Industrial Trials Results of Scandium Oxide Recovery from Red Mud at UC RUSAL Alumina Refineries

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Abstract

UC RUSAL pioneered the development of technology to extract scandium oxide from red mud with a pilot plant arranged at one of the company alumina refineries. Pilot production comprises of a site of scandium concentrate production and a site of scandium oxide production. In the paper, the results of industrial trial of scandium oxide production process from red mud are given, in particular: processes of scandium concentrate production and its re-cleaning yielding a commercial product – scandium oxide. In the course of industrial trials, pilot batches of scandium oxide with scandium content 99.9 % were obtained. From the pilot batch of scandium oxide aluminium-scandium master alloy was produced corresponding to the requirements of GOST R 53777-2010 for master alloy of AlSc2 (A). The developed process, which was implemented at pilot scale is competitive and can be easily integrated into the alumina production. This process does not yield acidic or toxic effluents and provides competitive production cost of scandium oxide

Keywords: red mud, scandium oxide production.

1. Introduction

In recent years, there has been a trend of increasing the demand for scandium oxide and scandium-containing materials. According to [1], in 2017 the scandium oxide market was estimated at 16.3 t/year, and in 2018 it was estimated at 18.9 t/year. By 2028, the demand for scandium is forecast to increase up to 300 t/year in terms of scandium oxide due to its wider application in such industries as shipbuilding, aerospace, aircraft engineering, 3D printing and others [1].

Currently, scandium is mostly produced in China from solutions resulted from the processing of ilmenite concentrates at titanium dioxide production sites and from industrial solutions at zirconium production sites. At the same time, it is known that most of the world's scandium volume is contained in bauxite and its process waste, which is red mud (RM) [2]. It is only the RUSAL alumina refineries located in Russia that annually produce over 2 million tonnes of red mud containing about 240 tonnes of Sc. Unlike other ore and man-made sources of scandium, red mud has a number of advantages, namely, it has already prepared for processing and does not require any extraction and grinding costs.