Anode Properties Improvements at Sohar Aluminium

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Abstract

The present study describes the relevant technical, operational and maintenance practices that contributed in improving anode properties in Sohar Aluminum Smelter. The physical-chemical properties and correlations that improved the anode quality are demonstrated in this paper.

The superior level of anode properties like baked anode density (BAD) and CO_2 reactivity (CRR) is supporting the plant load increase plans and improving pot performance with a stable anode setting cycle and stable anode butt weight. The anode plant has pursued for several years a strategy of investments in key equipment, standardized approach towards reliability and maintenance schedule compliance. A joint team with technical, operation and maintenance on a daily management system in place is one of the main levers for the recent accomplishments.

As a result, the baked anode density reached 1.610 g/cm^3 and the CRR was increased beyond 94 %. The paper highlights as main technical contributors for the optimization, the coke and butts aggregate optimum sizing, setting of process parameters, new maintenance routines, vibro-compactors performance optimization and a better raw materials management.

Keywords: Baked anode density, CO_2 reactivity, Coke Sizing, Aggregate distribution, Maintenance strategy.

1. Strategy to Meet Future Carbon Need in Potlines

Sohar Aluminium's business plan is to exceed 400 kA in pots during the next 5 years. Due to the limited carbon available in the current anode (weight and butt size), several options were considered.

As a first option, it appeared that the anode size increase (length, height and width) is limited due to the AP-40 anode baking furnace (ABF) dimensions. The ABF modifications would trigger a multi-million dollars investment project [1].

A second option to supply more carbon to the potlines is to reduce the anode set cycle in the pots from 80 to 76 shift cycle. It implies an increase of 5 % in the number of anode assemblies produced. This is the selected solution in the long-term. The new cycle will generate an extra 40 kg of carbon available per anode for future amperage creeping.

However, the drawback of this option lies in the short-term. In the first years of the amperage creeping, the extra carbon mass is only partially consumed. This will result an additional cost of production due to higher gross carbon consumption. The benefits, though, will only follow the annual amperage increments.

The third option would consist in increasing the anode density without changing its size nor the anode production figure. As shown in Figure 1, the green anode density (GAD) weekly average may vary from 1.65 g\cm^3 to 1.68 g\cm^3 during the year, at various instances. Assuming that the pot amperage requires an anode weight limited by the lowest values of density, a reduction of variation in density would definitively benefit the smelter in the short-term at least.

Decision: Third option. Working to reduce density variation and in the midterm the eventual implementation of the second option (anode cycle set reduction). This decision will postpone by a few years any need of investments in capacity increase.

As a reference, a variation in density of 0.01 g\cm^3 between the highest and the lowest weekly figures corresponds to an extra mass of approximately 4 kg per anode. It means one additional year of production at 80 shift cycle saved. The solution to produce extra anode mass to the potlines required for the amperage creeping focused initially in the reduction of the density variation.

2. Density Variations Reduction

2.1 First Approach: Density Reject Criteria

The first approach consisted in rejecting the anodes produced below a certain density. On Figure 1, it was set a minimum density at 1.625 g\cm^3. Any anode under this value was rejected, causing 0.9 % of the anode plant production to be rejected and recycled. To gain an additional 4 kg in the anode, the reject criteria should be set at 1.645 g\cm^3. This could generate a rejection rate of 8.1 %, which was not acceptable. This approach was abandoned.

