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STUDY FINER FINES IN ANODE FORMULATION (CASE STUDY: ALMAHDI HORMOZAL ALUMINIUM SMELTER)

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Abstract : The To facilitate continuous improvement and permit amperage increases in the pot room, efforts have been focused on anode formulation at ALUMINIUM ALMAHDI. The impact of finer fines on baked anode properties was considered and trials to measure this impact were developed. Green mill operation and process parameters were adjusted to produce finer fines as measured by Blaine Number – the R&D Carbon method used to infer the "fineness" of carbon dust. Analyses were conducted on green and baked anode properties. Green and baked apparent density and air permeability improved with high statistical correlation. Electrical resistivity and flexural strength required increased pitch content to demonstrate improvement. No crack rate increase was observed and the bakeloss was very low. Finer fines are also a potential control for baked anode properties as calcined coke

Keywords: "Anode, Fines, Blaine, Green Mill;"

Introduction

In order to provide an amperage increase at ALUMINIUM ALMAHDI and continuously improve the anode production process, anode properties that could be impacted by the aggregate formulation were identified.
Generally there finer according to type of property or comparable blain high intake of tar or pitch to reduce or increase the density can be produced with the best will lead anode Aggregation of all materials in carbon plant,s aluminum almahdi is done in the standard range of the Andes is the best example, but also other factors such as mixer , mixer cooler , pre heating and quality of raw materials are a conditon of the best kind of anode. But in this part of the core zone and the main focus is on tar excess Blaine and Blaine procedure. equipped with a method of measuring the R & D is performed. Blaine number has been increased from 3700 to 5500 in the last

3 years. For this trial, an increment of 350 points was implemented. The goal of this paper is to demonstrate the positive results in the baked anode properties resulting

from this change.

Experimental Procedure

Development

Method to Measure Carbon Dust – Blaine Number
Coke dust consists of material less than 250 μm and includes the ball mill product along with the filter dust taken from various sections of the anode plant. This faction contributes more than 90% of the total aggregate surface area and largely dictates the optimum pitch requirement. In an anode plant, fluctuations in coke dust granulometry cannot be adjusted for by continually changing the binder content and will lead to incorrectly pitched anodes and inconsistent performance. Authors should present the materials and experimental procedures briefly. Please identify the complete name and address of the companies which provided the materials and equipments.

Design of Experiment (DOE)

A detailed plan was developed to increase the Blaine Number by350 points, from 3700 to 5500.In the green mill, adjustments were made to the ball mill and air classifier (Figure 1). The ball mill was retrofitted to support incremental ball volume by increasing the power input. The existing air classifier operation was modified without the need for mechanical changes.

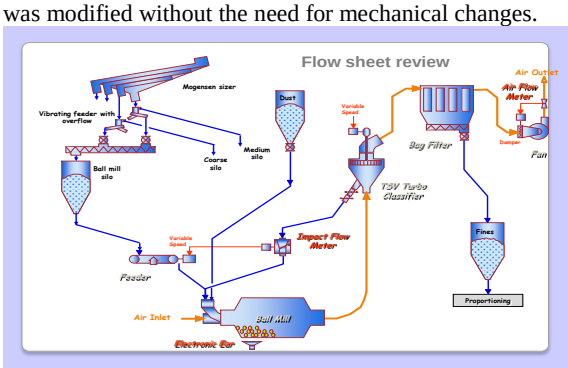

Figure 1 – Carbon dust generation system

Anodes were produced based on the following procedures to Minimize any forming and baking variation:
• Pitch content: 13.2; 13.4 13.77; 13.95 , 14.09,14.34 and 14.54;
• Mix temperature, mix time, vibration time and all Others parameters were fixed at green mill;
• All green anodes marked for tracking;
• All anodes loaded at furnace 1, at least 4 sections far from the crossover and in central pits;
• All baked anodes sampled and weighed

Results and Discussions

BAD – Baked Anode Density – has significantly improved at Aluminum almahdi since Blaine Number carbon dust control began. Initially, the Blaine Number was 3700.

Process Parameters

No variation in the coke and pitch properties was observed during the test.

