AP Technology™ newsletter

Issue 21
February 2019
ap-technology.com

Rio Tinto

AP Technology™

Exceptional value delivery worldwide

Towards the smelter of the future

Editorial

Our technology centres continued to push technical development further in 2018, rolling out advanced technology bricks to improve the performance and robustness of the AP60/APXe and AP40 pot platforms. Furthermore, at our prototype hall in France, performance trials are underway to strengthen our ability to develop new technology bricks.

As technology bricks are made to be compatible with other technology platforms, you will have additional technical options to consider in the improvement of your plants and projects.

In 2018, our technology teams successfully reached major milestones, notably through:

- leveraging enhancements to our ALPSYS/RADAR products to set up remote technical potline support, providing technical advice to plants during technology upgrades and advising on areas of operation such as pot amperage creep, energy reduction or process optimization;
- deploying resources in the new field of data analytics, with promising results trialled in our plants;
- introducing the industrial version of MAX™, our autonomous anode transport vehicle, which is on its way to the Liberty Aluminium Dunkerque plant as I write this; and
- significantly improving the Anode Baking Furnace (ABF) fluewall design, with the ABF without headwall operating at the Rio Tinto Bell Bay Aluminium plant since early 2018.

Jean-François Faure
General Manager
Aluminium Technology Solutions group,
Rio Tinto Aluminium

Finally I am pleased to report that during the year, Rio Tinto Aluminium renamed its Technologies & Project Development group to Aluminium Technology Solutions. The team will focus on delivering value to its customers via the development and industrialization of innovative technological projects. We are now working even more closely with our colleagues in operations, who are central to our activities.

On behalf of the entire AP Technology™ team, I want to thank our customers for their longstanding support.

Please enjoy reading the interesting updates and news, and stay tuned for another year of advancement with AP Technology™.

> “Please enjoy reading the interesting updates and news in the following pages and stay tuned for another year of marching ahead with AP Technology.”

Spent potlining treatment – 2018 breakthrough

Breakthrough in the LCLL Technology – Significant Energy savings and a step forward in by-product valorisation

2018 was an exciting and challenging year for the Low Caustic Leaching and Liming (LCLL) Spent Potlining (SPL) detoxifying process team. An improved process was implemented in fast-track mode to provide greater energy efficiency and faciliate valorisation of inert by-products.

The "Breakthrough" project was initiated by Rio Tinto's Arvida Research and Development Centre (ARDC) in Saguenay (Québec, Canada), home of the initial LCLL process developed in the 1990s.

After small scale trials (20 per cent), full scale implementation followed in a record timeframe of under a year. Evaporation/crytallisation and causticisation (liming) sections were improved, with a 40 per cent reduction in steam consumption and an improvement in the quality of calcium fluoride (CaF2 or LCLL Spar) by-product (80 per cent CaF2 and reduced humidity at 33 per cent H2O).

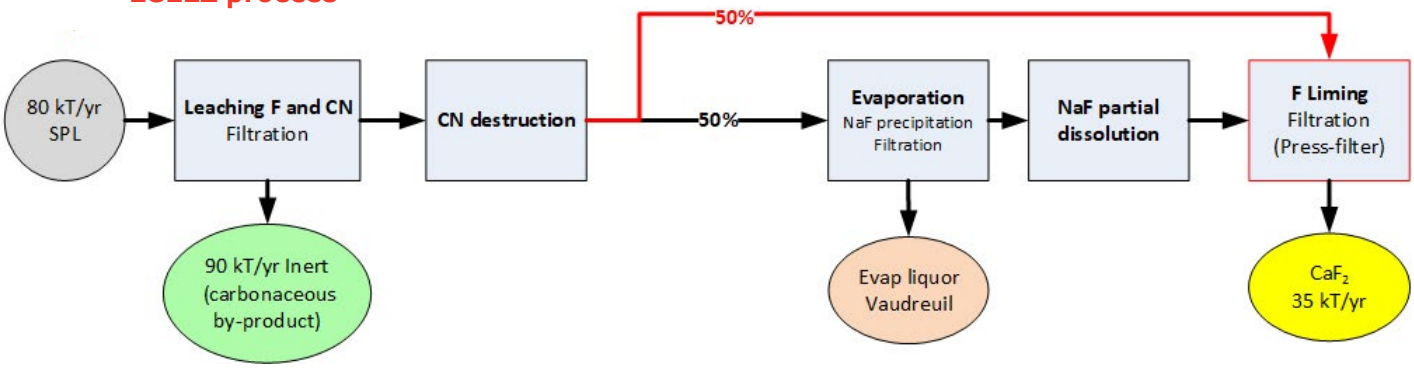
The improved LCLL Spar opened the path for full valorisation as raw material for Arvida's AlF3 plant, and as a fluxing agent in the steel and cement industries.

