Massive Recycling of Underpot Material to Pots at Sohar Aluminium Smelter

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Abstract

In modern aluminium reduction prebaked cell technology, spillage of cover bath material and alumina into the basement is still a challenge and requires appropriate management. This spillage can be controlled by improving the operation practices and implementing engineering controls. The basement material management is an important process, as the smelters are keen to reduce costs and increase production efficiencies. The appropriate cleaning of the basement material contributes to better air circulation under the pots, allowing the expected heat exchange in the pots. The controlled and levelled recycling will reduce impact on metal purity quality and the quality of the anode cover material which plays as a heat insulator for the pot and protect the anodes from air burning.

Up to 2017, Sohar Aluminium accumulated 22 000 tonnes of basement material that needed to be reintroduced into the potline. It was developed an innovative strategy to speed up the recycling rate instead of using the traditional regular introduction through the bath plant, blended in the anode cover material.

This paper describes the learnings from the accumulation of materials along the years, the planning and the equipment developed for the innovative segregation of bath and alumina from the basement material. The finer material was recycled as alumina in the Gas Treatment Center (GTC) and the coarser material in the bath plant. As a result, in 3 years, with this process, more than 10 000 tonnes of alumina were captured as cost reduction, and 10 000 tonnes of pure bath sold to the market.

Keywords: Aluminium reduction cells, Basement spillages, Alumina recycling, GTC, Potline services, Metal purity, Pure bath generation.

1. Introduction

The Sohar Aluminium plant operates a single potline of 360 cells that is divided into two rooms with AP40/42S pot design, with a metal production of 400 000 tonnes per year. It also has a carbon plant producing baked anodes and a cast house producing ingots and sows. Sohar

Aluminium has several customers in GCC, Asia and Europe and supply liquid high purity metal to four downstream partners next to the Smelter in Sohar.

Sohar Aluminium facilities include a smelter that utilizes advanced technology operated with best practices along with an owned state-of-art 1 000 MW power plant and dedicated port facility in the Sohar industrial port area.

Sohar Aluminium had 22 000 tonnes of accumulated basement material that was removed in 2017 after a line shutdown event. Accumulated basement material needed to be segregated and reintroduced into the potline as it has a great value for Sohar Aluminium and the environment. The aim was to develop an innovative strategy to recycle basement material directly in the pots, instead of using the regular single introduction though the bath plant. The regular blend in the anode cover material will be slow and would make if finer and increase variability of percentage of alumina in the material.

Figure 1. Basement material accumulated in 2017.

Aluminium electrolysis is a delicate process highly dependent on managing impurities within the cell. Basement alumina, a byproduct generated during the process itself, often contains elevated levels of iron and silicon. These impurities will dissolve in the bath and directly contaminate the metal. Once dissolved, they can significantly impact cell performance in several ways, such as:

1. Metal purity. Understanding the behavior of these impurities, particularly those with a detrimental effect like iron and silicon, is crucial for smelters to optimize their processes, especially plants with high purity metal contracts.

2. Efficiency metrics. Even small changes in anode cover material or alumina granulometry can affect current efficiency or anode effect frequency of a potline, key metrics for smelters. By effectively managing these impurities, smelters can improve cell performance, reduce emissions, and enhance the quality of the aluminum produced.

3. Emissions and GTC stability. Furthermore, recycled alumina directly in the Gas Treatment Center (GTC) can present challenges in flowability throughout the alumina circuit, including the Hyper Dense Phase System (HDPS) and air slides. The presence of fines and the potential for segregation within the recycled material can disrupt smooth flow in these systems. For the HDPS to function effectively, a consistent particle size distribution is necessary to ensure proper mixing and transportation of the alumina. Similarly, air slides rely on the proper flow characteristics of the alumina particles to function efficiently. Blockages or uneven flow caused by inconsistencies in granulometry can disrupt the entire alumina feeding process. Optimizing the granulometry of the recycled alumina and potentially implementing strategies to address segregation become crucial steps in ensuring efficient utilization of this valuable byproduct.

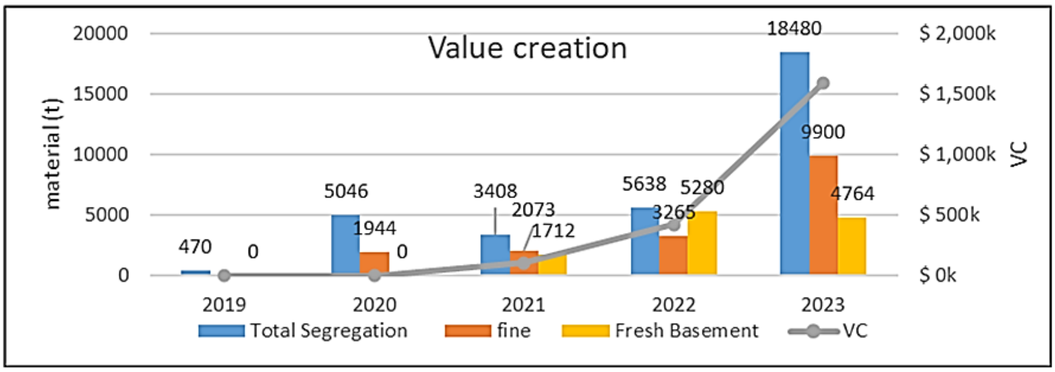

Figure 16. Value creation over project period.

This project exemplifies a comprehensive approach to basement material recycling, encompassing both under-pot material and fresh material for cover mix control. The new system ensures quality control, operational efficiency, and proactive maintenance. Sohar Aluminum's success serves as a model for the aluminum industry, demonstrating how responsible recycling contributes to a sustainable and cost-effective future.

The inadequate management of the underpot material can be a huge problem for smelters. If well managed this material turs an important effort to improve cost and efficiency in the operations.

7. References

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