

The Rio Tinto logo consists of the words "Rio Tinto" in white, sans-serif font, set against a red rectangular background.

Anode Technology Leading the way



Sohar Aluminium, Oman
(courtesy of Sohar Aluminium)

Anode quality is crucial to the safe and optimal operation of any potline. Over the last years, we have focused on developing processes and technologies to constantly deliver high anode quality. Innovations include the SCAP-Rhodax[®], Bi-Eirich processes, and advanced baking furnace technologies.

AP Technology Anode Solutions

At Rio Tinto, we know what it takes to produce high quality anodes: state of the art know-how, unmatched industrial experience, continuous R&D and our advanced AP Technology[™] anode solutions. That's why we're recognised worldwide as the leader in designing, building and operating paste plants, anode baking furnaces and rodding shops.

Together these innovations provide you with the benefits of unrivalled performance, low investment costs, continuous process improvements, unprecedented reliability and simplified anode plant construction, commissioning and operation.

End-to-end services

Our flexible AP Technology[™] anode solution ranges from complete anode plant or baking furnace construction to plant retrofits. Our services include:

- Pre-feasibility studies
- Transfer of anode technology expertise through licensing agreements
- Basic engineering of the paste plant, baking furnace and rodding shop including all handling systems
- Detailed engineering of the baking furnace refractory, insulation and concrete casing
- Training at our Institut Paul Héroult Technical support during construction, commissioning and operation
- Refractory supply quality control services
- Lab analysis of raw materials, baked anodes and specific construction materials

Worldwide users of AP Technology™ anode solutions

	Production capacity (kt/year)	Complete anode plant	Baking furnace	Furnace retrofit
Alba 2	84			2002
Alba 4	169	2005		
Almahdi	72		2008	
Alouette 1	125		1992	2006
Alouette 2	169		2004	
Alro	135			2004
Aluar 2	76			2013
Aluar 3	184		2007/2009	
Aluminium of Greece	80	1965		2018
Boyne	235		2012	
Dunkerque	125	1991		2013
EGA Al Taweelah	330		2013	
Egyptalum	173	2000		
Hillside 3	70		2003	
Hindalco Aditya	197			2013
Hindalco Mahan	197			2013
Kitimat	250			2015
Kurri Kurri	100		2004	
Lauralco	125		1991	2014-2017
Maaden	480	2012/2013		
Mozal 1	135	2000		
Mozal 2	135	2003		
Nalco 2	105	2003		
Qatalum	340		2010	
Trimet Saint-Jean-de-Maurienne	150			2015
Sebree 1	33		2009	
Sebree 2	109		2011	
Sohar	200	2008		
Tomago 1	135	1983		2008
Tomago 3	83		2003	
Zalco D	82		2003	

Sohar Aluminium smelting showcasing our industry leading anode solution

- High productivity SCAP-Rhodax® process
- Capex efficient Bi-Eirich mixing line
- Lowest baking furnace capital expenditure due to nine pits per section
- Significantly reduced baking furnace energy consumption of 1.6 GJ/t
- New fluewall and headwall design ensuring refractory stability with heat expansion
- New fire process control methodology to manage short fire cycle and ensure complete combustion of volatile matters

Our state of the art anode solution is part of our AP Technology™ offer, the industry's most comprehensive smelter technology and services package.



Sohar Aluminium Baking Furnace (courtesy of Sohar Aluminium)

Improved HSE standard performance

Our commitment to health, safety and environment (HSE) excellence is reflected in our anode process technologies.

Our state-of-the-art AP Technology™ anode package includes, for example, bake processes that minimise waste and reduce environmental impacts. Thorough combustion of fuel and volatiles in the fluewalls ensure low tar content in the fumes. Our worldwide expertise and sophisticated modelling tools yielded a furnace design that minimises energy consumptions and lowers CO₂ emissions. A one-step dry fume treatment uses alumina to scrub the fumes without solid or liquid by-product rejection.