To complete the by-product valorization, plant improvements were made in recent years to enable the LCLL Process to be fed either by mixed, first (cathode) or second (refractory) cut SPL, depending on the target market (geotechnical, energy) or use (as raw material for cement plants).

With those recent improvements, LCLL technology becomes the best technology available for SPL detoxifying and valorisation.

Rio Tinto – Aluminium SPL Treatment plant in Saguenay, Quebec, Canada.

Breakthrough: LCLL2 process



LCLL Process "Breakthrough" – Bypass of the evaporation/crystallisation and press filtration of CaF2

LCLL Breakthrough team following project commissioning

News brief

ELYSIS

In May 2018, Rio Tinto and Alcoa announced a revolutionary process to make aluminium that produces oxygen and eliminates all direct greenhouse gas emissions from the traditional smelting process. To advance larger scale development and commercialisation of the new process, Alcoa and Rio Tinto formed Elysis, a joint venture company to further develop the new process, with a technology package planned for sale as of 2024.

SOHAR restart

In August 2017, following open circuit conditions due to a pot tap-out, the Sohar Aluminium potline completely ceased production, with all 360 AP40 pots frozen. With the support of the AP Technology™ teams, Sohar Aluminium safely restarted the potline within four months. The first pot was re-energized in mid-September 2017, and full production restored by January 2018. A Solid Recovery workshops organization implemented across the smelter enabled Sohar Aluminium to restart an average of three pots per day, with peak operation periods of up to nine pots per day.

With the courtesy of Sohar Aluminium

ALRO AP12LE

ALRO, one of the largest aluminium smelters in Continental Europe, and AP reached an agreement in April 2018 to implement at Slatina a new low energy reduction pot design (AP12LE) that will allow ALRO to reduce the amount of electricity needed to produce aluminium.

“Over the past 15 years we placed a strong emphasis on investments to increase the operational efficiency and reducing the energy consumption has always been a significant part of this programme”, said Gheorghe Dobra, CEO ALRO. “While the past investments helped us become one of the most efficient aluminium smelters in Europe, we still need fine tuning solutions to further lower the electricity consumption. We are confident that this agreement signed with Rio Tinto Aluminium will support our operational efficiency plans and will get us closer to our goal of becoming a Green Factory, Next Generation Factory, Innovating and Sustainable”.

This project aims at reducing the specific energy consumption by approximately 300 kWh/t, while maintaining the current production. The AP12LE technology targets an energy consumption below 13 kWh/t, from an average of 13.2 kWh/t from the AP9 pots type currently in use at ALRO, while maintaining current efficiency at its current level (more than 95.5 per cent). The AP12LE pots design is based on the “Technology Brick" approach, developed by Rio Tinto Aluminium and using new relining materials, new cathodes and metallic bar assemblies and slotted anodes.

Modernization of the plant will start in 2019 and take place in stages, in compliance with the pot repair schedule. The AP Technology™ experts from Rio Tinto will provide technical assistance both during construction, as well as during the operation of the new AP12LE pots.

With the courtesy of ALRO

Mozal AP3XLE

The AP3XLE project targeting 378 kA an 13.0 MWh/t is on track. The AP Technology™ package was delivered in 2018 and the expert missions to support its implementation took place in due time to allow the first AP3XLE pot to successfully start the 26 September 2018.

With the courtesy of Mozal

AP40 Alouette

Early 2018, the Alouette smelter embarked on the implementation of the AP40 technology at the 594 AP30 pots smelter located at Sept-Îles (Québec). This ambitious programme aimed at increasing production started mid-2018 and will take places in stages and in accordance with the pot relining schedule. It is taking a strong cooperation between the AP Technology™ team and Alouette operations team to meet the project milestones and targets starting with the 1st AP40 pot which was started in June 2018.

