EXCLUSIVE INTERVIEW: PHIL MARTENS, CEO, NOVELIS
Aluminium has a bright future

Before I joined Aluminium International Today (AIT), my only contact with aluminium was as a consumer. I’ve owned many electronic devices with a brushed aluminium finish, starting a while back with a Grundig C410 tape player that I still own.

I don’t own an iPad, but since the new millennium I’ve rarely been without a cellphone and while the various cars I have owned probably owe their existence more to steel, I’m sure aluminium had its role to play.

Now, as I put the final touches to my first edition of AIT, I can honestly say that I know a lot more about aluminium – or ‘aluminum’ as they say in the USA – and can safely inform you that I’ve bored my wife almost to death on the subject of its recyclability and how, since production began back in the late 19th century, over 70% of all primary aluminium ever produced is still in existence today – mainly in buildings.

As she looked skywards and rolled her eyes, I might well have mentioned the fact that aluminium can be infinitely recycled without losing its strength and that UBCs – that’s used beverage cans – can be back on the supermarket shelves (as beverage cans) just 60 days after being sent for recycling.

As my wife reached for the kitchen knife, I didn’t have time to explain lightweighting or how aluminium might cost a fortune to produce, but it’s environmental benefits far outweigh the inherent energy-related problems associated with its primary production.

I never thought to mention that I was flying to Montreal to interview Orbite Aluminae’s founder, Richard Boudreault, about his revolutionary process to eliminate the industry’s red mud problem (see page 51) or that I was planning to take a short Delta flight from there to Atlanta to meet and interview (exclusively) Phil Martens, CEO of Novelis, a leading global player in UBC recycling and a major supplier of rolled aluminium to the automotive industry (see page 24).

Martens is optimistic for the future of aluminium. So am I. I’m also rather hoping you will enjoy reading this issue. Let me know.
Tata’s Ma’aden car plant

Saudi Arabia might find itself with a fledgling car industry is Tata Motors’ decides to set up an assembly plant next door to the Ma’aden aluminium smelter, a joint venture with Alcoa that is scheduled to start production in 2013.

Ratan Tata, chairman of Tata Motors, said that a car plant next to the Ma’aden facility might make an interesting business case, given the company’s commitment to aluminium in its products.

Refinery temporarily closed

An alumina refinery in China that is 33% owned by Chalco has been closed down temporarily on environmental grounds.

The refinery is located in Guangxi, South Western China and has been closed following an order from the Ministry of Environmental Protection last week.

As a result, the Guangxi Huayin Aluminium Company has shut down three of its five production lines. The company has the capacity to produce 1.6Mt/yr of alumina.

Tianshan Aluminium plans capacity boost

Tianshan Aluminium Co plans to increase capacity at its Shihazi, Xinjiang smelter to 1.8Mt/yr by 2015.

Tianshan is also planning to construct an aluminium processing plant with a 1Mt/yr capacity alongside a captive power plant equipped with 10 350MW generators.

UC Rusal cuts capacity

UC Rusal, the world’s largest producer of aluminium, plans to cut 150kt (3%) of aluminium capacity by the end of 2012, having originally planned to cut double that amount.

The move has been opposed by SUAL Partners, which believes that closing down the loss-making Aluminium Smelter Company of Nigeria is a far better option.

New Zealand Aluminium Smelters (NZAS) has announced that its planned 100 job cuts at the Tiwai Smelter in Southland will be completed by November 2012 and not over five years as originally promised.

The company said that NZAS was facing ‘unprecedented external challenges’ exacerbated by low international metal prices and a strong New Zealand dollar.

Tiwai is majority-owned by Rio Tinto Alcan, which earlier this year approached power supplier Meridian Energy to renegotiate a power supply agreement that was due to come into effect in 2013.

The smelter is powered by electricity from Meridian’s Manapouri Power Station, which was built in 1970 with the specific purpose of feeding the Tiwai aluminium smelter.

The planned redundancies are designed to make the smelter ‘resilient in any market conditions’ according to general manager Ryan Cavanagh.

Those losing their jobs will be paid two weeks for every year served up to 52 weeks, according to general manager Ryan Cavanagh.

Tiwai has a 750-strong workforce and is accountable for 9% of Southland province’s GDP. It contributes NZ$525 million to the local economy and last year spent NZ$391 million with New Zealand-based suppliers of which NZ$351 million was with local businesses.

Orbite seeks OTCQX investors

Canadian clean tech company Orbite Aluminae Inc, which has produced a process that can solve the aluminium industry’s red mud problem, has begun trading on the OTCQX.

The OTCQX marketplace is billed as the premier tier of the U.S. over-the-counter market where investor-focused companies can offer investors transparent trading, superior data and easy access through regulated broker-dealers.

Richard Boudreault, president and CEO of Orbite Aluminae, argues that his new process presents a very strong investment opportunity that will be available in the USA through Orbite’s presence on the OTCQX.

Aluminium International Today flew to Montreal to interview Mr Boudreault. For the full and exclusive interview, see page 51.

Midal Cables gets go-ahead

Bahrain-based Midal Cables international has been given the go-ahead to build a manufacturing facility at Tomago, New South Wales, next door to the Tomago smelter, a joint venture between Rio Tinto Alcan and Hydro Aluminium.

The new facility will create 250 jobs immediately and is likely to further boost the workforce in the medium-to-long term.

Midal’s AUS$30M planned operation will produce 50,000 aluminium rods and conductors for a range of industries including power transmission and distribution.

Vedanta to close alumina refinery

An acute shortage of bauxite has forced Vedanta Resources to shut down its 3Mt/yr alumina refinery in Lanjigarh, Orissa, India.

The company has submitted 26 applications to the state government for mining licences since mid-2007 and now has no option other than closure.

Vedanta’s problems began when the Ministry of Environment prohibited bauxite mining in the Niyamgiri region of Orissa.

Closure will increase production costs for state-owned Balco, a big Vedanta customer.

Russia courts the Chinese

Russian aluminium giant UC Rusal is seeking Chinese partners to set up production plants in Siberia where a ton of alumina costs US$1600 per tonne as opposed to US$2,250 in China’s Henan province – power is cheap too.

UC Rusal has set up a dedicated work team to attract Chinese investment and has signed a Memorandum of Understanding with the Chinese Non-Ferrous Metals Industry Association.

Electricity accounts for 45% of total production costs and 90% of Chinese smelters are losing money due to falling metal prices.

Emirates Aluminium (EMAL) employees celebrated the latest addition to its Phase II expansion: the arrival of the first completed Potshell and the superstructure – the two main components in the aluminium reduction process and key elements in EMAL’s plan to double production to 1.3 million tonnes upon completion in 2014.

IN BRIEF

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Hydro cutbacks to continue

Norsk Hydro is to increase in-house primary metal sourcing for its Neuss-Grevenbroich rolling mills instead of relying upon cold metal remelting, which is less efficient. The move forms part of Hydro’s ongoing optimisation efforts in the face of ‘challenging market conditions’, according to Oliver Bell, executive vice president of the Hydro’s rolled products business.

Hydro has secured a five-year power deal with Vattenfall, a Swedish energy group, totalling an annual 2.2 TWh (250 MW) and based on new and existing arrangements.

