

Successful Experience in Organising Baked Anode Production at RUSAL Volgograd

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Abstract



The construction of new capacities that employ the aluminium production technology based on the use of baked anodes at RUSAL's sites increased the need for expensive baked anodes. In order to reduce expenses associated with purchasing baked anodes (BA), the Company decided to build its own capacity to produce BA (Taishet anode factory) and organise BA production at the existing mothballed anode paste operations (Volgograd anode factory). In 2016, a new project for establishing a BA production site, without sacrificing the anode paste production, was launched at the existing anode paste production site in Volgograd. To minimise the costs of organising the BA production site, the following modern and non-standard solutions were used in the framework of the said project:

- an anode-baking furnace has been built within the existing building of the mothballed potroom,
- the pitch coke calcination plant has been retrofitted to produce calcined petroleum coke with a 25 % increase in performance (for the first time in the world practice!),
- technological and construction solutions relating to the anode paste plant were developed, which made it possible to maximise the use of existing equipment for the production of green anodes,
- the existing gas treatment centres of the reduction area have been retrofitted to treat exhaust gases that are simultaneously supplied from the potroom and the anode-baking furnace, and
- energy-efficient technologies have been applied to ensure the complete utilisation of heat from the calcining systems as well as heat and electricity generation.

The project was implemented in the shortest possible time (design, procurement, construction), and the target design of 104 000 t of BA per year were achieved. Thanks to the implementation of the project, the volumes of BA purchased by the Company decreased, and the experience in organising a BA production site, which will be used in the construction of new production facilities, was gained. Quality performance figures of the produced BA correspond to the benchmark. This article provides information on pre-operational testing, start-up and commencement of the BA manufacturing process at RUSAL Volgograd, as well as production figures for the first year of operation.

Keywords: green anode block, baked anode block, paste plant, anode baking area, anode factory.

1. Introduction

Due to the construction of new aluminium production facilities using BA, RUSAL has faced a large shortage of baked anodes. To cover it, RUSAL purchases baked anodes in China. Given changes in the China's domestic legislation, there is a high risk of increased cost of anodes and that their supply will become unsteady. In order to replace Chinese imports and improve the economic efficiency of the Company, in 2015 it was decided to establish in-house production of green and baked anodes at RUSAL Volgograd facilities.

At the time the project was launched, the reduction area at RUSAL Volgograd was partially stopped and mothballed. The total design capacity of the anode paste (AP) production site is 185 000 t/ year. At the time the project was launched, the production was reduced to the amount demanded by the Kandalaksha aluminium smelter – 35 000 t/year and two potrooms of RUSAL Volgograd which was 35 000 t/year. The production capacities of 115 000 t/year were idle. In this regard, it was decided to use the existing reserve capacity and establish a BA production site with a capacity of 104 000 t/year. The project is planned to be implemented for a period of 24 months plus a 12-months period is scheduled in order to achieve the project indicators.

The general contractor responsible for the implementation of the project “Organisation of BA Production” is LLC RUSAL ETC. Within the framework of the project, modern and non-standard solutions were applied. The design activities were carried out by JSC RUSAL VAMI and JSC SibVAMI. The main equipment suppliers are the following companies: Riedhammer, Fives Solios, Storvik, FLSmidt, R&D Carbon, Mogensen, NKM Noel, Tomorrow Technology, Siemens, and PSP.

2. Application of modern and non-standard solutions during the project implementation

2.1. Retrofitting of the pitch coke calcination plant to be able to produce KEP-2 calcined petroleum coke

The calcining systems of the RUSAL Volgograd branch were designed to calcine pitch coke. For this purpose, they have been operated for many years. The design capacity of the calcining furnace for calcined pitch coke is 10 t/h. Considering the change in the anode paste production technology (calcined petroleum coke instead of pitch coke) at RUSAL Volgograd, the calcining systems have been mothballed since 1999.

The main difference between the petroleum coke calcination process and the pitch coke calcination process is a high temperature and a larger volume of gases from the calcining furnace due to the high content of volatile matter and coke dust in the petroleum coke. This requires the use of additional equipment (heat recovery and efficient gas treatment equipment, high-performance exhaust fans), the use of more heat-resistant materials, gas ducts with a larger cross-section, etc. Also, to ensure its own need for calcined petroleum coke, the furnace capacity should be increased up to ≥ 12 t/h.