With the courtesy of Alouette

Liberty Aluminium Dunkerque

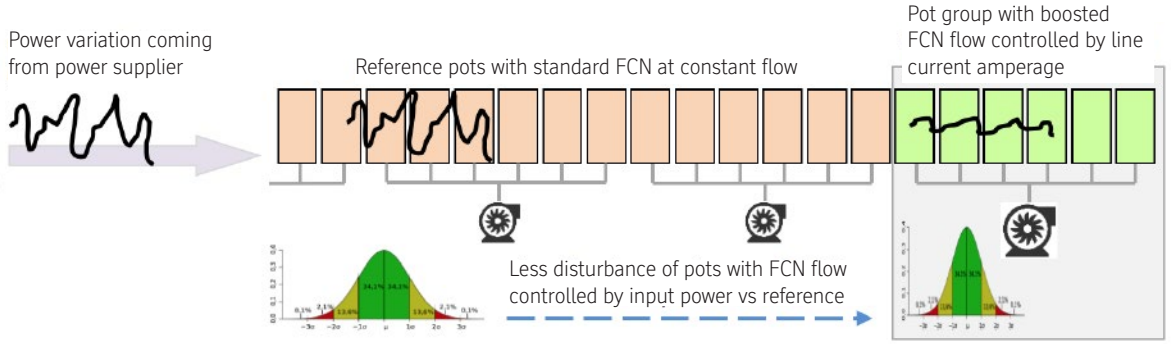
AP Technology™ team and Liberty Aluminium Dunkerque (LAD) are developing operational strategies to modify electricity consumption according to changes in energy prices.

The possibility of adjusting the side cooling with the forced convection network (FCN) should allow to regulate the power level in the pots and thus to undergo larger power variations.

Ongoing tests will demonstrate that the thermal impact of amperage variation on pots can be minimized using the following levers:

1. An algorithm for refocusing the intensity and catch up of part of the power losses after a modulation period;
2. Better control of the FCN flow rates, with boosted fan and fan speed control; and
3. An asymmetrical FCN, with increased ventilation to specific areas of the pot shell.

With the courtesy of Liberty Aluminium Dunkerque



Upgrade of the three pots @ LRF

For the last 50 years, the LRF has been at the leading edge of reduction technology development. Known as the cradle of the A18, AP30 AP60/APXe technologies, the LRF workshop is currently undergoing complete replacement of its three pots to support the development of Rio Tinto Aluminium 21st century technologies. The new pots will start during the year 2019.

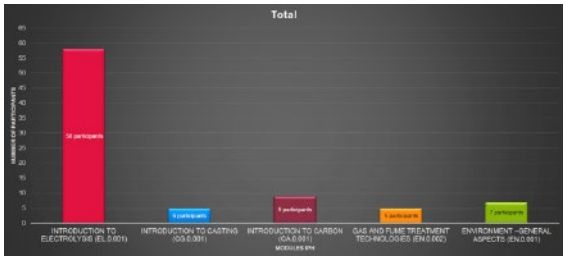
INCAL 2019

A team of six Rio Tinto delegates attended the 2019 INCAL conference & exhibition, held in Bhubaneswar, Odisha, India, from 31 January to 3 February 2019, focussing on growth and development of the aluminium smelting industry. We presented four technical papers covering a wide range of technical solutions:

- Innovation and development in alumina refining capability
- Low Caustic Leaching and Liming (LCLL) for the treatment and recycling of spent potlining material
- Expertise and methodology for improving aluminium smelter efficiency
- Evolution and perspective of ALPSYS pot process control to support productivity improvement

Technical training IPH: e-learning Hillside

To answer Hillside's technical training needs AP organized a virtual classroom last summer to provide to the Hillside staff, access to our IPH e-learning modules. Strong collaboration between IPH and Hillside teams contributed to the success of this first classroom for the 80 trainees registered.



Automated vehicles take it to the MAX

Driving the future of aluminium smelters

Designed to make work safer for its people, and to increase the efficiency of the aluminium production process, MAX, is also a world-first. Aluminium smelters are a new frontier for autonomous vehicles. The magnetic fields, indoor and outdoor traffic, dust and heat levels in the operations present a set of new challenges, and none of the available autonomous vehicles had been able to meet their specific requirements.

The prototype MAX 01 was developed by Aluminium Technology Solutions teams, and first went to work at the Dunkerque aluminium smelter in northern France. After a successful pilot there in 2014, we are now developing an industrial version of the technology, names MAX ANODE, which is set for first deployment this year.

MAX named for three key properties:

Modular, **A**utonomous, with the ability to cross (**X**) over different parts of the plant.

Bringing MAX to life

With no existing autonomous capability in the aluminium market, our ambitious mission was to bring MAX to life. The technology teams' goal was to pioneer a transportation solution that was safe, environmentally sustainable and that would increase productivity.

The heavy anode transportation that MAX is designed for has, until now, been done using specialised transportation trucks, driven by operators on rotating shifts. During its trial, the vehicle transported anodes between baked anode storage sites and potrooms through a variety of weather conditions. And in a series of tests of its emergency braking and advanced anti-collision safety system, MAX passed with flying colours.

A partnership of human and machine

Though MAX is unmanned, people are essential to its operation. Yet the arrival of autonomous technology can create uncertainty among an industrial workforce.

