

Effects of Flue Wall Deformation on Aluminum Anode Baking Homogeneity and Temperature Distribution

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Abstract

The quality of anodes used in aluminum industry depends strongly on the baking process. It is essential to achieve a uniform temperature inside the anode during the baking process. Flue wall may deform during the service life of the furnace that may affects the baking process of the anodes and consequently reduce the quality of the anode. During furnace operation, the thermal expansion of flue walls is restrained due to the presence of headwalls that may promotes the deflection of flue walls. This study aims at investigating this phenomenon by developing a 3D model able to take into account a large number of physical phenomena and parameters that play a role in the baking process and affect the flue wall deformation process. This 3D model takes into account the thermo-hydro-mechanical coupling due to coupled fluid flow and transient heat transfer, packing coke load and the thermal expansion, the model is used to analyze the influence of these parameters on the resistance and deflection of the flue walls. This model can be used as a useful tool to study the effect of flue wall deflection on the aging of carbon anode furnaces.

Keywords: Baking process; aging; deflection; flue wall; thermo-hydro-mechanical coupling.