

BX03 - Bauxite Tailings Valorization: From Test Works to Industrial Scale Up

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Abstract



Since decades, AKW Equipment + Process Design has been exposed to bauxite washing and valorization, through the supply of a variety of proprietary equipment up to turnkey processing plants. To identify potential recovery rates of valuable bauxite and the possibility of improving the overall yield of the process, comprehensive test procedures are the first important step and constitute an important condition for reaching out reliable results and defining performance targets. Due to the advantage of an own state-of-the-art technical laboratory, we performed for a customer an extensive test work package on average bauxite samples. Through these skills and capabilities, we developed a customized process allowing the recovery of specific bauxite quality grades for both fresh tailings discharge and existing tailing pond, which drove the customer's decision to erect the corresponding processing plants. Specific test works were executed on fresh tailings originating from the existing washing plant and tailings originating from old dams. These tests showed the following improvement results: Gibbsite mineral content improved from 50.0 % up to 72.3 %, Al₂O₃ content improved from 41.2 % up to 48.5 % and A/S ratio: improved from 3,4 up to 11. Based on the test results, the process flow was defined, followed by the plant design and execution on a turnkey basis. With the installed processing plants, significant breakthrough was reached: 50 % increase of valuable product recovery for the bauxite washing plant resulting in longer lifetime of the deposit, and lower loading of the tailing pond and 50 % recovery of valuable fraction out of the old tailing pond resulting in additional product availability and maximizing the valorization of old resources and reuse of old tailings dams. The unique valorization principle and a detailed case study is presented on the basis of the above selected project.

Keywords: Bauxite valorization, bauxite washing, turnkey processing plants, customized process, technical laboratory.

1. General Information on Bauxite

1.1 Resources

Bauxite is a naturally occurring, heterogeneous material composed primarily of one or more aluminum hydroxide minerals, plus various mixtures of silica, iron oxide, titania, aluminosilicate, and other impurities in minor or trace amounts.

Over the last years, due to the general decrease in the availability of good bauxite raw material quality, the need and investigations for new bauxite valorization opportunities have gained momentum. This is particularly the case for bauxite tailings, which can in some cases constitute a powerful alternative to mined bauxite.

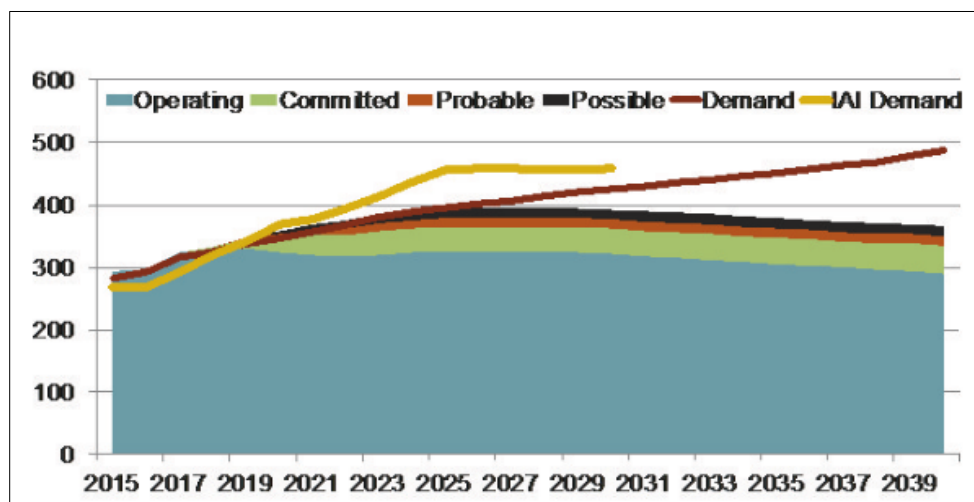


Figure 1. Current & predicated worldwide bauxite supply & demand, 2012-2039 (Mt) [1].

There are approx. 80 bauxite mines listed worldwide. The largest 8 ones, with capacities above 10 up to 25 mtpy, are mainly located in Australia, Brazil, Guinea and Indonesia. Most of the bauxite mines have capacities below 5 mtpy down to under 1 mtpy.

1.2 Qualities

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.

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

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

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



Figure 13. Processing plant fresh tailings.

50 % recovery of valuable fraction from existing bauxite tailings material: this results in additional product capacity and reuse of old tailings dams.



Figure 14. Processing plant stock tailings.

6. References

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