MAX is designed to complement existing manned vehicles and the employees who receive the material it is transporting. And although people aren't physically in the vehicle, they'll play an essential role in monitoring and maintaining MAX and in planning its missions.

Technologically, MAX is controlled by the Logistic Integrated Solution for Aluminium Fleet Management system: the "LISA FM". This system provides real-time updates on the status of each vehicle, inventory levels and storage locations, to determine where MAX should be, and when.

MAX ANODE

Once testing was complete, the prototype was considered a resounding success, and was showcased last year at the Autonomous Machines World conference in Berlin.

Rio Tinto has since been developing the industrial version – MAX ANODE – working in partnership with ECA Group, which specialises in robotics, automated systems and industrial processes. It's set for deployment at Aluminium Dunkerque in 2019.

Smelter of the future

MAX is but one part of the AP Technology™ smelter of the future, also known as the "4.0 smelter."

The aim is to develop a safe, profitable smelter model that appeals to employees, uses cutting-edge technology and taps into synergies generated by new collaborations with external partners.

Processing, sensors, modelling, control systems, data analytics and automation of Zero emissions, improved working conditions and new opportunities for market differentiation are among the research objectives.

Stats	MAX 01	MAX ANODE
Dimensions	5.3 metres long x 3 metres wide	8.5 metres long x 3 metres wide
Maximum load	5 tonnes	12 tonnes
Maximum speed	18 km/hour	15 km/hour

APM4: New generation AP Pot Micro… the countdown begins

2018 Launch of detailed design new generation AP Pot Micro to replace all prior generations (APM1, APM2, APM3)

2019 Prototype validation and industrial trial

2020 APM4 available for plant implementation

Key features of the APM4:

- Based on existing proven APM3 design
- Compatible with standard market remote I/O cards, ability to integrate dedicated card for specific needs
- Ethernet communication with I/O, compatible with ASI networks
- Web standardized user interface accessible through mobile devices like tablets
- Compiled code security
- Modern system tools (Open UNIX operating system and C++ development language)
- Graphic display

- A highly robust solution achieved via:
  - a fully decentralized pot control system with autonomous pot panel; and
  - a very fast equipment change-out in case of pot panel breakdown.

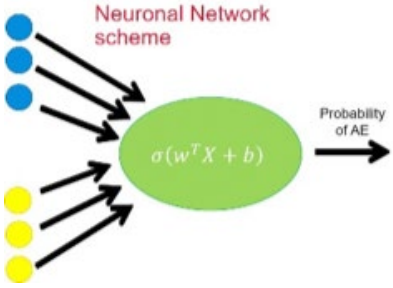
Anticipation of anode effect detection for preventive treatment

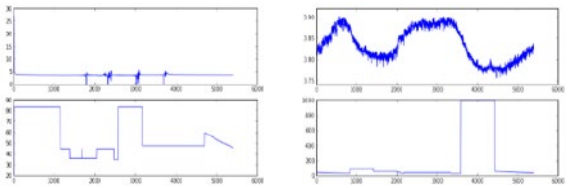
Rio Tinto developed a new machine learning algorithm that uses ordinary data (pot resistance, alumina feeding rate, number of feeders in use, etc) that does not need specific sensors. The algorithm uses Neuronal Network scheme capability to determine the probability of anode effect in five minutes.

Ninety per cent of the data recorded over the past years was used to train the neural network, with ten per cent used for testing. In testing, the model accurately detected more than 60 per cent of the anode effects, with zero false positives.

In light of these encouraging results, Rio Tinto decided to implement this algorithm in a future version of ALPSYS.

BIG DATA ANALYTICS





ALPSYS V15 is underway

2019 will be the starting point for the new ALPSYS V15 version. V15 contains as standard the latest features of the ALPSYS product encapsulated in a completely renovated HMI based on a solid, modern and efficient ergonomics.

2019 agenda:

- Three Go LIVE for UGB (Canada), MOZAL (Mozambique) and SOHAR ALUMINIUM (Sultanate of OMAN).
- A fourth project in TOMAGO (Australia) started in January 2019 for a GO LIVE in 2020

More successful testing of ALPSYS controlling pots of other technologies

AP has recently conducted another trial in a smelter equipped with non AP pots, proving once more that ALPSYS can successfully control such pots and improve performance. A standard ALPSYS version with a specific parameterization set was used for the trial.

