Performance Analysis of a Horizontal Anode Baking Furnace for Aluminum Production

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Abstract

Anode baking is the most expensive and the most important step during carbon anode production. The operational-geometrical parameters have significant influence on the anode baking furnace performance and carbon anode quality. Numerical modelling is an imperative tool to investigate the effect of different parameters on anode baking process. In the present study, a numerical model is developed which simulates heat transfer and flow distributions of the entire anode baking process. Using this numerical model, effect of various factors on anode temperature distribution is studied. Impact of degraded refractory-wall thermal conductivity on baking process is investigated and it is observed that for the aged furnaces this material properties degradation should be addressed accordingly. During the preheating and firing sections the temperature drops drastically from flue-gas to the center of the anode through the width of the pit which indicates a huge loss of energy. Calculating temperature standard deviation for the entire baking process, it is observed that the temperature non-uniformity presents mostly in the refractory wall and packing coke regions, and anode experiences a homogenous temperature distribution.