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Eds: Dr P.K.N. Raghavan, Dr. R.N. Prasad, Shri M.K.B. Nair, Dr. C.R. Mishra

BALCO EXPERIENCE ON PRODUCT GRANULOMETRY CONTROL

S Jena, N K Kshatriya, S Dasgupta
Bharat Aluminium Co. Ltd., Korba

ABSTRACT

Alumina product quality is a priority for all refineries. The productivity and economics of all alumina refineries depends on optimizing the precipitation process. The precipitation process determines the productivity of the entire cycle and the particle size of the product. The dual aim of the precipitation is to maximize the productivity and to improve product quality. Precipitation process control is governed by the parameters such as caustic and MR of pregnant liquor, residence time, seed charge and temperature. This paper covers the action taken to control the product granulometry in Korba Alumina Refinery.

INTRODUCTION

Alumina product quality is a priority for all refineries. Chemical purity of alumina is controlled on the red side whilst physical quality control happens largely within precipitation, with great care taken to meet customer specification. Specific surface area, alpha alumina and LOI are controlled in calcinations. Particle size is controlled in precipitation. Excessive nucleation, poor size control and particle breakage across calciners result in increased fines in product. The alumina physical properties are major concerns fore the smelters (e.g. –45μm, -20 μm and attrition index). Combining these three categories into one "dustiness" category would have seen it as clearly the highest ranked concern. Alumina fines content has a larger impact on a number of smelting sub process including bath operation, sludging tendency, control of dust, fluoride emissions etc. In the Bayer process both productivity and quality of the alumina tri-hydrate produced are dependent on the performance of the precipitation section. An important issue in the optimization of the bayer precipitation section is the constraint to sustain a delicate balance between fine particle generation by nucleation and coarsening through particle growth and particularly agglomeration. To achieve optimum precipitation performance various techniques have been applied in practice, such as :

- Agglomeration of the finest seed fraction.
- Growth on new agglomerates to deplete the liquor further, resulting in a high yield and a product with an acceptably low soda content in the resulting alumina.
- Realization of an optimum temperature profile with respect to economic precipitation yield, through the application of inter-stage coolers.
- Presence of enhanced surface area in the growth section which is accomplished by various novel techniques, e.g. by effectively withdrawing an overflow with a lower solids density than in the precipitator contents.

- Classification of hydrate by hydro cyclones and thickeners for optimum seed recy

PRECIPITATION CONTROL PARAMETERS-ACTIONS TAKEN IN BALCO

The precipitation process control is governed by the parameters such as caustic concen and MR of the pregnant liquor, temperature profile across the precipitation train, seed and residence time. Amongst these parameters some are fixed at the design stage. controls remain with moderate variations in temperature, caustic concentration and MR pregnant liquor and seed charge to certain extent.

Korba alumina refinery is designed to produce semi-sandy alumina based on the tech of 1960's. The quality specification was always maintained at around 35-40% range fo 44um fraction of the product alumina. A need was being felt by the customer (our i captive smelter in this particular case) to reduce the fines content of alumina so as to in the efficiency of smelter operation.

In order to achieve the same the following road map was followed, the objective b produce a relative coarse product, i.e. less than 20% of –44 μm without compromi liquor productivity. These are :

a. Installation of hydro cyclones for classification of precipitator slurry.
b. Installation of inter-stage coolers for improving the temperature profile precipitator circuit while improving upon the liquor productivity.
c. Introduction of laser particle size analyser to monitor granulometry of s product.
d. Introduction of crystal growth modifier (CGM) to coarsen the particle.

The background and results of our decision to try out CGM as a coarsening tool is the following section:

The precipitation circuit, originally a Hungarian technology, is designed to produc type of alumina, with fines (-325#) around 45% in the product. As the circuit condi stretched for more liquor productivity, an increased generation of fines are formed wide fluctuations in hydrate granulometry were being observed, which adversely aff process control in precipitation, and created operational problems at the smelter end.