Since the company’s long-term power contract expired in 2005, Hydro’s Neuss plant, which is near Dusseldorf, has sourced power on a short-term basis. ‘Improved framework conditions’ and expected CO2 compensation means that the plant can resume some of its previously curtailed production.

Neuss has been operating at 50kt/yr due to weak global demand and depressed metal prices. The plant’s total production capacity is 230kt/yr, but when the CO2 compensation is in place, production will increase to around 150kt/yr during the first half of 2013.

Will Japanese banks fund Emal growth?

Emal claims that its safety record demonstrates its commitment to deploying high safety standards.

Alcoa wins drill pipe contract

Alcoa's oil and gas unit has won a contract to supply aluminium alloy drill pipes to Pennsylvania General Energy (PGE) for use in the Marcellus Shale, a unit of marine sedimentary rock found in Eastern North America.

The use of aluminium alloy drill pipes will enable PGE to drill deeper while using less energy. The 4.5in drill pipe, will enable PGE to drill to around 7,500ft, which, it is claimed, is around 1,000ft deeper than is possible using steel pipes.

The drill pipes are constructed from high-strength aluminium alloy tube incorporating proprietary thermal connection technology – meaning that the aluminium drill pipes can work with steel joints and pipes.

It is likely that aluminium drill pipes will find increasing usage in shale operations as they function well in horizontal drilling, which is common to gas operations.
80% recycled content

Novelis moves closer to 80% recycled content

Atlanta-based Novelis, a world-leader in rolled aluminium products, has today announced that it has moved a step closer to achieving its goal of using 80% recycled metals in its production processes.

The company’s second annual sustainability report shows an increase in the recycled content of its products from 33% to 39% one year after announcing its target of achieving an 80% recycled content by 2020.

The report, which received an A rating from the Global Reporting Initiative (the world’s most widely used framework for sustainability reporting) also recorded a 19% reduction in energy intensity, an 11% reduction in greenhouse gas emissions and an 18% improvement towards reducing landfill to zero.

Chief executive Phil Martens says that sustainability is driving the company’s business strategy and that a growing number of people want to buy products that lower their carbon footprint.

“By dramatically increasing the amount of recycled content in our aluminium sheet and applying innovation to our product development, we enable consumers to make sensible, environmentally sustainable purchasing choices,” said Martens.

Novelis is investing in new technologies and facilities to process a broader array of aluminium scrap.

In the past three years, the company has announced investments of approximately 810kt of increased global recycling capacity in Germany, Korea and Brazil and has strengthened its recycling collection systems.

The company recently set up the Novelis Sustainability Council, which includes ecological luminary Jonathan Porritt as a council member.

Beverage can recycling up 7% says Aluminium Association

The US recycling rate for used beverage cans (UBCs) has increased by 7% from 58.1% to 65.1% for 2011, although the increase is largely due to increased imports of UBCs from Mexico and Canada.

Where imported UBCs are concerned, the Aluminium Association has included them in its recycling rate since 1972 when it began reporting and claims that high demand in the USA for recycled aluminium cans is behind the 25% increase in imports in 2011.

Heidi Brock, president of the Aluminium Association, said, “We are excited to have made strong progress toward our goal to increase the aluminium can recycling rate to 75%, but we need the help of every American to continue to raise the rate. There is much more work still to be done here in the United States to reach our goal by 2015.”

The new figures mean that 61 billion UBCs were recycled in 2011, making the aluminium can the most recycled beverage container in the world.

Allison Buchanan, chair of the Aluminium Association’s can committee, said that the amount of energy saved from recycling 61 billion UBCs was equivalent to 17 million barrels of crude oil, which would fuel one million cars for 12 months.

It is also the same amount of energy used to produce the 29 billion plastic water bottles consumed annually by Americans. According to Buchanan, the ‘infinite recyclability’ of aluminium cans means that recycled UBCs can be back on the shelves within 60 days of being collected for scrap. In fact, aluminium cans not only have the highest recycling rate of all beverage packages, they also have the greatest amount of recycled content (68%).

Joe Pickard, chief economist of the Institute of Scrap Recycling Industries, said, “In 2011, aluminium recovered from purchased scrap in the United States increased 8% to more than 3Mt, while at the same time total US aluminium scrap exports rose 12% to more than 2.1Mt.

Vedanta calls for restrictions

Vedanta Aluminium has called upon the Indian Government to restrict exports of bauxite and instead support the country’s domestic requirements for the mineral.

Vedanta’s Odisha aluminia refinery has been operating at 70% capacity because it can’t source its daily bauxite requirement of 100,000 tons.

The company claims that some state governments are limiting the amount of bauxite mining leases and that such a practice cannot be justified as in the national interest.

According to Vedanta, the federal government should open new mines in eastern Odisha state where the country’s largest bauxite reserves can be found.

Limiting the amount of bauxite mining leases, it is claimed, is due to local protests over land acquisition.

Chalco’s loss

Higher fuel costs and weaker metal prices are blamed for Chalco’s US$510M first-half loss.

China’s biggest aluminium producer, predicted a first-half loss earlier in the year as prices remained low and raw materials and fuel costs soared.
If you can’t beat them...

Following Indonesia’s imposition of a 20% tax on bauxite and other metal ore exports, Aluminium Corporation of China, otherwise known as Chalco, has decided to invest in an alumina refinery in the South East Asian country. The investment comes from Chalco Hong Kong, a wholly-owned subsidiary of Chalco, and follows moves by Bosai Minerals (the global trading name of the Chinese Nanchuan Minerals Group) to invest in a $1 billion alumina project in Indonesia. The Chalco deal is with PT Indonusa Dwitama, a mining company.

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Power games

High-cost power contracts and low aluminium prices have taken their toll on several North American producers and the result has been more idling of smelter production capacity and more to come if the smelters can’t convince power suppliers to renegotiate their contracts. **By Myra Pinkham**

It isn’t that North American aluminium producers haven’t made a concerted effort to cut their power costs. Stephen Gardiner, vice president of communications for the Arlington, Va-based Aluminum Association, says that the primary industry in North America has reduced energy consumption by about 17% while increasing production. The cost of electricity continues to be a huge concern for producers, says Gardiner, noting that it accounts for as much as 40% of the overall cost of primary aluminium production. But there is a lot of upward pressure currently on power prices, says Prajit Ghosh, senior analyst for North American power research at Wood Mackenzie. This, he says is not just coming from federal environmental policies and regulations, but also the fact that a number of states have portfolio standards requiring that a certain percentage of electricity be generated by renewable sources, which tend to be more expensive. On the other hand, the push for development of the nation’s shale natural gas could reduce the cost of electricity that is partially generated using natural gas, says Kelly Driscoll, managing consultant for aluminium at London’s CRU Group, which would seem to indicate that this might be a good time for North American companies to renegotiate their power contracts. Natural gas prices are currently at a near all-time low at about $2.65/MMBtu compared with $12/MMBtu just prior to the economic downturn.

The problem, according to Edgardo Gelsomino, senior analyst, aluminium, at Wood Mackenzie, is that lower natural gas prices won’t necessarily drive down electricity costs for smelters as the power they use tends to be more coal-based.

