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Study of the conditions for maximum extraction of alumina from mudstone of the Volchansk deposit

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Abstract

Alumina is widely used in industry. Due to the limited resource base – deposits of high-quality bauxite, which are processed by an alkaline method, and the presence of significant reserves of substandard raw materials (nepheline, alunite, as well as high-siliceous bauxite), the possibility of their processing to obtain Al₂O₃ by the acid method is being considered. The object of research is the mudstone of the Volchansk deposit, which is a waste product from coal mining and substandard high-siliceous alumina-containing raw materials. The study of the composition of mudstone was carried out by methods of chemical, IR spectroscopic and X-ray phase analyzes. This raw material contains the following main components, wt. %: SiO₂ – 52.60; Al₂O₃ – 23.31; Fe₂O₃ – 7.30. According to the data of X-ray phase analysis, the composition of mudstone includes α-quartz, sillimanite, kaolinite, albite, halloysite, nontronite. The work is devoted to the study of the conditions of nitric acid leaching of mudstone for further production of alumina. The equations for the reactions causing the transition of acid-soluble components to the liquid phase are given. The use of nitric acid for drilling mudstone is motivated by the possibility of regeneration of the leaching agent during thermal hydrolysis of aluminum nitrate. The low yield of aluminum up to 35% in the leaching of uncalcined raw materials and the presence of thermally unstable components in the composition necessitated preliminary preparation of the raw materials - calcination. Thermogravimetric analysis made it possible to determine the calcination temperature (650-

750 °C), leading to a change in the phase composition, confirmed by X-ray phase and IR spectroscopic methods of analysis. The optimal conditions have been determined: the concentration of acid (30-40%) taken in an amount of 90-100% of the stoichiometry, the leaching duration is 3 hours. The established opening mode made it possible to increase the aluminum yield into the solution up to 80%.

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