Impressive results were achieved during the trial. The average pot voltage (day value) decreased by nearly 100mV; 95 per cent of all anode effects were treated automatically; and on the test group, the total anode effect overvoltage was reduced by 85 per cent. **ALPSYS is a proven and robust pot control system, capable of managing both AP Technology™ pots and pots using other technologies.**

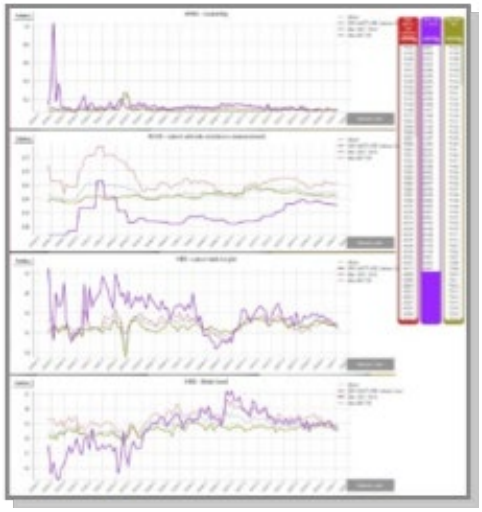
The ALPSYS team remains at the ready to demonstrate how the implementation of an ALPSYS pot controller in your smelter could benefit to the performance of your pots and potlines.

New RADAR tool for process experts

New RADAR application offers technical assistance to AP Technology™ experts:

- Displays all reduction data, even if the site has not yet installed RADAR
- New enhanced modules (i.e. advanced statistics, graphs presented by dates or by pot age, pot selection according to criteria)
- Family comparisons, even between different smelters

This new tool supports all AP Technology™ experts in their everyday missions. Dedicated reports are designed to save time on weekly follow-up.



Smelters around the world can be monitored remotely through RADAR.

RADAR deployment in 2019

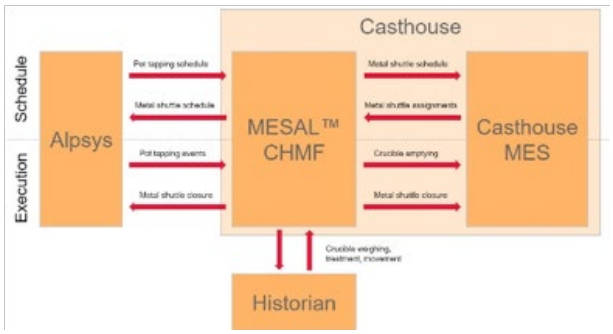
Three smelters are about to be equipped with RADAR:

- Grande-Baie (Canada)
- Mozal (Mozambique)
- Sohar Aluminium (Oman)

By the end of the year,
RADAR will be deployed in 11 smelters.

Hot Metal Flow

In 2018, Rio Tinto go lived the new version of Hot Metal Flow Management at the Grande Baie smelter (Canada). The new version allows full management of metal flow between the Reduction and Casthouse sectors. The solution consists of two sets of functions:

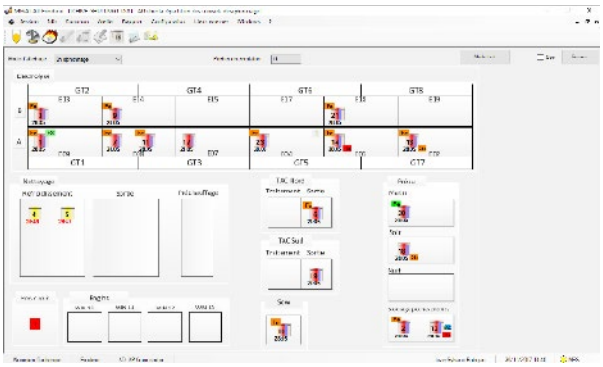


Scheduling functions

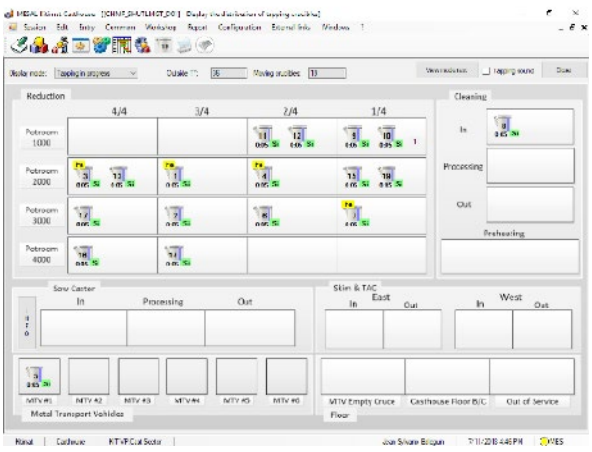
- Receipt of pot tapping schedule
- Assignment of pot to shuttles and scheduling of metal shuttles
- Pre-assignment of metal shuttles to casting equipment (furnaces, sow casters, ...)