A need for coarser hydrate with improved crystal strength was being increasing improve the smelter plant operations, and exercise a greater process contrc precipitation area. At this point, the management of BALCO decided to run Cryst Modifier (CGM) trial and an action plan was chalked out between Balco and one supplier of CGM. The CGM trial started in October 2006 with an aim to coarsen th and stretch the circuit as and when allowable. The primary control parameter w temperature, and the –20 μm in seed hydrate was chosen as a measure of incipient c or fining.

The trial-monitoring plan was jointly worked out and put in place. The important m parameters included temperature profile, gpl hydrate levels in first tank, liquor ca molar ratio, and complete hydrate granulometry using laser particle size analyser. of the monitoring plan, one engineer from the CGM supplier was required to be pres plant for the first 3 months, and discuss the daily results with BALCO technical tean any adjustments in the process.

Since the start of the application, CGM has been proving quite beneficial for BALCO precipitation circuit. The desired result of hydrate coarsening, liquor productivity and overall circuit control are being successfully attained, and the CGM dosage has been optimised to a fair extent.

Apart from a good control on hydrate granulometry, CGM has helped in reducing the hydrate attrition by about 8-9%. The latter has led to improved operations in the smelter area.

The CGM programme has proved to be a good process control tool for BALCO precipitation circuit.

RESULTS & DISCUSSIONS

The –45μm size of product alumina before and after the CGM addition are graphically shown in Fig-1. It can be seen from Fig-1 that fines were in the range of 35-40% before addition of CGM. It shows the fines are in the range of 20-25% after addition of CGM and stabilization of the circuit. Fig-2 shows the improvement brought about in the liquor productivity during the above mention period. Furthermore, it was observed that with introduction of CGM in precipitation circuit the coarser portion of hydrate slurry also increased which in turn resulted in improved classification efficiency in the hydro cyclones. Now crystal growth modifier is being used for fine-tuning of granulometry. The amount of variation in granulometry has been brought down to a very narrow margin. Further control is being exercised by controlling the addition of CGM as per the –20 μm level in the seed.

The various parameters, which are being controlled, are as follows :

1. The fill temperature.
2. Solid concentration (gpl) in the first and last precipitators.
3. Seed granulometry with special emphasis on –20 μm fraction.
4. CGM dosage.
5. End temperature.

CONCLUSION

It is our endeavour to consolidate the gains achieved through the usage of CGM and to optimize further on the precipitation parameters to strike a proper balance between the product quality and plant productivity. This will help us in striking a proper balance between the product quality and plant productivity. Though significant gains have been achieved in meeting the customer demand still fine turning and optimization of the process parameters is underway by the dedicated and young team of professionals.

Fig. 1 Fines as -45 microns, %

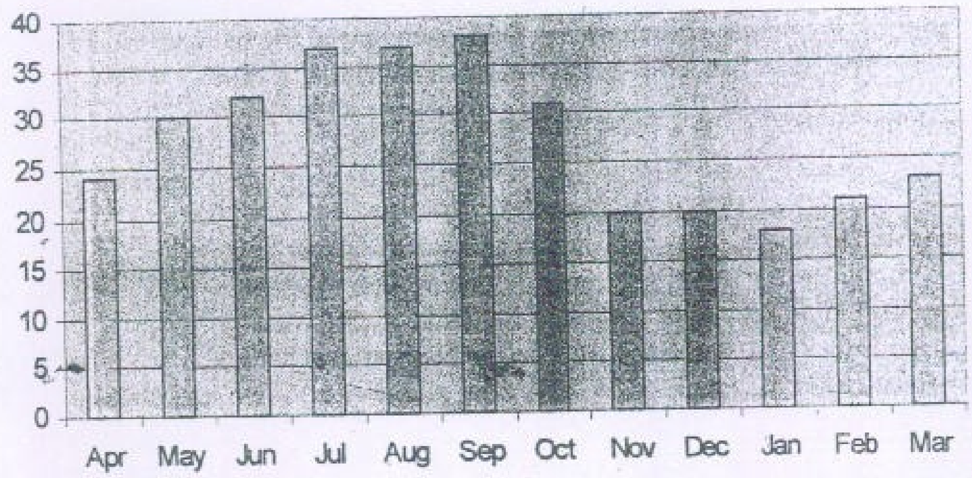

Fig. 2 :Liquor Productivity, gpl