Emission performance (at stack)

	Specified	Typical
Total particules	<5 mg/Nm ³	<3.3 mg/Nm ³
Gaseous fluoride	<0.5 mg/Nm ³	<0.25 Mg/Nm ³
PAH 16 US EPA	<2.5 mg/Nm ³	<1.5 mg/Nm ³
Specific flow rate	<4,500 Nm ³ /t	<4,000 Nm ³ /t

Green Anode Process

With many paste plants in operation, we are focused on developing and optimising green processes to address the challenges of amperage creep and declining raw material quality.

Our innovative approach and extensive experience in green anode processes ensure you benefit from the best basic engineering, specifications, flow sheet and technical assistance, to produce high density anodes.

SCAP-Rhodax®: a state-of-the-art process

Developed in conjunction with Fives Solios in Aluminium Dunkerque Smelter in France, this high productivity paste plant process results in an anode with improved density and high resistance to thermal shock cracking. At the Alba, Sohar Aluminium and Ma'aden smelters, licensees use our SCAP-Rhodax® process to:

- Produce an aggregate with a naturally high grain-to-sand (G/S) ratio after the fines fraction addition
- Lower investment and maintenance costs due to the need of only two fractions as opposed to four or more on conventional preparation lines

The Bi-Eirich mixing line

The use of two Eirich continuous mixers provides an alternative to conventional mixing processes, reducing investment and maintenance costs while producing anodes with similar characteristics. We've gained strong industrial experience with this process at the Alucam (15 t/h), Sohar Aluminium (36 t/h), Kitimat (36 t/h) and Ma'aden (40 t/h) smelters.

High densification vibrating compactors with counter pressure and vacuum

Our industrial experience at Alma, Aluchemie, Boyne, Saint-Jean-de-Maurienne, Sohar Aluminium and Kitimat facilities enables us to help optimise vibrating compactors to produce high density anodes. These compactors increase anode density by two to four points with the absence of cracks (baked apparent density above 1.60 with typical coke quality).

Anode baking furnace

We constantly strive to lower investment and operating costs by providing:

- High anode production capacity up to 85 kt/year/fire and low refractory mass
- 3D modelling to optimise fluewall design for flow and temperature homogeneity, pressure drop and refractory deformation with heat expansion
- New fluewall concepts.

AP Technology™ advanced anode technology and know-how produce tangible results including:

Low energy consumption

Fuel (oil / gas)	1.8 - 2.4 GJ/t
Packing coke	5 – 10 kg/t

Homogeneous level of baking

Typical Lc average	30 – 35 A
Standard deviation	1 A

Average internal fluewall life currently over 150 baking cycles (about seven to eight years) assuming efficient anode butt cleaning in the rodding shop

Furnace retrofit capabilities include anode size increases, concrete casing (tub) modification and conversion of closed furnace to open furnace design.

New fluewalls are prefabricated outside the furnace which facilitates fluewall replacement and avoids slowing down furnace production during maintenance.

Rodding shop and anode handling facilities

Modelling and simulation optimise the rodding shop design (configuration, conveyor lengths, machine numbers and trolleys) and anode handling equipment (furnace tending assemblies, auxiliary cranes and conveyor layouts from the furnace to the storage area). For an existing operation, this resulting analysis allows to improve the rodding shop performance by reducing cycle time and enhancing reliability.

Technical assistance

Dedicated and experienced technical support is provided during anode plant start-up and operation:

- Green process optimisation leading to increased anode density and improved thermal shock resistance with high G/S ratio
- Baking process optimisation resulting in decreased gas consumption and tar emissions, and increased baking homogeneity and fluewall life
- Control of carbon dust problems including raw material specifications and baking process optimisation
- Raw materials and anode manufacturing processes optimisation supported by our R&D programme

Contacts**Technology sales department**

725, rue Aristide Bergès Centr'Alp - BP 7
38341 Voreppe Cedex France
T +33 (0)4 76 57 85 00
F + 33 (0)4 76 56 61 10
ap-technology.com

Rio Tinto Aluminium head office

1188 Sherbrooke Street West Montreal,
Quebec H3A 3G2 Canada
T +1 514 848 8000
F + 1 514 848 8115
riotintoaluminium.com