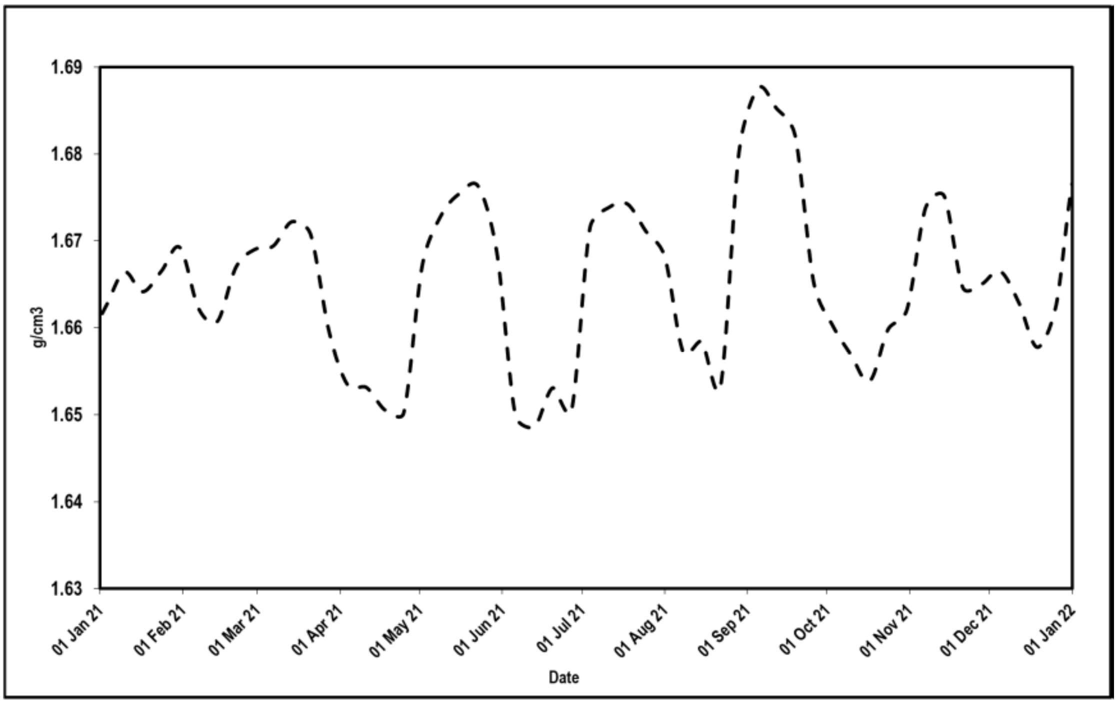


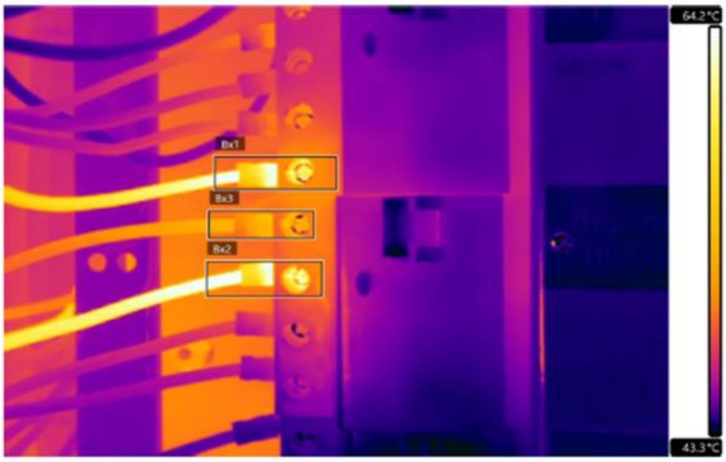
Figure 1. Variation of GAD (g/cm³) 2021.

An investigation of the cyclic variations of the GAD was undertaken. To understand the study, a short comparative introduction to the anode plant of the Sohar Aluminum smelter is required.

SOHAR ALUMINIUM
Condition Monitoring

Thermography Report

Department	Carbon
Equipment	Isolator Cable(High bay Lighting fixture-X431-EJLO-0020)
Part / Location	X431-EAA1-0002
Image taken Date	26/03/2023



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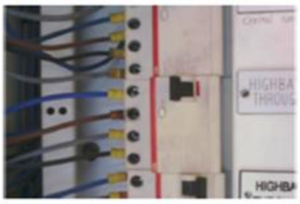

Bx1 Maximum	65.2 °C
Bx2 Maximum	66.3 °C
Bx3 Maximum	55.0 °C

Note: cable connector temperature is comparatively high, Needs to be checked.

Figure 28. Thermography used on baking furnace electrical cabinet.

6. References

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