Referring to the current cheap natural gas prices as an opportunity, Lloyd O’Carroll, senior vice president of research for Davenport & Co in Richmond, Va, says he wouldn’t be shocked if future domestic aluminium producers purchased land-based gas turbines to generate their own power. “They don’t need to be next door to the smelters,” he says. “Gas lines run to a lot of places.”

But while it won’t revolutionise North American smelting, low natural gas prices could result in a great abundance of coal and that in turn could cause coal prices to go down, Sion Roberts, research analyst for aluminium at CRU, maintains.

O’Carroll says that given current business conditions, you would expect more smelters to be idled than mothballed. This, he says, is because aluminium producers that have aggressively pursued subsidies remain viable – at least in the short-term. He says that such “deals” have implications for aluminium prices and, therefore, industry profits. “In our view, these deals keep aluminium prices lower than they otherwise would be. Marginal producers continue to operate after receiving a deal, which does nothing to eliminate the surplus in the market. Consequently prices need to go lower to eventually trigger production cuts at smelters unable to receive subsidies.

**Renegotiating or idling**

Currently, by some estimates, five or six North American companies are at the cusp of either renegotiating their long-term power agreements or idling production capacity. All of these, according to Driscoll, have tariffs that are on the high end of the power price spectrum. The most recent of such moves have been made by California-based Century Aluminum Co and Ormet Corp of Hannibal, Ohio. Toward the end of August Century Aluminum notified its power provider, Big Rivers Electric Corp, that it plans to cease all production at its Hawesville, Kentucky, smelter just a few days after it had issued a 12-month notice to terminate its power contract with Big Rivers.

“Our smelter in Hawesville is a great plant (that is) competitive on the global market in every category other than the price that we pay for electric power, which is among the highest such rates for smelters in the United States,” Michael Bless, Century’s president and CEO says. “The unavoidable truth is that the smelter is not economically viable with this power rate and under current market conditions. We need a power price that is reflective of the market, helps the plant weather these turbulent economic conditions and allows the plant to be competitive over the long-term.”

Inn documents filed with Big Rivers, Bless says that Century “has made a business judgement in good faith to terminate and cease all aluminium smelting at the Hawesville smelter and has no current intention of recommencing smelting operations” at the plant. A spokesman says that Century would continue operating the smelter for the next year and if current circumstances – either metal price or power price or some combination of both – change then the company will continue operating the plant, but if circumstances remain as they are, then it is the company’s intention to close the plant. Ormet, after announcing in July that it would be shutting one of the six pot lines at its Hannibal, Ohio, smelter because – according to Mike Tanchuk – the company’s chief executive officer, the price wasn’t viable to keep it running. At the end of August Tanchuk said Ormet would be shutting a second pot line as well, declining to speculate what the fate of the remaining four pot lines would be. Ormet had said in the past that in addition to low aluminium prices, a proposed power rate increase by American Electric Power Co would strain the smelter’s ability to continue operating.

Driscoll says that Rio Tinto Alcan is looking to renegotiate its power agreement at its Sebree, Kentucky, smelter in the hope that it will make it more attractive to a new owner. Also, Alcoa Inc. and Century have extended a deadline to decide whether it would seek a better power deal from June 30 of this year to June 30 next year. “The extension provides additional time for continued discussions with Santee Cooper (its power provider) regarding the development of a post-2015 power contract,” a Century spokeswoman says. Alcoa has also secured a power contract extension from the Bonneville Power Administration for its Intalco aluminium smelter in Ferndale, Washington.
Markets and costs are king

Expoaluminio 2012 held in São Paulo, Brazil in April, embraces the Fifth International Aluminium Congress, the Eleventh International Aluminium Recycling Seminar, and the Aluminium International Exhibition. The event offered roundtables and panels on strategic issues related to markets and costs as well as technical contributions on specific aspects of the industry. By Germano Mendes de Paula*

Expoaluminio 2012 was big. It consisted of 168 presentations, including six opening addresses, 15 keynote presentations, 48 workshops, 12 recycling seminars and 87 technical sessions. There were 1,570 delegates, 31% more than at the 2010 event, and 370 of them were linked to academic institutions. In total, there were around 12,500 visitors.

Global scenario
Marco Georgiou, head of primary aluminium and products at CRU, delivered a comprehensive presentation about the worldwide aluminium industry, emphasising the macro-economic environment, which is characterised by uncertainty. He said that while Europe has improved its situation, the risks surrounding high debt in Spain and Italy remain and that the high debt and austerity measures adopted will have a negative effect on European demand. The US economy experienced a good Q1 and while a sustained recovery is expected, the growth rhythm would be modest. During the same period, the Chinese economy decelerated while inflationary concerns in Brazil and India are expected to stunt growth.

CRU forecasts that demand for primary aluminium in China will expand from roughly 19Mt in 2011 to 21Mt in 2012 and to almost 24Mt in 2013. This will be equivalent to 15%, 10% and 11% year-on-year growth respectively. (Fig 1b). Despite the recent deceleration of the Chinese economy, therefore, aluminium consumption remains robust. For the rest of the world, demand is expected to grow by approximately 1Mt per annum, resulting in a 7%, 3% and 5% year-on-year growth respectively for the period 2011-2013 (Fig 1a).

Georgiou compared the forecast for aluminium demand in two important market segments: transportation and packaging. Fig 2a shows the consumption trajectory during the period 2010-2016 for six selected countries: the USA, Japan, China, Germany, India, and Brazil. As you can see, aluminium demand from these nations will expand from 10Mt in 2010 to 16Mt in 2016 where transport is concerned, implying an 8.1% compound annual growth rate (CAGR). China leads the pack, followed by the USA and Brazil – where demand is low.

Where packaging is concerned, there are some important differences. First, the size and growth rate are smaller than transport. The combined demand for packaging is expected to grow from 3.1Mt in 2010 to 3.6Mt (Fig 2b), resulting in 2.5% CAGR. Such low dynamism is partially explained by the fact that consumption in the USA – the largest consumer – is diminishing. China is in second place, while Brazil has a prominent role in this particular market segment.

Where primary production is concerned, the contrast between China and the rest of the world is quite evident. CRU stressed that 3Mt/yr capacity is going be added in China in 2012 from 19 green field and major brown field projects. These are mainly located in Xinjiang, Gansu, Guangxi, Inner Mongolia, Ningxia, Qinghai, Shaanxi, and Shandong provinces. Elsewhere in the world, production will be stable in 2012, thanks to a combination of factors: production curtailments in some places (Alcoa, Klesch, Hydro and Rio Tinto Alcan in Europe and Australia) major disruptions in others (Rio Tinto Alcan in Canada) and large-scale greenfield projects (Mahan in India, Ma’aden in Saudi Arabia, Boguchansky and Taishet in Russia, and Press Metal in Malaysia), on the other.

Georgiou predicts that, during the 2012-2016 period, the smelter capacity in China will enlarge by 12.7Mt/yr, of which 9.0Mt/yr will be realised between 2012 and 2014. With the rest of the world already considering capacity cuts, the respective figures are 5.0Mt/yr (2012 to 2016) and 3.2Mt/yr (2012 to 2014). In this way, the global aluminium industry’s excess capacity problem can be aggravated.

