

PROCESSING OF RUTILE CONCENTRATES BY FLUORINATION

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ABSTRACT

The present paper substantiates the necessity of developing a new technology for processing titanium-containing concentrates. It describes a thermodynamic study of the process of rutile concentrate fluorination by elemental fluorine using “ASTRA” software. The study has shown that from a thermodynamic point of view, the process has no limitations. The article contains the description of the kinetic features of the process and their mathematical processing. It has been established that the process is limited by diffusion factors supply of a fluorinating reagent to the surface of a solid material. The article contains a brief overview of industrial technologies for producing titanium powders. The study substantiates the necessity of developing a fundamentally new fluoride technology for producing titanium powders from low-temperature fluoride melts. The authors describe a method for the preparation of fluoride melts using the process of hydro fluorination of lithium and sodium fluorides with anhydrous hydrogen fluoride obtained during the decomposition of potassium hydrogen fluoride. The article describes the processes occurring during the electrolytic production of titanium powders from fluoride melts using titanium tetra fluoride as a reagent. Since the potential of titanium extraction is much less than similar values of fluoride eutectic potential of fluoride salts, the process of titanium extraction proceeds with high efficiency. The paper describes the design of a laboratory unit for carrying out the electrolysis process and the sequence of operations for obtaining cathode deposit. The dependence of the effect of the cathode conductance on the titanium yield is investigated and the optimal conditions for electrolysis are selected. The paper presents the experimental results of electrolytic production of titanium and it shows that the cathode efficiency is not less than 93%. Two technologies are proposed for washing off the impurities from a titanium-containing cathode deposit washing off in a mixture of inorganic acids and anhydrous HF; the advantages of HF washing are shown; the content of impurities in the titanium powder obtained by washing in anhydrous HF is slightly lower than in the case of the “acidic” washing. This is due to the dissolution of these impurities in anhydrous HF during washing. In the industrial implementation of the washing of the cathode deposit in anhydrous HF, this reagent is recycled in the scheme, which ensures the environmental safety of production and low cost of the obtained titanium powder.

KEYWORDS: Rutile Concentrate, Fluorination, Titanium Dioxide, Titanium Tetra fluoride, Electrolysis

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