# Improving Prebaked Anodes Electrical Resistivity in Aluminium Bahrain (ALBA)

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**Abstract**



Carbon anodes are used in electrolysis process for production of aluminum. The quality of anodes has direct impact on aluminium production cost, carbon and energy consumption and environmental emissions. One of the critical properties of anodes is electrical resistivity. Low electrical resistivity anodes help to reduce energy consumption, while high electrical resistivity anodes can lead to squeeze anode-cathode distance (ACD) in electrolytic cells leading to anodes spikes formation. Anode electrical resistivity depends on raw material quality, dry aggregate granulometry, mixing energy and anode forming parameters. The presence of cracks and pores in anodes increases the anode electrical resistivity. Therefore, it is important to know how the pores and cracks form during the anode production so that the necessary actions could be taken This paper shares the experiences of Aluminium Bahrain (ALBA) in reducing electrical resistivity (ER) from 58 - 60 μΩm to below 55 μΩm consistently. This was carried out by conducting various trials to investigate the impact of different anodes production process parameters such as vibration time, counter pressure, vacuum, forming temperature, coke temperature, granulometry, butts % in recipe, fire cycle, heating gradient used during baking to reach to ultimate objectives.

**Keywords:** Carbon anodes, Quality of anodes, Cracks and pores, Electrical resistivity, Process parameters

## 1. Introduction

Aluminum Bahrain (ALBA), the world's largest single-site aluminum smelter ex-China with aluminum production of more than 1.6 million tonnes (2022) is known for its technological strength and innovative strategies. ALBA always striving to maximize the productivity and reduce resources consumption such as carbon and energy in-order to reduce impact over environment, to improve safety and to improve overall business.

With meticulous approach, ALBA progressively achieves its potline current creep plan successfully over the past many years.

Potline 6 was commissioned in 2019 based on DX+ Ultra technology with original design to operate at 460 kA. Presently this potline is operating at 478 kA which is more than 4 % of its design in just two years. One of critical elements to operate potlines successfully at higher amperage is anodes quality. ALBA Potline 6 performance was found quite sensitive to anode electrical resistivity probably due to high anodes current density as compared to other potlines.

Potline performance impacted negatively at higher ER close to 60 μΩm. Hence, a team was formed to optimize the process parameters to bring ER from level of 60 to below 55 μΩm.

Anode electrical resistivity depends on raw material quality, dry aggregate granulometry, mixing energy, anode forming parameters and heating rates in Kiln. The presence of cracks and pores in anodes increases the anode electrical resistivity. This paper describes work done by ALBA to reduce ER from 60 μΩm to 55 μΩm by optimizing granulometry and other anode production parameters. This paper also covers brief details of literature survey, and technical papers referred to conduct trials and make process changes to reduce anode electrical resistivity.

ALBA Paste plant 4 commissioned in 2019, catering anodes to Potline 6, it equipped with latest art of technology having Rhodax® crusher for the preparation of dry aggregates (Figure 1) of paste recipe with two fractions grains and fines, IMC® process (Intensive Mixing Cascade) which relates to the preparation of the Paste mixing and cooling in Eirich cooler / mixer (Figure2) and Xelios™ vibrocompactor which relates to anode forming.

In this plant two fraction grain (0.3 - 30 mm) and fine (< 0.03 mm) being used for green anode production. The process of forming grain and fine fractions is shown in Figure 1.

All the dry mix material together feed to the Rhodax® crusher, output of crusher goes to Mogensen screen to classify the material based on particle size. Particles > 50 mm from the Mogensen screen goes to the reject bin, over size fraction (30-50 mm) will go to the recirculation loop of the Rhodax® crusher. Particles + 0.3 - 16 mm goes to the grain silo and < 0.3 mm goes to further grinding to get the fine fraction. Particles < 3 mm passes through the Turbo classifier 1 (TSV1) and then TSV 2, the output of TSV 2 stored in the fine fraction silo and reject will goes to ball mill for further grinding.

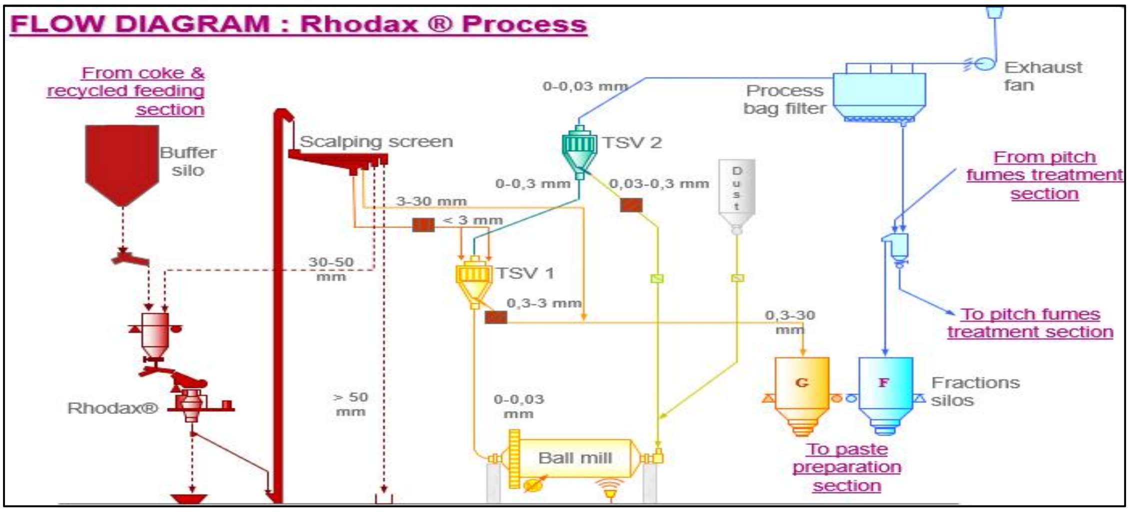


**Figure 1. Dry aggregate preparation line.**

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