The remarkable performance of China in terms of growth in production and demand is not derived from cost advantages. On average, the cash costs of Chinese producers were approximately 20% higher than the rest of the world in 2011 and this is clearly related to higher power tariffs. The left axis of Fig 3 highlights regional production and the importance of energy sources (nuclear, gas, hydro and coal). China was top of the pile with 19.5Mt, followed by Europe (4.7Mt), CIS (4.6Mt), Middle East (3.8Mt), Canada (3Mt), Australasia (2.3Mt), Central and South America (2.2Mt), the USA and Asia (2.0Mt each), and Africa (1.8Mt). In China, 87% of the energy came from coal and 13% from hydro. In the Middle East, 97% were supplied by gas and 3% by hydro. In Central and South America, 86% were fed by hydro and 14% by gas.

The right axis of Fig 3 shows the

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average tariffs paid by smelters in different regions of the world in 2011. China unquestionably had the highest costs, with nearly $65 per MWh. Europe was in second place with $44 and then Central and South America, $40. The costs for the rest of world varied between $39 (the USA) and $25 (Middle East).

Cost competitiveness

Expoaluminio 2012 featured an opening section on the cost competitiveness of the Brazilian aluminium industry. Adjarma Azevedo, president of the Brazilian Aluminium Association (ABAL), declared that the country’s aluminium industry will need to invest roughly $33 billion up to 2025 in order to address the growth of domestic demand.

According to Azevedo, Brazilian aluminium consumption increased by 9.8% CAGR in the last five years. This was derived from a higher income, in general, and by the emergence of a so-called “new middle class”, in particular. As a consequence, Brazilian demand reached 1.45Mt last year, putting the country among the 10 largest aluminium markets in the world. However, the situation is not so positive where per capita consumption is concerned. In 2011, Brazil consumed 4.3kg of aluminium per inhabitant, which is considerably lower than other nations, such as the USA (31.3kg per inhabitant).

If the forecast made by ABAL is correct, the Brazilian aluminium market will triple in size over the next 14 years. Furthermore, 250,000 direct jobs will be created, remembering that currently the industry employs directly 144,000 people. It is worth noting that recycling activities have created an additional 150,000 indirect jobs.

Despite such a positive perspective, ABAL stressed the risks of de-industrialisation, due to increasing imports, which rose from $600M in 2009 to $1.18bn in 2010 and to $1.67bn in 2011. The country’s global trading in aluminium might switch from surplus to deficit (in tonnage terms) this year or next and let’s not overlook the closure of two smelters in recent years – Valesul and Novelist Aratú.

The country’s five main producers – Norsk Hydro’s Aleras, Alcoa, BHP Billiton, Novelis, and Votorantim Metais CBA – experienced a 6.8% decrease in production in 2011 when Brazil’s primary aluminium was 1.44Mt, compared with 1.53Mt in 2010. Production is expected to reach 1.48Mt this year.

Electricity costs represent the crucial competitive disadvantage of the Brazilian aluminium industry, which is currently equivalent to 50% of total costs. Nevertheless, the government has recognised the competitiveness hurdles faced by the industry and last summer established an Aluminium Committee to solve (or at least mitigate) the problems. While a practical outcome has yet to be reached, the companies concerned are optimistic about governmental commitment to improve conditions for the country’s aluminium sector. In the same panel, key executives of the aluminium companies operating in Brazil explained their plans.

Alcoa

Franklin Feder, president of Alcoa Latin America and the Caribbean, used his presentation to clarify news about a possible closure of the Poços de Caldas plant (State of Minas Gerais). Feder said that the company had started discussions in 2009 with the federal government stressing that if the electricity costs were more competitive, Alumar could improve its production from 450kt/yr to over 1Mt/yr. Since then, the global aluminium situation has deteriorated and prices have decreased by 30% and stocks remain high.

As a consequence, Alcoa reduced its world aluminium capacity by 12%. Brazil was not included in Alcoa’s initial capacity cuts. In fact, in March, the company postponed its decision for 60 days, due to a request made by President Dilma Rousseff. According to Feder, the company has never considered closing down the entire Poços de Caldas plant – only the smelter. If this happens, Alcoa will use 220MW to feed Alumar and, consequently, the electricity contract with Eletronorte will be interrupted. At the time of the conference, Alcoa had not found a definitive solution to cost reductions or making their operations more competitive in Brazil, but it observed potential advances.

In June, Alcoa CEO Klaus Kleinfeld met with President Rousseff in Brazil and stated that Alcoa will keep its smelters at Poços de Caldas and Alumar because of the government’s commitment to reducing the burden of energy costs on aluminium producers. Instead of a major capacity cut, it will only make “adjustments”.

Last year, Alcoa’s total sales in Brazil reached $2bn, with extensive upstream and downstream activity. The company is considering investing mainly in finished products for transport, packaging, and construction. Feder explained that Embraer, an aircraft manufacturer, is one of Alcoa’s largest customers in Brazil, but added that there was not enough scale yet to justify local production of alloys for the aerospace industry.

Novelis

Marco Antonio Palmieri, president of Novelis for South America, highlighted the company’s strategic intention to diversify its customer base. Currently, Novelis’ activities in Brazil are many associated with packaging. Brazil consumes about 18.5 billion aluminium cans per year and has the highest recycling rate in the world, with a 98% ratio.

The aluminium foil market is responsible for 80% of Novelis’ business in South America and the company wants to go beyond traditional aluminium cans in order to double sales in Latin America by 2017. Its plan includes a large investment in Brazil by 2013 and tackling the automotive segment.

Last year, South America represented 12% of Novelis’ global turnover ($1.2bn) and Brazil accounted for most of that amount, being the hub of business in the region. Novelis plans to invest $385M on expanding its rolling capacity to 600kt/yr at its Pindamonhangaba facility in the State of São Paulo. It will also enhance the painting line and double the recycling capacity to 390kt/yr.

Besides traditional beverage cans, Novelis has a medium-term strategy to improve the importance of Brazil in its global ranking. Roland Harings, vice president of Global Automotive, was also...
a keynote speaker at Expoalumínio 2012, and declared that the company wants to spread the use of aluminium in vehicle bodies. Harings argued that aluminium leads to a 45% lighter end product, which means less fuel consumption and reduced CO₂ emissions. For every 100kg in saved weight, fuel economy reaches 0.3-0.5 litres per 100 kilometres, implying an 8-11kg CO₂ reduction.

Novelis believes that automotive businesses must begin to take prominence in Brazil over the next three years as automakers in Brazil already use Novelis products in other countries, making business negotiations straightforward. Harings didn’t rule out the construction of another factory in the country to meet new demand.

Norsk Hydro Albras
Jorge Luis Nunes, president of Albras, part of Norsk Hydro, stated that the company could sell more primary aluminium in the domestic market. Albras, a 460kt/yr smelter in Barcarena (State of Pará, in the northern region), was constructed originally to service international demand. Since 1998, it has been servicing Alubar, a cable and rebar producer also in Barcarena.