Execution functions

- Management of metal shuttle (planned and actual)
- Management of crucible (graphical identification of current location)
- Management of metal reconciliation (Reduction versus Casthouse)
- Management of crucible life cycle
- Management of weighting equipment



Additional functionalities include the ability to embed specific display devices within metal transports vehicles to manage the crucible transport and real-time knowledge of all the actions on crucibles-movements, weighing, treatment and emptying.



MESAL™ 2019 agenda:

- SOHAR ALUMINIUM to upgrade its MESAL™ Solution in use since 2008 to the latest MESAL™ 4.0 version for the full smelter. This upgrade includes the full implementation of the new Hot Metal Flow Management function.

Anode Baking Furnace (ABF)

Innovating in anode baking furnace design to increase anode production

Bell Bay Aluminium in Tasmania (Australia)

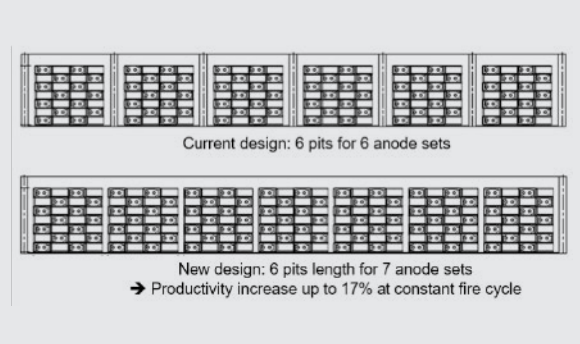
Reduction amperage creep leads to a higher demand in baked anodes. This is generally achieved in the anode baking facility through a fire cycle time decrease and/or furnace modification to accommodate bigger anodes. Negative effects are often less time for refractory maintenance, need for fine-tuned operation and process control (to manage higher pitch load), and a wider distribution of anode baking level.

In 2014, Bell Bay Aluminium's (Australia) target was to increase production by installing additional cells. This would meant an accelerated cycle time at the anode baking shop at a time when local operations were already facing challenges to maintain inventory. Out-of-the-box thinking was required to achieve increased production and avoid major investment.

After an exhaustive technical and economic review of all possible alternatives, Bell Bay Aluminium began collaboration with Rio Tinto engineering teams to implement an innovative design. The selected solution would meet production demand, while reducing construction and operation costs.

The NG Technology concept patented by Rio Tinto involves partial or total removal of headwalls to increase the anode loading ratio. The number of headwalls to be removed depends on the anode dimensions, to accommodate either an extra set of anodes or an anode dimension increase. Bell Bay Aluminium opted to remove five headwalls to create a 33 meters-long pit to bake an extra set of anodes.

The design phase lasted for several months, alternating between Australia (Bell Bay and Pacific Aluminium technology center in Brisbane) and France (Rio Tinto engineering team in Voreppe). Experience acquired in the development platform located in Grande-Baie plant (Canada), and the use of specific modelling tools were needed to predict future behavior of the long fluewalls (thermal dilatation management) and decrease the level of risk.

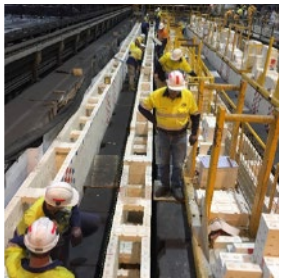


NG Technology prototype concept for achieving higher productivity

Construction started in December 2017 and lasted for 27 days. Construction activities were scheduled for day shifts only, and routine operations managed at night. Construction was completed within the available timeframe and without any safety incident under the leadership of Bell Bay operation construction teams and Rio Tinto experts in baking furnace design and process.

The industrial prototype has been successfully operated by Bell Bay Aluminium since December 2017 with Bell Bay and Rio Tinto continuing to improve the sustainable operation of this new technology.

Construction work



NG anode baking prototype overview

Results achieved

Expected performance met, with no impact on anode quality

Anode production	**+17%**
Installation cost	**-14%**
Gas consumption	**-35%**

ABF Brief

Liberty Aluminium Dunkerque

Innovative cross-over repair

Cross-overs are a critical part of the anode baking furnace. Monitoring their condition is critical for limiting their impact on the repair process and anticipating as much as possible any needed repair.

With the support of AP Technology™ refractory experts, Aluminium Dunkerque realized a critical maintenance operation on the refractory by using an innovative gunniting method. The impact on production was limited, and the repair of potentially serious damage a success.


