Update on the Abart Gas Treatment Center Technology

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Abstract

The Abart (Aluminium Best Available Recovery Technology) is well known in the Aluminium industry and more than 1000 gas treatment modules have been installed worldwide. In some cases up to 34 modules have been assembled into large centralized gas treatment centers (GTCs). Since the first installations the technology has continued to evolve including new step changes in gas cooling technology (HEX), alumina distribution (Alfeed) and the compact Abart-C technology. Abart- C provides more flexible solutions that can be especially beneficial for retrofit and expansion projects, and can include an integrated SO_2-scrubber. The paper will focus on the various technologies involved such as integrated silos for alumina handling, fan integration, gas and alumina distribution, and gas cooling. Scaling and erosion are challenges within the GTCs, and can affect the performance of the individual components and modules comprising the GTC. In addition, although more rarely, upset conditions within individual modules can occur if there are mechanical issues with, e.g., air fluidization devices. A new method for gas sampling and detection of upset process conditions will be discussed including a patented early warning detection system based on SO_2 gas sampling from the individual Abart modules.

Keywords: Gas Treatment Center; Abart; Alfeed alumina distribution; HEX gas cooling technology, Sniffer.

1. Introduction

Gas Treatment Centers (GTCs) today recover almost all (except a small fraction) of the HF gas emitted from electrolysis pots using the Hall-Heroult process for aluminium production. The HF gas is removed from the raw gas in the GTC dry scrubbing stage where the raw material to the pots, alumina, is brought into contact with the gas. Typically the fraction of HF in the raw off gas is in the order of 2 - 400 mg/Nm³, while the outlet clean gas from the GTC can contain less than 0.5 mg/Nm³ which gives an HF removal efficiency of more than 99.7 %. High removal efficiency protects the environment around the plant from potentially harmful emissions, and since the fluoride is recovered back to the pot (see Figure 1) the consumption of the costly AlF_3 is reduced significantly.

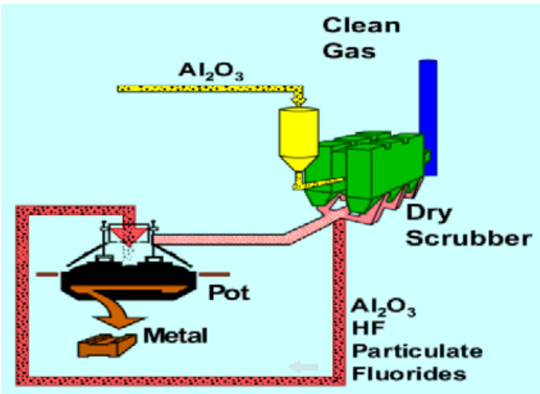

Figure 1. The alumina HF recovery loop.

In Figure 2, the main components in a large GTC 2 x 17 centralized Abart modules single line dry scrubber located in the Middle East are shown. This shows the preferred layout in the industry today. Each pot superstructure is connected to the branch duct via the electric isolator piece into the potroom ducting and finally into the GTC inlets. Also shown are the primary alumina silo storage, enriched alumina silo, main fans, stack and alumina distribution systems. In some cases as a part of the GTC, SO_2 is removed with a wet scrubbing stage either using sea water or sodium hydroxide solutions as absorbent. The wet scrubber is typically located between the main fans and the stack (see also Section 7 on SO_2 scrubbing).

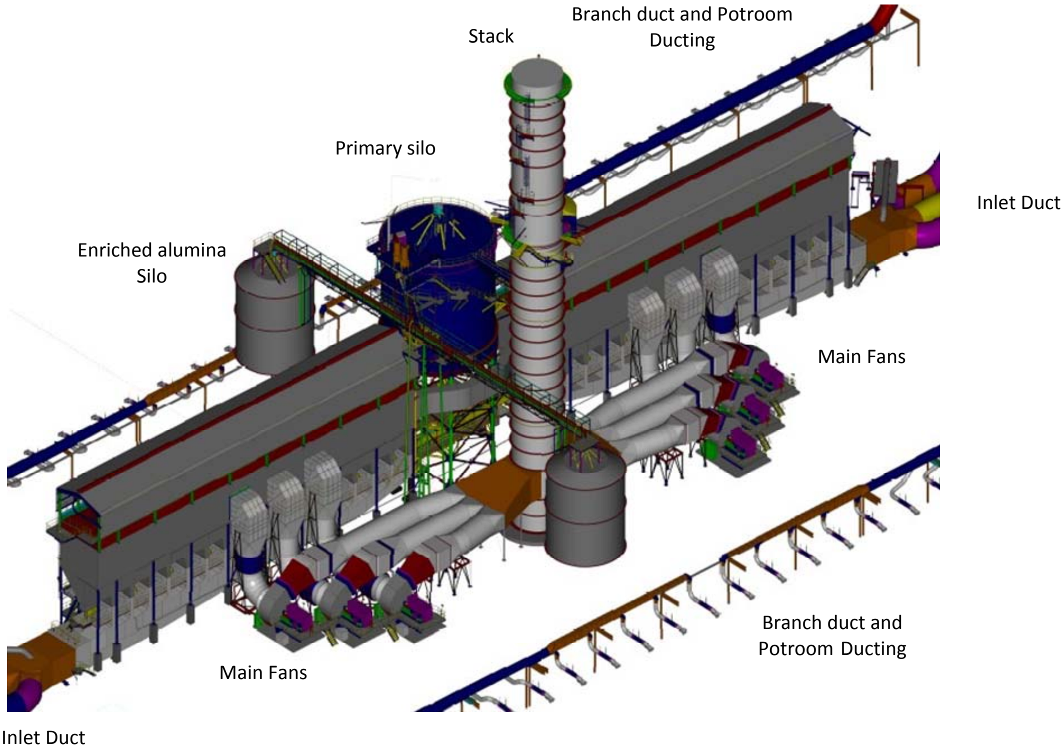

Figure 2. Large centralized GTC.

In the following sections the main principles and new developments in the Abart system will be described.

2. The Abart Principle

The high specific surface of alumina together with its high affinity to HF helps to capture the HF molecules contained in the raw gas from the pots and is a decisive factor that allows for the HF adsorption to take place. In addition the GTCs must be designed to reliably mix the alumina and the raw gas as efficiently as possible without causing too much attrition to the fragile alumina particles. Retention times, mixing lengths, concentration and flow profiles etc. must also be favourable to achieve optimal adsorption. In addition erosion and scaling must also be under control, as well as minimum energy consumption.

Within all of the above restraints, the Abart GTC technology has proven to be very reliable over time and more than 1000 Abart dry scrubbing modules are now in daily 24 hours, 7 days per week operation worldwide. The main characteristics of the Abart dry scrubbing system are shown in Figure 3.

concentrated gas requiring new gas cooling systems including heat exchangers and waste heat recovery systems that now are in operation several places in the world.

SO_2 gas scrubbing is not always required depending on the local regulations and SO_2 load, but the trend is probably that this will be mandatory in more locations in the future, and retrofits of existing GTCs may be necessary. In this case the new Abart-C retrofit is particularly interesting as it does not require any added footprint on the plant, and the modularized and standardized SO_2 scrubber can be easily lifted into the existing penthouse.

The sniffer system pinpoints the location of abnormal operation, eases the maintenance and troubleshooting, and can also predict the emissions with the patented early warning system. The sniffer also allows for multiple stacks (one for each Abart-C module) to be implemented with less cost, and allows for easier optimization and balancing of the large GTCs.

9. References

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