Today, Albras is supplying about 34kt/yr of aluminium to Alubar. More importantly, in 2012, it reached a deal to sell 36kt to Novelis. As a result, the company will sell 70kt to the domestic market this year despite logistical difficulties. Nunes said that transportation costs from Albras to Rotterdam are cheaper than from Albras to Brazil’s South-eastern region.

According to Nunes, Albras’ domestic sales might improve further if the Government reduces the cost of electricity, although such a move, which is under consideration, will not benefit exports.

Norsk Hydro stressed that the greenfield Companhia de Alumina do Pará (CAP), to be built at Barcarena, has been postponed but not cancelled. The new alumina refinery was scheduled to start production in 2015 using bauxite from Hydro’s expanded mining operations at Paragominas. Phase one will have a 1.86Mt/yr capacity. Hydro retains an 81% stake in CAP, with the remaining 19% held by Dubai Aluminium Company (Dubal). Construction was delayed due to global economic uncertainty and supply and demand issues.

Votorantim Metais CBA
João Bosco Silva, CEO of Votorantim Metais CBA, stressed that the company is 85% self-sufficient where electricity is concerned. However, this competitive advantage is under pressure as concessions from hydroelectric facilities expire from 2015 and there is a lot of uncertainty surrounding the regulatory framework of the electrical system.

Another uncertainty concerns the new mineral regulatory framework, which will be submitted to the National Congress this year. Additionally, some important States (Minas Gerais and Pará) began to charge new mineral supervision taxes. While these new taxations focused on iron ore, which might serve as a disincentive for bauxite mining activities.

Chinese exports
While the Brazilian import tariff for aluminium is roughly 12%, some States have been conceding fiscal incentives for imports, which has become known as “harbour war”. Despite the recent devaluation of the local currency in 2012, it has appreciated considerably since 2008 and Silva stressed that a rise in value of the domestic currency tends to foster imports. He paid particular attention to parity with the Chinese yuan.

Votorantim Metais CBA said that Chinese aluminium producers receive tax rebates for exporting finished products and disincentives for selling low value-added aluminium products abroad. Silva emphasised the threat caused by Chinese exports to the world in general and in Brazil, in particular.

Uncertainty at both a global and local level has devalued the attractiveness of investing in the Brazilian aluminium industry. The sector is in a stand-by position waiting for more competitive trading conditions in order to sustain its primary aluminium output.
How technology saves the Chinese aluminium industry

It's not hard to understand why China is so important as a market for aluminium.

Over the last 30 years there has been a breathtaking economic development – especially since 2001 when China joined the World Trade Organisation (WTO).

Add to this a vast population, an inevitable shift towards urbanisation, much improved per capita wealth and low penetration rates and aluminium was always going to be highly strategic to China's ongoing economic, strategic and political success. That important position is likely to remain for many years to come.

Less clear is why the country continues to build new smelting capacity when resources are scarce, operating costs are high and the environment is deteriorating.

China now represents close to 50% of the world’s aluminium supply, with 25% of the world’s population, with finite supplies of bauxite, a heavy reliance on coal as a source of fuel, and with a production cost differential that sits well above the average for the rest of the world. Indeed, almost since the western aluminium industry started taking notice of the Chinese, China’s smelters have consistently sat in the top or fourth quartile on cost curve analyses (Fig 1).

There are many reasons behind this mismatch including a low barrier to entry, insufficient policing of environmental regulations and problems for foreign corporations entering China and being able to export profits. And let’s not forget the role of government intervention.

Research and development (R&D), however, has been key to the development of new smelters and how they are operated. China’s efforts in R&D have grown over the last 20 years across several aspects of the conversion process from red dirt to shiny metal. Where China used to be regarded as a copier of foreign technology, the country is now one of the world’s leading technology innovators.

For many years, China’s aluminium smelters were based on Soderberg technology, a methodology that the rest of the world has largely (though not completely) discarded as inefficient and environmentally unsound. The first Chinese prebake smelter was built in the 1970s, although these early facilities were still relatively inefficient, and well behind prevailing Western technology. A good deal of the original prebake technology came from Russian influence, as had the original Soderberg designs.

There were some initial contacts between China and the West. Aluminium Pechiney, later purchased by Alcan and now part of Rio Tinto Alcan, had initial discussions with Chinese producers with a view to introducing French AP technology.

There were suspicions and accusations that the Chinese had copied some aspects of the French design, and eventually the French went in other directions.

With the development of the Guiyang and Shenyang design institutes, otherwise known as GAMI and SAMI, technology design and development took off. Within a few years – and much to the alarm of the French and others – the Chinese were looking at exporting their technology. Chinese smelter designs were soon employed in Kazakhstan, Iran and other “second tier” countries, including India.

The abolition of Soderberg plants in 2004/2005 caused a major spurt in smelter capacity. The ruling that forced Soderberg plants to close included a clause allowing plants to be re-built as prebake. By so doing, many facilities doubled or tripled in size, and total capacity for the country accelerated.

This rapid growth in smelting capacity caused large shortages of alumina, forcing China to increase imports. The result was a spike in prices.

Rising prices prompted the Chinese to invest heavily in new refining capacity. The adage “practice makes perfect” was more than apt in this instance and China has become highly proficient at building alumina refineries, thanks to the combination of huge demand, high import costs and relatively low bauxite prices.

China has now become so efficient in building alumina refineries, with more than 50 “trains” built in the last few years, that foreign companies have been copying Chinese design. A-Z China is aware of one very large Western producer of alumina that paid more than US$1 million to reverse-engineer Chinese technology for its own applications.

For many years now, the West has been chasing amperage. The logic being that increasing aluminium output from the pot on a daily basis increases revenue and improves profits. Since the 1980s, the average pot amperage has climbed from the 150KA-180KA to more than 400KA and this has come at a cost – greater electricity consumption. This factor has not

*Paul Adkins, owner, A-Z China Ltd
been ignored, but the focus on metal output has a higher priority.

China’s aluminium smelters, however, did not spend so much time focusing on increasing amps, but instead sought to find ways of reducing specific electricity consumption. This was partly because China was considerably behind the west, with consumption rates running at well above 15,000KWH/t in many plants. That consumption rate was especially punishing, with the cost of electricity in China sitting well above equivalent prices in Western countries.

Electricity prices have continued to rise in recent years, exceeding inflation. While corporations, especially state-owned companies, can negotiate with electricity supply companies to seek better prices, the industry has marshaled its own resources to focus on reducing specific electricity consumption rates. A virtual electric cattle prod has done the trick.

The result has been a 20% industry-wide drop in specific electricity consumption, even though average amperage has risen. On a plant-by-plant basis, the results are even better, with some plants achieving below 12,000KWH/t on a DC basis, and running at better than 400KA. Even on an AC basis, the Chinese have been working to push current efficiency up. The best plants in China are now achieving 95% current efficiency.

