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Magnetic Separation and Leaching Study of Rare Earth Elements from Apatite-Iron Ore

Ariuntuya BATTSENGEL[1], Altansukh BATNASAN[2], Kazutoshi HAGA[1], Yasushi WATANABE[2] and Atsushi SHIBAYAMA[2]

[1]Graduate School of Engineering and Resource Sciences, Akita University, Akita 010-8502, Japan
[2]Graduate School of International Resource Sciences Akita University, Akita 010-8502, Japan
E-mail:d9515002@s.akita-u.ac.jp

Recovery of rare earth elements from apatite during phosphoric acid production based on nitric acid and sulphuric acid digestion is the most common treatment process for the industries. By the reaction of phosphate rock with sulphuric acid, the most of rare earth elements (REEs) are lost into the phosphogypsum and a remainder of the REEs in the sludge is dissolved partially by nitric acid solution. Whereas the REE-phosphate minerals are dissolved about 50-60% in nitric acid at 70° C. Development of REEs leaching technique with high recovery is still essential to reduce processing steps, energy consumption and emission of toxic gasses during the processing. The objective of this paper is to investigate the efficient condition for leaching of REEs from apatite-iron ore sample using magnetic separation and leaching with sulphuric acid solution. Ore sample contains major oxides as dominant 30.4 wt.% of calcium oxide (CaO), 28.0 wt.% of total iron oxides (TFexOy), 8.40 wt.% of silicon dioxide (SiO_2) and 10.96 wt.% of total rare earth oxides (TREO). Lanthanum, cerium, praseodymium and neodymium consist about 95% of the total rare earth elements (TREEs) in the ore. A wet high-intensity magnetic separator was used to remove iron bearing minerals. As results, 71% of iron was separated into the magnetic fraction from the iron rich apatite sample, while 92% of REEs were remained in the non-magnetic fraction. Then non-magnetic fraction was decomposed by dilute sulphuric acid solution. Analysis of leaching experiments indicated that more than 85% of REEs were dissolved into the leach solution.

Keywords : Rare earth elements, apatite-iron ore, magnetic separation and leaching