Mineral Density Fractionation of Bauxite Residues for Enhanced Recovery of REE and other Metals

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The extraction of critical materials, including rare-earth elements (REEs), from secondary sources has been gaining more attention in recent years due to their rising demand. Bauxite residues are considered a potential source of REE, however, their complex chemistry and high buffering capacity, makes it challenging to achieve high rates of recovery of REEs, and requires large amounts of acid for leaching. Current and past leaching studies showed lack of consensus on the optimal reaction conditions for release of REEs from different bauxite residue sources. In this study, a method was developed for reducing the alkalinity of bauxite residues through density separation of alkaline solids, such as carbonates and aluminosilicates, by heavy liquid extraction. Density separation of bauxite residues was followed by X-ray powder diffraction (XRD) analysis verifying the major mineral phases. The effect of leaching conditions such as type of acid used, acid concentration, solid-liquid ratio, and leaching time on the extraction rates of REEs are determined for both light and heavy bauxite residues fractions. The results of the analysis are compared to other studies in literature to help improve the understanding of the effect leaching conditions and composition have on the release of REEs. Leaching at various pH indicate high release of vanadium at alkaline pH and release of REEs and actinides at acidic pH.