The Chinese have achieved this partly by making performance trade-offs. By shrinking the gap between anode and cathode (the “ACD” or Anode-Cathode Distance), electricity consumption rates can be reduced, but this has many side-effects. For the last four or five years, China has been focusing on reducing the ACD by redesigning the cathode. So-called Profile Blocks, or Chocolate Blocks have now been deployed in several smelters across China, including 500KA pots. These blocks generally include a channel running the length of the block and a cross-channel running across the middle of the blocks. The height/depth of the channel varies, as does the width, according to the various iterations and experiments that have been performed over the years. The most recent versions seem to show that the channels are shallower, but a little wider.

Interestingly, most of these new profile blocks have been produced using amorphous raw materials, not petroleum coke. In cathode terms, this means the block is graphitic. The trend over the last 10 years in the West has been to move to petroleum coke blocks, using a graphitising process.

Graphitised blocks are meant to be better for higher amperage pots, where the current density can be at the upper limits. The Chinese didn’t get the memo.

Graphitised blocks have just been introduced into Chinese pots. There was a lot of resistance for many years, simply because they were significantly more expensive than the amorphous kind. “Whole Life” calculations did not apply in a situation where the person making the decision had to show that he was reducing direct costs. In China there is a tendency to buy on price without focusing on the most economical selection.

**Bottom to top**

The bottom of the pot isn’t the only place where technology is being deployed.

The Chinese understand that carbon is a potential limiting factor. Supply of anode-grade petroleum coke, the main ingredient for producing an anode, is tenuous and requires oil refineries to continue producing increasing amounts of the material. Despite China being one of the main sources of anode grade petroleum coke, the Chinese are experimenting with shot cokes, as well as other cokes, which would normally be considered unsuitable. The Chinese have at least one team focused on solving the riddle of the “inert anode,” a technology that would eliminate the need for large amounts of carbon.

Even at a macro plant level, the Chinese are leading the rest of the world. China has a fully operating 500KA plant and at least five other projects under construction, which will be up to 600KA. Indeed, we expect the 600KA plant to be operational before the end of this year, ahead of RTA’s plant in Quebec, Canada.

**Corporate structure helps**

Part of the reason behind the rapid growth in technology development is the corporate structure involved. The two major institutes mentioned earlier, GAMI and SAMI, are both owned by Chalico, the engineering arm of Chalco. But while these two institutes focus on plant design, Chalco has a separate R&D department, based in Zhengzhou, Henan province, which focuses on process design and improvements. SAMI handles a great deal of cathode and anode design work.

Separate to and in competition with this structure, North Eastern University Institute (NEUI) has established its own commercial arm and sells alumina and smelter design to the Chinese market. NEUI, like SAMI, is based in Shenyang, and there has been some crossover of talent and ideas. NEUI is also providing 500KA technology.

With three technology providers competing for business, NEUI provides aluminium companies with a choice of supplier, but, more importantly, there is an impetus for technology providers to work hard to find a competitive edge. It’s a concept that many outside China would not associate with Chinese industry, but there is a marked level of competitiveness, especially between NEUI and the two Chalieco companies.

If there is a downside to the push into new technologies in China, it’s the operating practices that are meant to extract value from the innovations. Chalco’s 500KA plant, which has been in full operation for over 12 months, is a good example.

While it offers cutting edge technology, operating practices such as the selection of cokes for anode manufacture, or the segregation of different cokes in the storage area, are third rate. Cokes are chosen based on price, with no distinctions made, leading to poor quality anodes and pot operating problems.

The situation with China’s technology is best be summed up by the experience of one technology sales manager who we spoke to recently. He came to China to sell technology and after spending a week, he left saying there was no market for him in China – the technology is already better and on a different footing than what he had to offer.

**References**

1. This paper is not intended to be a technical analysis. For more information on the factors at work in the electrolysis process please contact AZ China.

**Contact**

China Aluminium Intelligence www.az-china.com
Canned heat

Atlanta-based Novelis is pushing the envelope when it comes to sustainability and hopes that by 2020, 80% of its production output will come from recycled metal. In an exclusive interview, AIT meets CEO Phil Martens

By Matthew Moggridge*

In an argument about what’s hot and what’s not, is it ever possible for aluminium to be considered cool? Most of the time, probably not, but if any ‘coolness’ is in the air, then it’s likely to be drifting in from Atlanta, Georgia, where Novelis is headquartered.

Is Phil Martens, Novelis’ CEO, the aluminium industry’s Jesus of Cool? He could be. Why? Because he’s trailblazing ‘sustainability’ and reinforcing the message that aluminium has a lot to offer the environment – arguably one of the hippest subjects around.

Novelis has grand ambitions, which are more than just pipedreams, and if Martens succeeds in his chief goal – for 80% of the company’s production output to be from recycled aluminium by 2020 – then expect a wave of Olympic grade euphoria to ripple through the very soul of the global aluminium industry, extinguishing the woes associated with high electricity costs and depressed metal prices.

For Martens, the reality of environmental conservation is creeping in globally. “Everybody’s reacting to environmental shifts from the weather, temperature profiles, drought and the like and slowly understanding that the CO₂ released into the environment is having an effect,” said a relaxed Martens, fresh from a trip to the London Olympics.

For Martens, global concern for the environment, on both a general population and a corporate level, will only increase. “Once carbon taxation hits, the price of our metal inputs is going to go up and the pressures to produce them will increase,” says Martens, adding that profitability will suffer too.

“Given that we are the largest roller and we are independent, we’re going to have to secure business on a long-term perspective and take a point of view that’s different from the past,” he says. Novelis is in a good position. It is not linked to an upstream primary aluminium manufacturer, which gives it tremendous flexibility to manage its affairs in a completely different way from what has gone before.

“And with that kind of ability to be both agile and, if you will, disciplined about our strategic planning, without being hindered by an upstream linkage, then we can set a course that nobody’s been able to set within the industry,” Martens believes. That the business world is taking the environment seriously is of major importance to Novelis. Martens says it is changing the way business looks at...
management. “Almost all of our major customers have a sustainability profile that is in the top five of their strategic initiatives. Sometimes it’s number one, sometimes number two or three, and for our business to be compatible with them, we need a similar agenda. As I look at the marriage of our approach and other businesses – primarily our customers and some of our suppliers – compatibility is very high,” he says.

Martens is aware that his 80% recyclable content goal is ambitious and wants to make it clear that it’s an aspirational target. He knew when he announced last summer that 70% was possible – “if we really do things right” – but when he went for 80% the objective was to push the envelope. “I wanted to look beyond what we could do in theory,” Martens says, explaining how companies that stretch themselves and ‘realign their perspectives’ will drive better sustainable business models – even if they don’t know how to get there. “In fact, it’s probably better that you don’t know how to get there because it stretches your thinking,” he ventures.

Since the target was set, Novelis has realigned its thinking. “We are closing or divesting plants or product lines that we know have no ability to utilise recycled material,” says Martens, bringing into focus the reality of the challenge ahead. “Last year we were at about 40% recycled content. We’re above that at this point,” he said, claiming that the business engagement process with Novelis customers today is based purely on sustainable business models.

“All of that has allowed us to really look at the next three years,” he says, announcing that Novelis will hit 50% recycled content by the middle of the current decade and conceding in the same breath, that it all leads to one undeniable truth. “We’re going to have to change the way the business is run.”