Gunniting operation at Aluminium Dunkerque
With courtesy of Liberty Aluminium Dunkerque

Aluminium of Greece

AP Technology™ expertise in casing design to secure anode baking for the coming years

The Aluminum of Greece anode baking furnace was built in 1964 and extended in the 1970s. The 78 sections furnace underwent significant repairs at the end of 2018, with central casing walls replaced and insulation renovated. The AP Technology™ team combined technical expertise and experience with a similar project (Trimet smelter in St-Jean-de-Maurienne) to support AoG in the preliminary study and provided on-site support during execution to safety and successfully realize these major repairs.


Central casing wall replacement

Qatalum

Baffleless fluewalls condition review after 140 round of fires

Since 2010, Qatalum has operated two AP Technology™ furnaces. The 66 and 50 sections, nine fluewalls per section furnaces are equipped with the baffleless fluewall technology.

Qatalum and the AP Technology™ team performed a detailed review of the refractory condition and process performance last October. Observations made underlined the state-of-the-art operation and maintenance provided by Qatalum teams. Along with robust design, Qatalum internal fluewalls reached an expected average lifetime of 170 fire cycles and cross-overs and remains in good condition after eight years of operation.

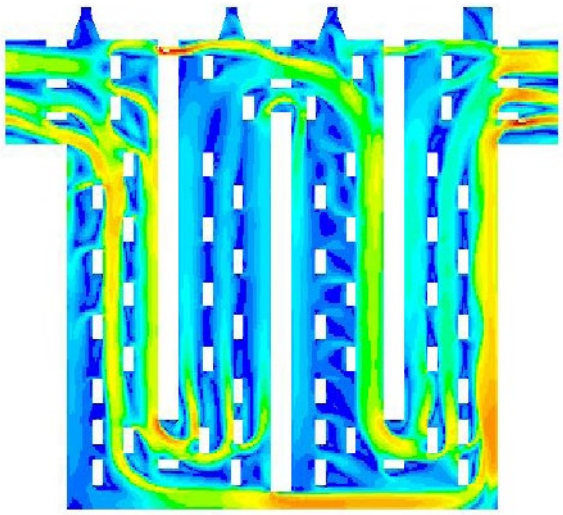
NZAS

Supporting next rebuild with modelling for fluewall design and internal design optimization

New Zealand Aluminium Smelter (NZAS) operates a 48 sections furnace with seven pits per section, originally designed by Alu-Suisse. NZAS is currently studying a potential partial rebuild of the furnace for the 2019 to 2021 period, with the support of the Rio Tinto Pacific Technology Center (PTC) located in Brisbane.

The AP Technology™ team supported NZAS and the PTC in optimizing the internal design of the flue wall. More specifically, modelling tools have been used to study the position and quantity of tie-bricks to improve the homogenous flow.

Given the AP Technology™ team's expertise in this area, the modelling and design optimization results were realized in a few days to meet the procurement schedule.



NZAS modelling

TMS 2019

San Antonio, Texas

Rio Tinto Aluminium will deliver the following presentations at the TMS2019 Light Metals Conference in San Antonio, 11 March to 15 March 2019:

Reduction

A Transient Model of the Anodic Current Distribution in an Aluminum Electrolysis Cell. We will present a transient model of the anodic current distribution that tracks the properties of each anode (age, dimensions, presence or absence of slots) and predicts the local current, anode-cathode distance (ACD) and current efficiency throughout the anodic cycle. More complex phenomena such as the deformation of the metal pad and the ledge formation around new anodes are also addressed. Extensively validated based on industrial measurements, the model can be used to gain insight into the behavior of the pot, estimate the local ACD, guide design and operating decisions.

Carbon

Anode Quality Monitoring Using Advanced Data Analytics. We will discuss MONSOON, the European H2020 innovation project dedicated to industrial process optimization through resources and energy efficiency. Rio Tinto and Liberty Aluminium Dunkerque (LAD) are among the industrial partners. The focus of our presentation is a two-component platform dedicated to the development and deployment of data analytics functions – built and used for paste plant process optimization at LAD. A method that uses real-time paste plant data based on machine learning techniques was developed to monitor the quality of the produced anodes and interpret the root causes of non-quality. The platform is yielding its first results.

Development of a New Baking Furnace Design Concept Without Headwall to Increase Anode Production Capacity.The subject of our paper is the new generation baking furnace design without headwalls. From proof of concept, to initial trials conducted at Rio Tinto's Grande-Baie plant (UGB), to implementation of the industrial prototype at Bell Bay Aluminium (BBA), we will cover the different phases required to successfully develop and test this breakthrough technology. Benefits contribute to increased productivity and reduced cost, depending on the implementation scenario (greenfield or brownfield projects).

