

A Study of the Alumina Distribution in the Lab-Scale Cell during Aluminum Electrolysis

Authors : Olga Tkacheva, Pavel Arkhipov, Alexey Rudenko, Yuriy Zaikov

Abstract : The aluminum electrolysis process in the conventional cryolite-alumina electrolyte with cryolite ratio of 2.7 was carried out at an initial temperature of 970 °C and the anode current density of 0.5 A/cm² in a 15A lab-scale cell in order to study the formation of the side ledge during electrolysis and the alumina distribution between electrolyte and side ledge. The alumina contained 35.97% α-phase and 64.03% γ-phase with the particles size in the range of 10-120 μm. The cryolite ratio and the alumina concentration were determined in molten electrolyte during electrolysis and in frozen bath after electrolysis. The side ledge in the electrolysis cell was formed only by the 13th hour of electrolysis. With a slight temperature decrease a significant increase in the side ledge thickness was observed. The basic components of the side ledge obtained by the XRD phase analysis were Na₃AlF₆, Na₅Al₃F₁₄, Al₂O₃, and NaF·5CaF₂·AlF₃. As in the industrial cell, the increased alumina concentration in the side ledge formed on the cell walls and at the ledge-electrolyte-aluminum three-phase boundary during aluminum electrolysis in the lab cell was found (FTP No 05.604.21.0239, IN RFMEFI60419X0239).

Keywords : alumina distribution, aluminum electrolyzer, cryolite-alumina electrolyte, side ledge

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