Martens says that to reach the 80% target, Novelis will have to rethink how it engages its customers. It will have to rely increasingly upon technical innovation and will use new alloy specifications with a higher recycled content. “We’re going to have to invest in how we remelt to get better capacity and how we recycle to get a broader range of recycled material,” Martens says.

Getting from 40% to 50% will be ‘hardware driven’ and in Martens’ world, ‘hardware’ means the asset structure of the business. That Alcan invested properly in building and maintaining its assets before it ‘spun-out’ Novelis, gave the Atlanta company a much-needed leg-up. “Not only were the plants well-managed and well-run, they were also geographically positioned pretty well,” Martens says, adding that if all the capital
Martens says he is ‘very confident’ that Novelis will reach the mid-50% to 60% rate for UBCs – that’s used beverage cans – and the fact that the USA’s total used beverage can recycling rate stood at 58% when AIT met Martens in Atlanta last month.

The US-based Aluminium Association has since announced a 7% increase to 65.1% for 2011, albeit based on increased UBC imports from Mexico and Canada.

Martens believes that if the US recycling rate for UBCs reached 80% nationally, the entire business community would benefit. “I think the United States has got to stand up and say ‘we can do better’. When Martens made his 80% announcement, he took on that responsibility. ‘There’s no question about it,’ he says. “We’ve taken quite a lot of strategic action to open up avenues so we can increase our ability to work cohesively with our business partners,” says Martens, explaining how discontinuing the Evermore recycling joint venture with Alcoa was ‘a very strategic move’.

“The fundamental strategic goal was to buy directly and not through a middle man. By coupling with Alcoa we could get the scale and through the scale the economies on the pricing side of the business,” says Martens.

“It’s not that Evermore was not working. It was working quite well, but it was not allowing us to engage exclusively with companies like Coke or exclusively on a global integrated basis, which is something we wanted to do. We had to make a move to innovate our business and our capability to become a more cohesive partner to our end consumers,” he says.

Evermore worked well, according to Martens, and Alcoa was a good business partner. Novelis’ decision to end the partnership was probably not what Alcoa expected. “I have a lot of respect for the people who worked on the board, but ultimately, when you separate, it’s usually because one party has decided they no longer want to participate. We were very clear with Alcoa that our split was a strategic move and nothing to do with the quality of effort put in by both parties,” Martens insists.

Withdrawing from Evermore has enabled Novelis to work more exclusively with Coca Cola on a set of recycling initiatives. “Coke has a very compatible sustainability model. They want what they call an entire closed loop system and we’re happy to work with them,” says Martens. “Without Evermore we can pursue that without any boundaries.”

Novelis is also working in conjunction with some of its canning companies on a 100% recycled beverage can using a unique alloy specification. In the light of Novelis’ withdrawal from the Evermore Project, the ironically (and some might argue insensitively) named ‘Evercan’ is infinitely recyclable and destined for global expansion.

Large-scale recycling centres are being developed in key regions of the world as part of Novelis’ global recycling programme and headed by Novelis’ senior vice president and supply chain offer, Nick Madden and VP of global recycling, Derek Prichett.

“On recycling now we’re probably spending about half a billion dollars on new systems and that’s just one part of it,” says Martens. Novelis has aligned its technical and research activities and opened a global research and technology centre

Novelis’ global research and technology centre features a pilot production line for cans

has been deployed, Novelis will reach its target. “What really drives me now, what’s exciting, is the changing dialogue at the top of our company and at the top of our major suppliers’ companies.”

Sustainability, he says, is the predominant topic of discussion in the business negotiation world of today.

Having made it clear that his 80% target was aspirational rather than set in stone, Martens says he is ‘very confident’ that Novelis will reach the mid-50% to 60% mark. “That was always the theoretical bandwidth,” he adds. “I think we’re much farther ahead and getting there than we’ve ever been, because of the way other businesses are responding to the sustainable initiatives that have to take place.

“The discussions that we’re having with automotive companies, with canning companies, with the fillers – such as Coke, Pepsi and AB – are all in the right direction and I think, most impressively, when we opened our plant project in China, the interface we had with the Government was all about sustainable business,” he says.

Martens admits that he’s a lot more comfortable with the 80% target today than when he first announced it. “I’m confident we’ll make every effort to get there,” he says without flinching when I dare to mention the possibility of 100% recyclable content.

“I think that’s not something we don’t think about,” says Martens, mildly reminiscent of Donald Rumsfeld’s famous ‘known unknowns’ comment, but insisting that it’s not an unthinkable goal.

We move on to UBCs – that’s used beverage cans – and the fact that the USA’s total used beverage can recycling rate stood at 58% when AIT met Martens in Atlanta last month.

The US-based Aluminium Association has since announced a 7% increase to 65.1% for 2011, albeit based on increased UBC imports from Mexico and Canada.

Referring to the 58% figure, Martens was not impressed. “That means there’s over 40% that go unclaimed,” he says. “The United States need to look at getting more aggressive around recycling in general, but also around sustainable packaging, he says, adding that where there is deposit legislation, the figure is above 85%.

Martens believes that if the US recycling rate for UBCs reached 80% nationally, the entire business community would benefit. “I think the United States has got to stand up and do something about it,” he says.

“Without Evermore we can pursue that without any boundaries.”

Novelis wants to lead the way in UBC recycling in the USA and stand up and say ‘we can do better’. When Martens made his 80% announcement, he took on that responsibility. “There’s no question about it,” he says.
incorporating a pilot production line for cans. The plan is to integrate the company’s production and molten metal processes with engineering, research and technology under the management of chief technical officer, Jack Clark.

Martens says that Novelis is adding casting capacity and recycling capability to meet its own growth initiatives and drive the company’s recycling rate. In order to collect scrap metal, Novelis employs a head of recycling in each of the major regions around the world. Each recycling head is charged with the task of developing a proper procurement network.

“In the United States and Brazil there’s an established scrap system and we’ve expanded our collection centres. We have seven or eight of them geographically located around Brazil. In the States we deal with large brokers of scrap and similarly in Europe,” says Martens.

“We’re now expanding to look at all aspects of scrap in anticipation of the launch of our recycling plant in Nachterstedt, Germany, which will come on stream in about two years,” Martens said, adding that a recycling operation in Korea is planned, but not on the same scale as Nachterstedt. Novelis is also launching a recycling centre in Vietnam.

**Strong recycling growth**

Martens expects strong recycling growth in Asia as the UBC population in the region grows. “We’ll have to set up our operations in those countries and then ship the scrap into our main recycling system in Korea,” he says.

The recycling plant in Nachterstedt, Germany, is Novelis’ largest recycling project, costing an estimated US$250 million. The facility will be capable of recycling UBCs and 18 other different kinds of scrap material. “Technology in recycling is no longer focused just on bringing in the UBCs—shredding, heating and burning them—it’s now handling all sorts of aluminium material sources, be it tyre casings, construction equipment, even horseshoes,” Martens explained. “You have to sort and bring out the other metals that are in there to get down to the pure aluminium—that’s the expansive nature of what we’re trying to do here.”

