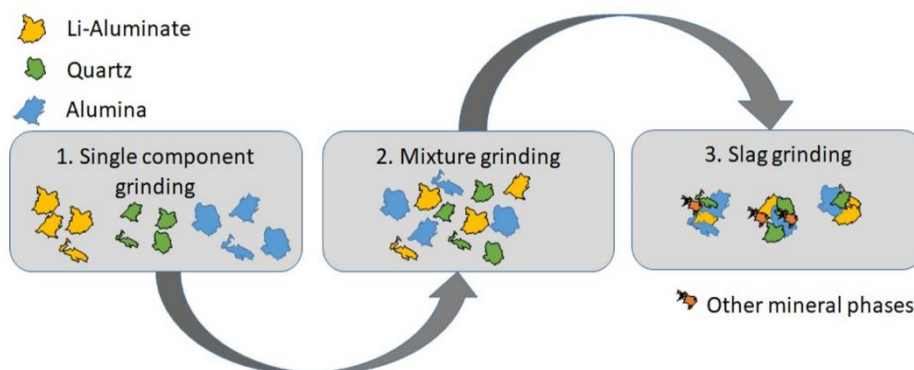

Figure 1: Schematic diagram for the selective grinding of mixtures of the model materials used.

Working programme

The project is divided into four working packages, which are described in detail below (s. Figure 2). The first work package (WP1) deals with the characterization of the model materials. After conditioning of the starting material to 300 - 700 µm by sieving and dry milling, the material is analysed with respect to zeta potential, composition, solubility, crystallinity and particle breakage. After the characterization of the materials, the next step (WP2) is the grinding of individual components, mixtures and artificial slags. For this purpose, the grinding of model materials and mixtures [3], selective component analysis of ground slags by wet sieving and density separation [4] should be carried out as a first step. Subsequently, the suitable grinding conditions should be transferred to real EnAM slags [3], [5]. Once the previous steps are done,

the enrichment of $LiAlO_2$ can be addressed by targeted separation (WP3). Taking into account surface properties, particle size and density, separation of $LiAlO_2$ from slurries should be achieved. The methods used for this are wet screening (> 100 μm), rotating single-shaft disc filter and flotation. As the last work package (WP4), the Li-rich slag phases are activated mechanochemically. The appropriate adjustments of milling conditions, crystal phase and pH are to be investigated. A selective extraction of $LiAlO_2$ is to be carried out by amorphizing the ground particles. Increased solubility allows extraction under milder acid/base conditions.

Figure 2: Schematic representation of the work packages for project C15.

References

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