Rhodax green anode plants - 10 years of success

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Abstract

Over the last 10 years, Fives Green Anode Plant technology has been based on the Rhodax process. The Rhodax Crusher key characteristics are linked to in-bed compressive grinding which allows a selective crushing for higher green and baked anode density. The Rhodax process delivers a dry mix recipe with a high grain/sand (G/S) ratio to minimize thermal shocks of anodes. The simplification of the process is significant with respect to conventional processes and makes it a cost effective solution in terms of CAPEX and OPEX. With today seven plants under operation serving the production of more than 2.6 Mtpy of primary aluminum, this process has demonstrated its ability to produce high quality baked anodes with strong benefits on the energy consumption, thermal shocks and carbon consumption in pots. This ultimate process solution is proposed as a global package technology on a turnkey basis all over the world: Gulf, India, China, Russia, etc. As EPC contractor, Fives offers pioneering and cost effective solution for Green Anode Plant which combines high performance and sustainable development.

Keywords: Rhodax; Green anode plant; thermal shock; grain/sand ratio; Fives.

1. Introduction

With more than 200 years of industrial history, close to 8000 employees and 100 subsidiaries worldwide, **Fives** designs and supplies machines, process equipment and production lines for the world's biggest industrial players, in aerospace, automotive and manufacturing industries, cement, energy, logistics, steel, glass and of course in the **aluminum sectors**.

In the aluminum sector, Fives covers several fields of expertise:

- **Carbon** with the turnkey supply of Green anode plants (GAP), Crushing recycling units, Firing control systems, Fume treatment centers (FTC), Furnace tending assemblies (FTA), Anode rodding shops or Liquid pitch terminals ,
- **Reduction** with Gas treatment centers (GTC), Pot tending machines (PTM), Cathode transport cranes, Anode changing cranes, Anode beam raising frames, various pot equipment, Alumina transport systems and Bath treatment plants
- **Casthouse** with a thermal and turnkey expertise

With more than 50 references, the carbon sector flagship is the green anode plant. It is typically proposed with extended battery limits including, crushing & recycling unit, raw material storage, paste plant, forming, cooling tunnel and all associated utilities. For the past 10 years, Fives green anode plant technology has been based on the RHODAX® process.

2. RHODAX® history

The Rhodax process is the results of two parallel developments started in early 90's.
On one side, Aluminium Pechiney (AP now **Rio Tinto**) was validating a new concept of high Grain/Sand ratio (ratio [+300 µm] / [30-300 µm] far above 4 compared to usually not more than 2) which has been proven to be a key factor to minimize anode thermal shock problems [1].

On the other side, Solios Carbone (now **Fives**) had developed a new crusher for the mineral processing applications, the Rhodax, which key characteristics are linked to the in-bed compressive grinding principle:

- The outlet particle size distribution (PSD) is almost insensitive to the inlet PSD (graph in the upper part of Figure 1).
- Selective crushing takes place by preserving the hard and coarse feed particles (mostly baked scraps) while crushing preferably the weaker, porous or pre-cracked particles (mostly raw coke). In carbon anodes application, it prevents also from producing fine particles from the baked scraps.

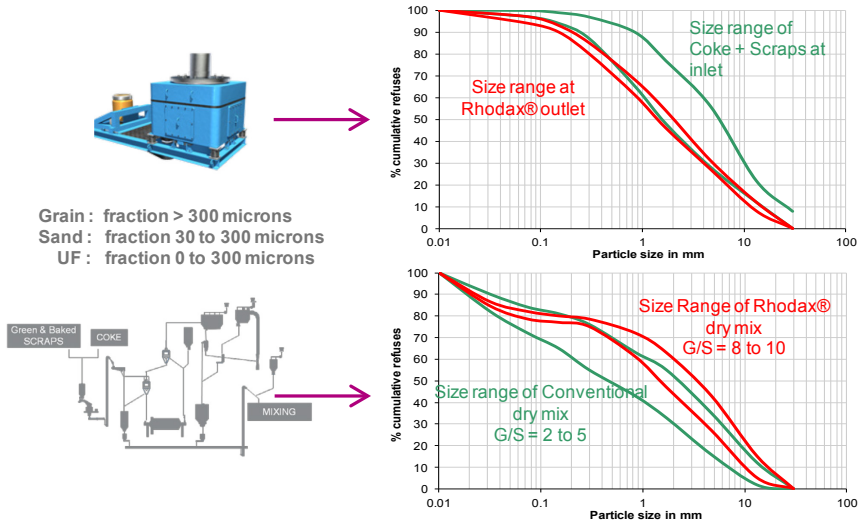

Figure 1. RHODAX® process – particle size distribution.

In early 2000's, Fives and AP joined their R&D efforts and co-patented the SCAP-RHODAX process (Figure 2) which consisted mainly in:

- Mixing all solids (raw coke, green and baked scraps) to crush them all together at the same time without any detrimental impact on anode quality (like for instance, impact of baked scraps sodium dissemination in the binder matrix)
- Producing a recipe based on two size fractions only leading to a drastic flow sheet simplification

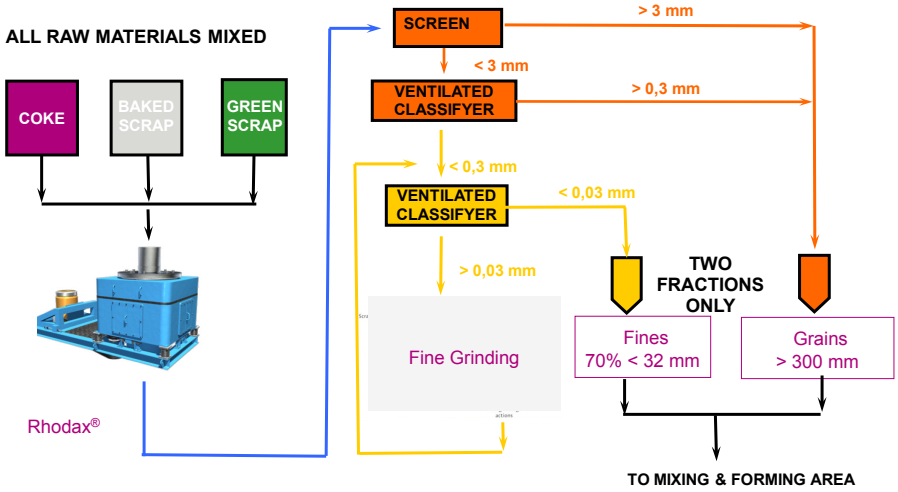

Figure 2. RHODAX® key process features.

with 7 green anode plant references, representing more than 1 500 000 mtpy of anode production, the Rhodax based baked anode properties are proved to be among the best-in-class and a major contribution to pot operation performance. It accounts why the main key player in the aluminium primary industry out of China have adopted this technology.

A further improvement is now proposed with the integration of the Horomill in place of the ball mill for the production of fines, in order to lower the grinding energy consumption, avoid the iron pollution and reduce the noise level.

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