Blaine averaged - as planned - 5500 with a standard deviation of440.Green Mill The improvement in the green anode density (GAD) during the trial is shown in the fig 1.

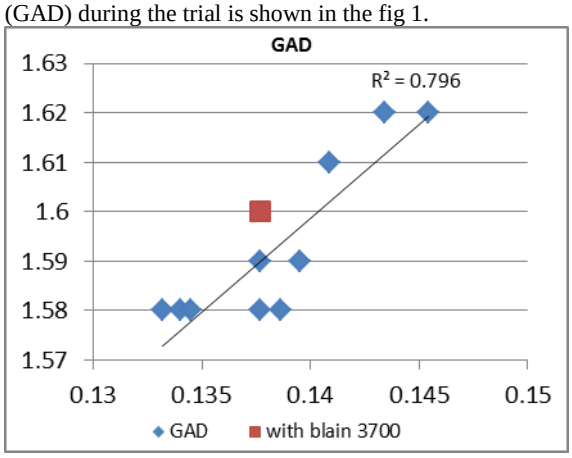

fig 2 – GAD versus % Pitch

The effect of higher Blaine is evident while changing from 3700to 5500 at a pitch content of 13.77. GAD decreased from 1.58g/cc to 1.62 g/cc. Specific area of the carbon dust increased and resulted in anodes under pitched.

Baking Furnace

Flue temperature, soaking time, gas pressure and all others parameters in the baking furnace were remained the same of normal production.

Baked Anode Properties Results

The baked physical properties analyzed were: BAD, air permeability, electrical resistivity and flexural strength (Graphics 2, 3, 4, 5 and 6). Chemical properties results were not considered here once is not the focus. The trends do not show the inflection point indicating overpitching, the point where additional pitch has no more positive impact in the baked anode properties. All graphics also show one point (red/square point in graphics) representing theoriginal process condition of 3700 Blaine, allowing comparison at both levels. Comparison of the baked anode properties at 3700 and 5500Blaine yields the following observations:

– BAD showed a significant improvement of 0.01 g/cc (from 1.56 g/cc to 1.57 g/cc) in spite of under pitching at 13.77 and 5500 Blaine.

– Baked loss decreased significantly without compromising baked properties.

– Electrical resistivity had a considered deterioration due to low BAD.

– Air permeability and flexural strength were the same.

Results at 4400 Blaine:

– BAD can be improved 0.02 g/cc, from 1.56 g/cc to 1.58 g/cc using 14.54 pitch (without overpitching)

– For all pitch levels, air permeability is better than current (4.05 nPm). Considering specifically 14.54 pitch, an improvement of 0.100 nPm is very agreeable considering the current level results.

– Electrical resistivity remained the same due to low BAD.

– Flexural strength can be improved from current level of pitch of 13.77 on.

– Notable improvements in the bake loss for all pitch levels were observed - normally lower than 5 - resulting in more carbon available for electrolysis.