To ensure the production of calcined petroleum coke with a real density of ≥ 2.06 g/cm³ and increase the furnace capacity up to ≥ 12 t/h, the following technical solutions have been implemented: systems for supplying secondary and tertiary air into the furnace have been installed, a new furnace lining with longitudinal baffle plates and tertiary air has been installed, the furnace's cooling grid has been reconstructed, and a waste heat boiler has been installed at the outlet of the gas path of the calcining furnace.

Thanks to the implemented technical solutions, calcined petroleum coke of anode quality with a true density of ≥ 2.06 g/cm³ was produced and the furnace capacity was increased by 25 % up to 12.5 t/h.

production and the anode baking parameters, the number of rejected anodes has been reduced to the design figures.

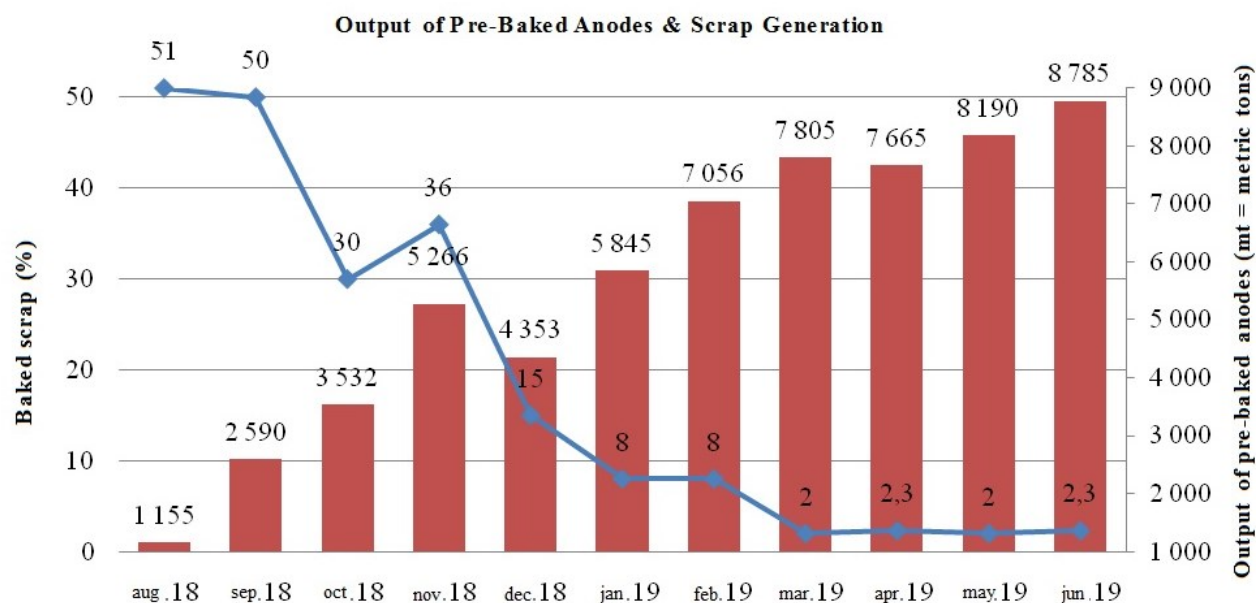


Figure 9. BA production and defective products volume

The quality of the produced BA: CRR > 90 %, the specific electrical resistance < 58 $\mu\text{Ohm}\cdot\text{m}$, the apparent density > 1.56 g/cm^3 , the mechanical strength < 50 MPa, the air permeability maximum 1.5 nPm.

5. Conclusion

The project 'Establishment of a BA production site at RUSAL Volgograd' was implemented in the shortest possible time (design, procurement, construction), and the project indicators of 104 thou. tonnes of BA per year were achieved. Non-standard solutions were applied to achieve these goals. Thanks to the implementation of the project, the volume of BA purchased within the Company was reduced, and an experience in establishing a BA production site, which will be used in the construction of new production facilities, was gained. The baked anodes qualities are at the benchmark level.