

AKW Apparate + Verfahren GmbH and its expertise in bauxite upgrading

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Abstract



The world production of bauxite was reported to be 258 Mt/year in 2012. With regard to the use of bauxite, metallurgical bauxite for aluminium production accounts for the main share, making up around 90 % of this total. The beneficiation of bauxite is gaining importance not only for effective production of alumina and export of bauxite but also due to decreasing bauxite quality. Even though the beneficiation happens on the red side, it has significant influence on the white side of alumina refineries. In the following the test methods for process determination and the resulting process design are shown. Further on, the implementation and operation of such bauxite beneficiation plants are explained with an example of an operating plant. The scope of supply of AKW A+V starts with the individual test work to determine raw bauxite composition at the company test center, then it is followed by the engineering work for process design and plant construction and is completed by the commissioning of such plant.

Keywords: Decreasing bauxite quality; beneficiation of bauxite; bauxite testing; process design.

1. Introduction

1.1. Background of AKW Apparate + Verfahren GmbH (AKW A+V)

AKW A+V is a medium-sized, privately owned company focused on process engineering and equipment as well as on plant engineering, construction and service for mineral processing plants.

Since the beginning of the 19th century, kaolin, feldspar and silica sand are produced in the area around Hirschau. This is where AKW A+V was founded in 1963 as a research department of a mining company. Since the early beginnings, innovations, new product ideas and technologies have turned the company into a global operating enterprise with the headquarter in Hirschau (Bavaria, Germany), offices in Kiel, Moscow, Shanghai, São Paulo, Dubai and agencies in many other countries. Experience, know-how, motivation, new ideas for products and technologies and a steadily high international standard in quality and service enable AKW A+V to offer tailor made solutions to the different customers and to act as an international provider of mineral processing technology, equipment and plants.

The first contact to the **Bauxite-Alumina-Aluminium** Industry goes back to a development in the early 1970s between VAW, a former German alumina producer (Schwandorf, Lünen, Stade) and AKW A+V. Shortly after the successful introduction of classification equipment (hydrocyclones) in the Bayer process, NABALCO, Gove was the first international refinery which installed AKW A+V hydrocyclones in 1978. In the meantime the hydrocyclone clusters of AKW A+V are used all over the world in the Bayer process.

In order to provide added value to customers, free rein is given to the curiosity of new processes. The strategic focus on interdisciplinary cooperation for the development of customized solutions for even the most complex challenges is the backbone of the long and

ongoing success. For the **bauxite-alumina-aluminium** industry the company is interested in an optimization of wet mechanical processes involved with the bauxite mining and the alumina refinery.

1.2. Motivation for upgrading of bauxite

The most important raw material for the production of alumina and aluminium is by far bauxite. In 2012, world production of bauxite was essentially unchanged compared with that of 2011. Total mine production of 258 Mill. t was reported from 26 countries. The leading producers of bauxite were, in decreasing order of tonnage mined: Australia, China, Brazil, Indonesia, India, and Guinea. These countries accounted for 86 % of total world production. The top three producers Australia, China, and Brazil together accounted for 61 % of the world's production. Based on the 2012 production the expected growth up to 2020 is:

- Bauxite: + 134 Mill. t/a of production;
- Alumina: + 52 Mill. t/a of production;
- Primary Aluminium: + 27 Mill. t/a of production.

The growth is dominated by the Chinese primary aluminium industry, followed by the growth of primary aluminium production in the Middle East.

The quality of the bauxite ore, in general, is highly variable between individual deposits. The bauxite deposits differ widely in

- their geological associations,
- content and type of aluminium ore minerals and
- gangue minerals.

Following table shows the typical range in the composition of metallurgical grade bauxite.

Table 1. Typical range in the composition of metallurgical bauxite [1].

Components	Wt.% (as metallic oxide if not indicated otherwise)
Al ₂ O ₃	30 – 60
Fe ₂ O ₃	1 – 30
SiO ₂	<0.5 – 10
TiO ₂	< 0.5 – 10
Organic Carbon (as C)	0.02 – 0.40
P ₂ O ₅	0.02 – 1.0
CaO	0.1 – 2
V ₂ O ₅	0.01 – 0.10
ZnO	0.002 – 0.10
Ga ₂ O ₃	0.004 – 0.013
Cr ₂ O ₃	0.003 – 0.30
S	0.02 – 0.10
F	0.01 – 0.10
Hg (ppb)	50 - 1000

Bárdossy and Bourke [2] published in 1993 the ideal characteristics for metallurgical-grade bauxite:

- High extractable alumina (+49 %)
- Low “reactive silica” (1.5 – 3 %, kaolinite)
- Low boehmite (< 3 %)
- Iron content (ideally 5 – 15 %)
- Low quartz (ideally < 1 %)

Following preliminary flow-sheet was designed for a beneficiation plant for 560 t/h of washed bauxite.

