Abstract

ETI Aluminyum A.S has its own bauxite mines, and has been extracting from two mines out of five to feed its alumina refinery since the 1970's. The refinery was designed to process boehmitic bauxite with a reasonable A/S (Al$_2$O$_3$/SiO$_2$, w/w) ratio of 8.2. Over the years, bauxite quality has decreased and current reserves show an average A/S ratio of 7.0. On the other hand, the characterization studies for the other three mines, which ETI will exploit in a few years, indicate that diasporic and goethite content of these bauxites are significantly higher than current ones. In these circumstances, ETI needs to prepare for bauxite quality changes which can adversely affect operating cost and product quality. The first and most interesting option for examination is lime utilisation, and ETI has focused on studying lime addition in laboratory and plant trials. In the study discussed in this paper, the impacts of lime addition on boehmite/diaspore solubility, goethite conversion, titanium behavior, caustic soda consumption, as well as red mud settling properties and product quality, have been investigated. It has been observed that both the lime dosing point and quantity play an important role on desired process result.

Keywords: Boehmitic Bauxite; Soda Consumption; Lime Addition; Digestion.

1. Introduction

Due to its economics, the Bayer process is still the preferred and most used process globally for producing alumina. Bauxite is the main feedstock of Bayer process. Progressive bauxite quality deterioration is one of the main challenges to the alumina industry. Bauxite mineralogy affects process efficiency through the chemical reactions in the process. Alumina to silica mass ratio (A/S), along with total available alumina and reactive silica contents are the amongst the most economically important parameters describing bauxite quality.

Operating cost was discussed for varying A/S ratios on diasporic bauxite by Z. Baiyong and L. Xinqin [1] and it was found that 8.0 was an inflection point for economic Bayer process application. An A/S ratio lower than 7.0 was considered to be low grade bauxite. L. Zhijian et al. [2], recommends lime addition to the Bayer process when processing low grade bauxite which has an A/S higher than 5.0 and the Sinter process for A/S ratios lower than 5.0.

Lime is widely used in the Bayer process for different purposes and in different forms. Digestion, side stream causticisation and filter aid are the main applications stated by L.A.D. Chin [3]. Digestion lime charge by adding burnt lime (or milk of lime) to the bauxite, bauxite slurry or feeding it directly to one of the digesters are also common uses. The proper selection of the feeding point(s) for digestion lime charge has very high importance [4]. Lime is effective