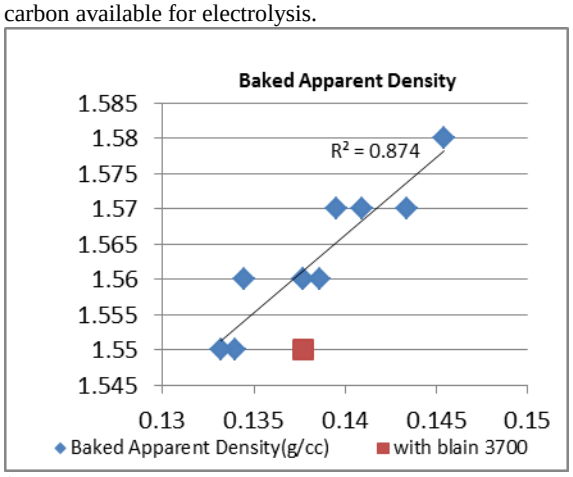

fig 3 – GAD versus % Pitch

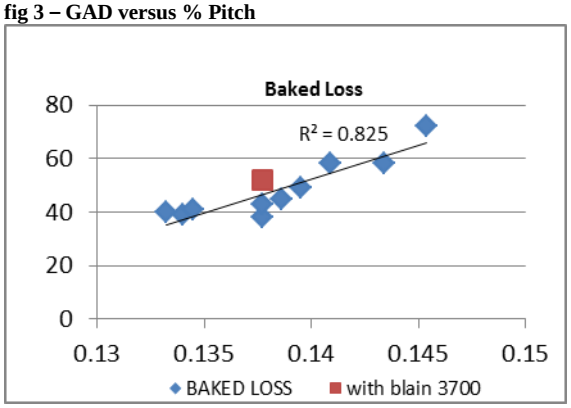

fig 4 – Baked Loss versus % Pitch

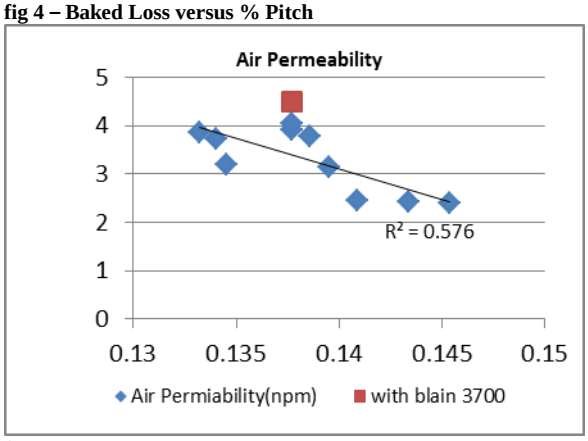

fig5 – Air Permeability versus % Pitch

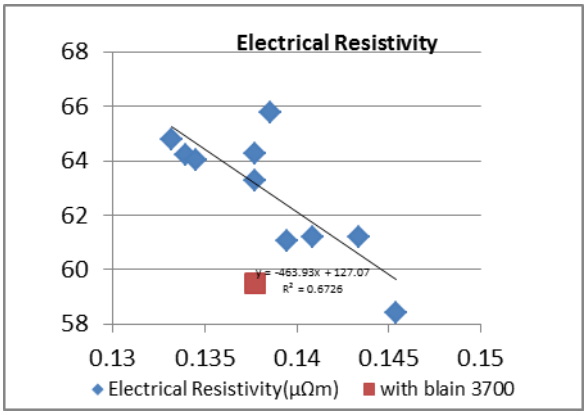

fig 6 – Electrical Resistivity versus % Pitch

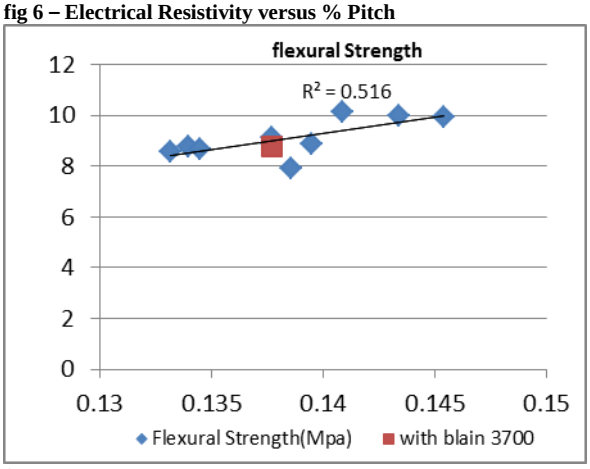

fig 7 – Flexural Strength Resistivity versus % Pitch

Conclusion

It is important to emphasize that efficient and frequent control of carbon dust is required to avoid inconsistent anode quality as well as burning and thermo shock problems. A Blaine apparatus from R&D Carbon is recommended.

It has been shown that by using finer fines in anode formulation, baked anode properties can be significantly improved in terms of physical properties. An evaluation of the capacity of the dust generation system and optimization of the pitch content, in the context of both economics and physical properties, may be required. Finally, finer fines can be an important process modification to:

– Allow amperage increase at smelters.

– Minimize the impact of calcined coke VBD (vibrated bulk density) deterioration.

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