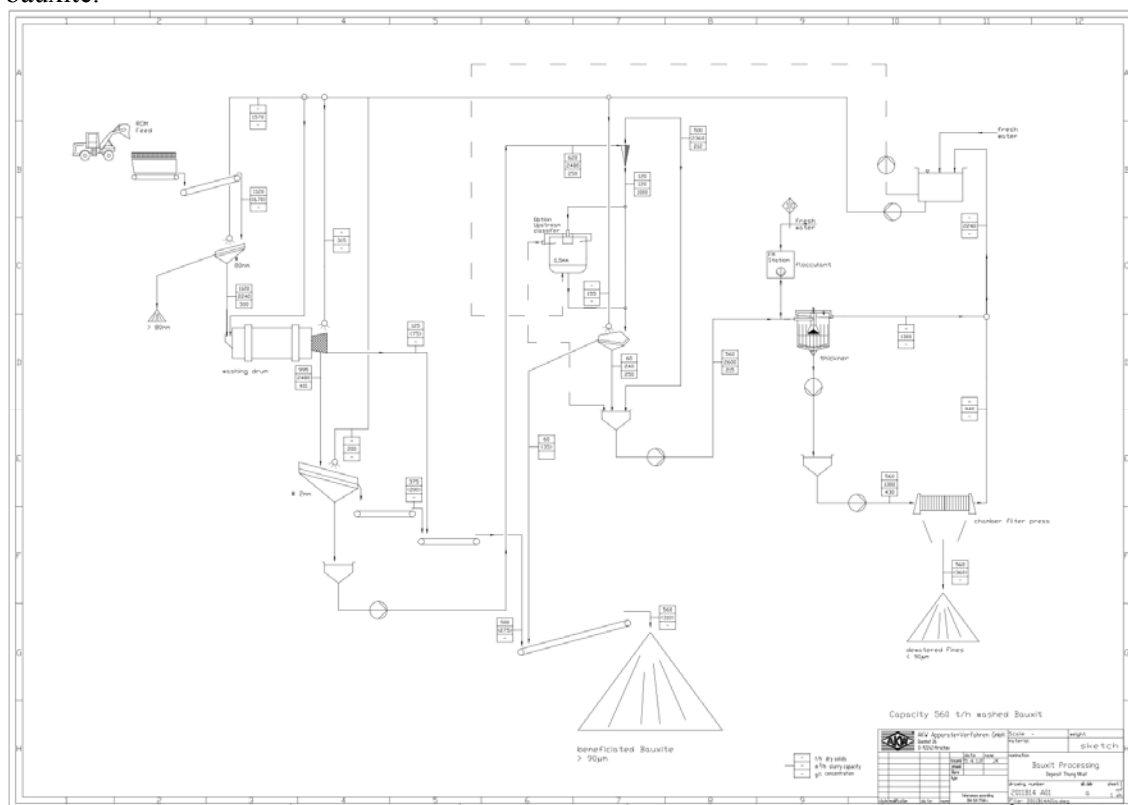


Figure 6. Preliminary flow-sheet of a washing plant for 560t/h washed bauxite.

4. Conclusions

The trend for an improved mineral processing of R.O.M. bauxite is likely to continue. Several reasons for a tailor made processing of the mined ore exist. Among these reasons the most important are:

- **Improvement of the sustainability of mining operations;**
By using adequate technology, it is sometimes possible to improve the lifetime of an existing mining operation. The advantage of this this option is obvious.
- **Improvement of the efficiency of the Bayer process;**
The mineral processing technologies to separate minerals with a negative impact on the Bayer process are existing and are used in mining operations of different ores. Besides gravity separation of coarse and fine material, magnetic separation has been tested with good success.
- **Improvement of infrastructure cost;**
The positive idea of hydraulic transport of bauxite slurry with pipelines will lead to a more advanced mineral processing at the beginning of the pipeline as well as at the end.

AKW A+V is looking forward to be a reliable partner for testing these processes for a given ore, as well as for planning and implementing a customized processing plant.

5. References

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