MECHANOCHEMICAL ACTIVATION OF KAOLINITE TO MANIPULATE THE DISSOLUTION KINETICS OF THE SOLID

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Abstract

The well-established Bayer process is the primary means of alumina production from bauxite; however, it generates more than 2.7 billion tons of bauxite residue (commonly called red mud) annually [1]. This quantity can be reduced by applying the so-called desilication step before the extraction of alumina at high temperature. This is a commonly used method when the bauxite ore contains high concentrations of silica. Bauxites contain silica in various forms, some of them are rather reactive and are capable of dissolving under typical Bayer digestion conditions, causing major caustic and alumina losses, scale formation in the pipes and exerting unfavorable effect on the quality of the final product. Our main goal was to contribute to the control of these processes by investigating the chemical events that take place during desilication.

Kaolinite is the main reactive silica containing clay mineral in bauxite. During desilication, it transforms into mixed sodalite (that is, different anions present in the product), called DSP (desilication product) [2]. In order to gain more information about the dissolution of the kaolinites and the subsequent formation of DSP in these systems, a suitable apparatus was designed, and the processes were investigated under conditions largely mimicking the industrial ones (using sodium aluminate solution with specific concentrations of the spent liquor and carrying out experiments at 95°C). To identify the key parameters responsible for the kinetics of the dissolution, the raw kaolinite was ground to change the characteristics of the starting material, hence affecting the dissolution rate [3]. The concentration of the Si(IV) during the dissolution-DSP formation process was monitored with ICP-OES, and the starting and final materials were characterized by a variety of experimental techniques.

References

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