Casting

Impact of the Main Casting Process Parameters on Floating Crystals in Al Alloys DC-Cast Ingots. We will present the findings of an impact assessment. Main casting process parameters include metal level, metal temperature, type of distributor bag, and use of a skim dam. We found how these parameters can be adjusted to obtain a homogeneous grain structure free from floating crystals, for use in applications that require a very uniform, high-quality surface appearance.

Reduction of Aluminium Ingot Cooling Time in DC Casting Process. Our presentation covers sheet ingot cooling time after casting, and how to reduce the cooling time of ingot in the casting pit to increase productivity. Two approaches were evaluated. The first method increased the cooling rate in the pit; the second method stripped the pit faster, with ingots at a higher temperature. A complete characterization of the ingot temperature was performed for each method. Constraints and issues were identified, and possible solutions to eliminate major bottlenecks were explored.

Additional presentations made over 2018 include

October – At the *Gulf Aluminium Council Carbon conference in Oman*, we presented the latest development on the New Generation anode baking furnace. At the *36th ICSOBA conference in Belem*, we presented a paper on Early Detection of Anode Incorrect Anode Positioning in a Pot, in which data from sensors that continuously monitor the current in individual anodes – together with machine learning techniques – have been used to elaborate an algorithm that predicts the anode current pick up, which is then used to evaluate anode positioning. The algorithm is currently being deployed on industrial cells and has been shown to greatly improve operators' decision making.

December – At the *12th Australasian Aluminium Smelting Technology conference in New Zealand*, the Rio Tinto Aluminium team presented three papers. One details experimental benches and modelling works that have been developed to respond to the challenge of alumina dissolution in high productivity pots, where bath volume available to dissolve alumina is considerably reduced. Another outlines the upgrade and implementation of a new rod assembly design for Boyne Smelters, developed to support amperage creep. The new design includes improvements to thermal mechanical robustness and thermal electric properties. The subject of our third paper examines an "in-house" imaging analysis system for process monitoring and control. The imaging analysis system performs real-time analysis of either digital video or images, then converts the analytical output into a measure of process performance and/or quality. This system has been used for bath detection on anode butts for sodium control; cast iron spillage detection for anode casting; anode rod fleet condition surveys/monitoring; and more recently, ingot casting surface finish.

Technology Sales department
725, rue Aristide Bergès - BP 7
38341 Voreppe Cedex
France

T +33 476 578 500
F +33 476 566 110

ap-technology.com

Rio Tinto Aluminium head office
400 - 1190 av. Des-Canadiens-de-Montreal
Montreal, Quebec H3B 0E3
Canada

T +1 514 848 8000
F +1 514 848 8115

riotinto.com
Mailing address
PO Box 6090
Montreal, Quebec H3C 3A7
Canada

The AP Technology™ team is committed to delivering innovative proven products in many critical fields to support increasing productivity and efficiency at your plant. Our technical platforms get upgraded with new technology bricks and allow adaptations of AP Technology™ solutions to best suit your own project configuration for unprecedented productivity and benchmark energy consumption.

Contacts
You can reach our AP Technology™ team at:

Bernard Allais — bernard.allais@riotinto.com
Saliha Cherigui — saliha.cherigui@riotinto.com
Benoit Feve — benoit.feve@riotinto.com
Claude Ritter — claude.ritter@riotinto.com

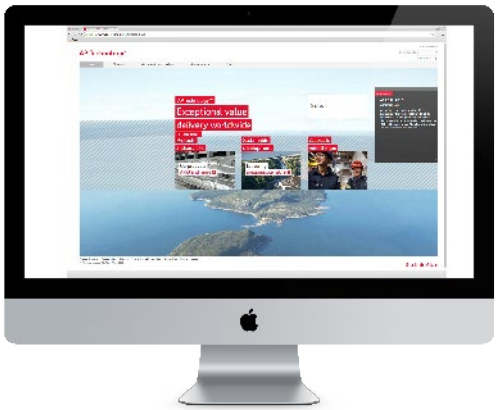
ALPSYS – MESAL
Julie Crombois — julie.crombois@riotinto.com
Aurore Escande — aurore.escande@riotinto.com
Gwenola Jaouen — gwenola.jaouen@riotinto.com
Pierre Trouiller — pierre.trouiller@riotinto.com

ANODE BAKING FURNACE (ABF)
Arnaud Bourgier — arnaud.bourgier@riotinto.com
Nicolas Tardy-Berger — nicolas.tardy-berger@riotinto.com

Design and production: tmdesign.ca

Visit our AP Technology™ website, where you will find our technical factsheets, our newsletter and more.

www.ap-technology.com



Visit our website at ap-technology.com