Performance of Gas Treatment Centers in the Shadow of Amperage Increase in Alba

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Abstract

Alba's commitment toward environmental safety manifests in the mere size of its investment at dry scrubbing plant by owning 10 of them. This paper will use total fluoride emitted from the exhaust stack, and fluorination rates of those plants to gauge their performance in the shadow of potline operating amperage increase. Also, this paper will review the upgrades done and future upgrades required in those plants, and challenges overcome to eliminate amperage increase burden and minimize its negative effect on the environment.

Keywords: Dry scrubbing, Gas treatment center (GTC), Potline current increase, Fluoride emissions.

1. Introduction

Aluminum Bahrain (Alba) is the largest aluminum smelter in the world outside China. Alba recently reached a benchmark in production with a 1.54 million tonnes per year after the latest expansion of production Line 6. The contribution of Line 6 was about 560 000 tonnes while the remaining production can be attributed to the other potlines. The proportional relation between operating current and aluminum production indicates that considerable production increase was the result of current increase.

Today Alba owns 10 dry scrubbing plants to handle the pot off gases, as the production increased, so did the byproduct of the smelting process. This meant a larger load to be carried by the gas treatment plants and a possible insufficiency in emission handling. Alba's commitment to the highest environmental standards pushed the rectification of that problem as all resources were provided for a set of upgrades of the gas treatment centers in order to keep up with amperage increase.

Gas treatment centers (GTCs) are dry scrubbing plants that are meant to recover fluoride from pot off-gases, remove excess heat from electrolysis process in pots, and to supply potroom with alumina enriched with recovered fluoride which is called fluorinated or secondary alumina. A GTC plant can be divided into three sections, first the fresh alumina handling system, in which alumina is stored and transported to the filters reactor. The second part is the gas handling system where the fluorine is adsorbed by fresh alumina that is injected in the reactor, and it is also where gas particulates are constrained from escaping to the environment by fabric bag filters. Secondary alumina handling system is the third section in which fluorinated alumina is stored and supplied to the potroom pot feeding system. Figure 1 shows the process flow of alumina and off-gases through different GTC sections.

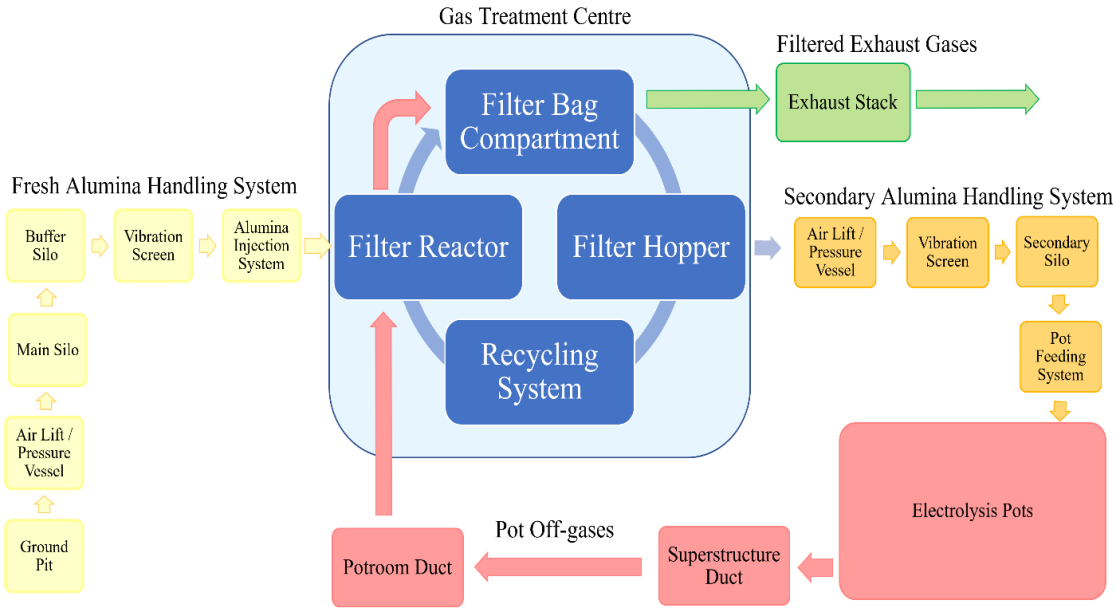

Figure 1. Flow diagram of GTC process.

GTC is a dry scrubbing plant that runs on the principle of adsorption which is the ability of solid particles (alumina in this case) to attract and trap gas molecules (hydrogen fluoride) at its surface. In addition to its environmental benefits of significantly reducing the harmful fluoride emissions [1, 2], dry scrubbing plants have a big economical effect as well through reducing the required amount of the costly additional excess aluminum fluoride (AlF_3) in electrolysis cell molten bath.

2. Line 4 Gas Treatment Centers

ABB systems (Flakt systems for aluminum industry) are used in Line 4 gas treatment centers GTC 1 and GTC 2. These plants were initially designed for a 300-kA line where 25 t/h alumina feed per plant would have been sufficient. However, as the amperage increased, so did the alumina required to feed the line and to keep emissions within the range of 0.7 mg/Nm^3 of hydrogen fluoride and 1.2 mg/Nm^3 of total fluoride emissions. Figure 2 shows how alumina feed increased during amperage increase through the years in Line 4.

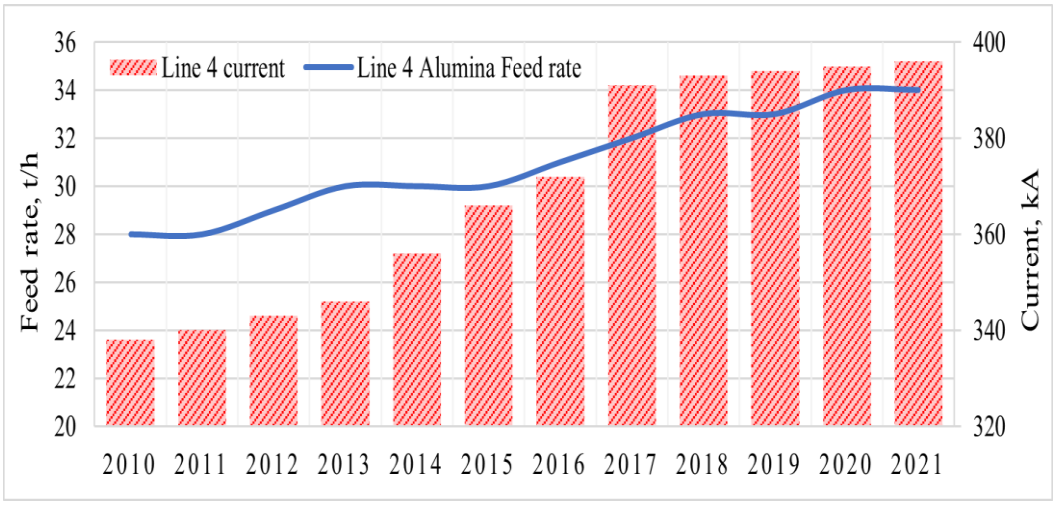

Figure 2. Behavior of alumina feed rate with amperage increase.

7. Conclusions

Through carefully evaluating the stated data of GTC's performance pre and post upgrade it is safe to say that the fruits of the investment in GTC upgrades were harvested. The applied solutions proved to be effective as the performance was maintained if not improved during current increase. ALBA's next goal is to obtain a similar result after reaching the next current milestone of 420 kA.

8. References

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