

Extraction behavior of REEs compared on four different Bauxite Residues

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In this study Bauxite Residues from four different European alumina refineries (located in Greece, Romania, Ireland and Germany) are subjected into dissolution tests in order to investigate their behavior in the extraction of the REEs (Sc, Y, La, Nd, Ce) compared with main BR's metals such as Fe, Al, Ti, Si. The selected leaching conditions are based in three different systems, using either sulfuric acid or the Ionic Liquid [Hbet][Tf2N] as leaching agents. In the case of sulfuric acid, three different parameters (molarity, pulp density and temperature) were studied for both intensive and mild leaching conditions. The intensive conditions were selected in order to achieve the maximum REEs, and especially Sc, extraction while avoiding the silica gel formation but resulted also in high co-dissolution of metals like Fe, Ti and Al from the BRs. Mild conditions were applied in order to achieve REEs leaching selectivity against Fe, Ti and Al, however such conditions favor also high silica dissolution and could lead to silica gel formation over time. The Ionic Liquid case is comparable with the mild sulfuric acid leaching as it presents high leaching selectivity of REEs against Fe, but also avoids silica gel formation as it does not dissolve Si. The results for the 4 different BRs leached under the 3 different cases are compared based on the leaching efficiencies achieved, the PLS concentration produced and the mineralogical analysis of the residues after leaching. Fe leaching follows similar trend in all 4 BRs for each corresponding leaching system, but the same is not true for Al and Ti. Al in the Romanian and Irish BR dissolves more readily in each leaching system. Likewise, Ti from the Greek BR is leached at higher yields than in the other 3 BRs. At the IL's and mild sulfuric acid leaching conditions, REEs are extracted at higher yields in the Greek BR. La can be leached in higher levels in the German BR (70%) and Sc in the Irish BR (70%), but with simultaneous high Fe and Al co-dissolution for the intensive leaching conditions with sulfuric acid. However, only in the case of the Greek BR can similar leaching yields be reached in the other two leaching systems.