Martens talks of the need to develop new sensing and melting techniques in order to separate out different metals in, say, a scrapped car. “We get down to the metal and it might be pure aluminium, but it might have other stuff in there and that will be a by-product we’ll sell to somebody else,” he says.

**Aluminium – the material of choice**

Moving away from canning, Martens argues that aluminium is definitely the material of choice, in terms of design, in the advanced development stages of both the auto sector and personal electronics. “It’s gone from being a ‘think-about’ to a very appealing product,” he says.

For Martens, the real growth is not packaging, which represents about 55% of Novelis’ business, but the auto sector, which he believes will grow dramatically over the next decade. Another major growth sector is personal electronics. “Just think about Apple alone. The iPad didn’t exist four years ago and now Apple buys 50kt of aluminium every year when before it may have bought 5kt,” he says.

“We’ve got to remember that aluminium is still a very young product. It started making headways in the seventies, but accelerated in the eighties when beverage cans went from steel to aluminium. Today there’s a broad understanding of how the product can be used,” Martens says.

Where the automotive is concerned, Martens is confident that more OEMs will turn to aluminium. “We’re beginning to see large-scale OEMs make big investments on aluminium and it’s going to expand.”

“I was in the auto industry for 20 years and aluminium was always known as the lowest cost weight-reduction option, but the difficulty was you had to really get in on a large-scale and go all the way back to the drawing board, and be willing to invest in rethinking engineering and manufacturing standards—the welding, the adhesion, the durability requirements, the styling—and that was always a huge barrier to entry.”

“Steel was so deeply integrated into the ways things were, but then Jaguar Land Rover made one of the first aluminium-intensive vehicles. That was the first time an OEM went through and produced for volume manufacturing and it’s been a success. They’ve gone through two or three cycles to refine it, and now they’re launching a whole new family of all-aluminium vehicles,” says Martens.

As a result, he expects rolled aluminium for the automotive industry to go from being six to seven per cent of Novelis’ business to around 20% and says that 33% of new capacity is destined for the automotive element of the company.

“We’ll probably have to add another 500kt of automotive sheet before the end of the decade,” he says.

Such optimism translates into global expansion and an estimated US$2 billion of capital expenditure. “For a downstream rolling company, that’s the largest cap-ex deployment in a short period of time in Novelis’ history,” says Martens.

Novelis is clearly top of the class as far as parent company, the Aditya Birla Group is concerned; and that’s why it has been able to attract such a high level of cap-ex.

When Martens was approached to take on the role of CEO at Novelis he was attracted by a number of key elements. “Whenever you look at a company you’ve got to look at the hardware and the software of the business. On the hardware side, the asset structure of Novelis was world class.”

Software-wise the business lacked the stability of a focused leadership team. “You can fix software easier than you can fix hardware,” says Martens, explaining how Novelis had a stable customer base and a strong business portfolio (of which 60% was packaging-focused).

**Responding to change**

“What’s been surprising is the aptitude of the management team to change its thinking and reorient itself in a short period of time,” he says, praising the support and determination of the board to restructure and rebuild the business around a sustainability model.

“I’m very optimistic about the future of aluminium and I think the brighter days are ahead of us. There are challenges – sustainability is a huge issue – and we don’t know how big they will be by the end of the decade. Companies issued their sustainability reports 10 years ago, but they didn’t go anywhere. Now they are fundamentally the drivers of business strategy and that, coupled with the need for broader CSR, is going to play out. Like I say, you don’t have to work every day and there’s no excuse for not performing because you’re only as good as your last quarter.”
Recent years have seen both a geographical shift in the aluminium industry’s centres of production and consumption – and a concurrent fragmentation of the vertically integrated business model.

Such dimensional changes have been accompanied by a decoupling of global alumina prices and aluminium LME prices, the latter influenced more by financing deals than industry fundamentals. With aluminium inventories over seven million tonnes, oversupply in the short-term will potentially lead to curtailments and price falls, but in the long-term there will be growth in key markets and a possible metal undersupply by 2020.

Consumers and end-users are increasingly demanding that the product they buy and use is not only responsibly mined, manufactured and moved, but that such responsibility is verified and potentially certified. With the value chain becoming increasingly fragmented and the supply base ever more diverse, there is a need to tell the aluminium story in its entirety, from mine to market.

Since its formation in 1972, the International Aluminium Institute (formerly the International Primary Aluminium Institute), the global association of aluminium producers, has defended the sector’s licence to operate, through measurement and reporting of key industry performance indicators (www.world-aluminium.org), such as energy use and emissions reduction. In recent years, in addition to this work, the Institute has focused increasingly on defending the industry’s licence to market: communicating the benefits of aluminium products in use and through recycling, answering the challenges of an informed civil society and customer audience, but also challenging customers, communities and individuals to play their part in ensuring that the value of the metal is realised through intelligent design and use and retained at end-of-life through efficient and comprehensive recycling.

Most recently, the Institute has developed a suite of websites, drawing on four decades of research, statistics and industry knowledge, that provide regional case studies, up-to-date global data and analysis of the industry’s sustainability performance as well as the environmental and socio-economic benefits of using and recycling aluminium products.

These websites provide a communications and promotional tool for participants in all parts of the aluminium value chain, to allow them to tell the full aluminium story to customers, regulators, employees and other audiences.

Thus a fabricator who is being asked for information on bauxite mining, for...
instance, can use the site to deliver relevant information, but can also put such information into context in an increasingly diverse and complex value chain.

**Aluminium for future generations**

The increasing diversity of aluminium applications and the value of its products to modern life continues to increase demand for the metal, which is expected almost to double between 2010 and 2020. The share of aluminium supply met from recycled sources is limited by the long lifetimes of aluminium products (a positive attribute for durable applications) and their growing markets, meaning that most aluminium is still in use, and not yet available for recycling. Indeed, around 70% of all aluminium ever produced is still in productive use. Given this constraint, around two thirds of demand will continue to be satisfied from primary sources for the foreseeable future.

The bauxite and alumina website: (http://bauxite.world-aluminium.org) and the aluminium production website: (http://primary.world-aluminium.org) are important resources for delivering the latest lifecycle and sustainability performance data on the global industry, as well as highlighting regional case studies and production process information.

**Recycling and value recovery**

Improving the overall collection rates of used products is an essential element in the pursuit of sustainable development, ensuring that the value of the metal is not lost to society and that, through the use of only 5% of the original energy input, this metal can be made available not just once, but repeatedly from these material resources for future generations.

Industry continues to recycle, without subsidy, all the aluminium collected from end-of-life products as well as from fabrication and manufacturing process scrap. With a growing number of initiatives and the help of appropriate authorities, local communities and society as a whole, the amount of aluminium collected could be increased further.

The recycling website: (http://recycling.world-aluminium.org) offers not just latest statistics on recycling rates and scrap availability, but also regional case studies, including strategies for communities, municipalities, industry and waste management authorities to improve collection and recovery rates, which are often locally specific.

**Benefits of aluminium in use**

Materials in general, and aluminium in particular, have a unique role to play in sustainable development, as enablers of eco-efficient services: transporting people further and faster with lower energy inputs; bringing power to new, growing, productive communities with fewer energy losses; and building green cities and preserving nutritional and pharmaceutical resources.

The potential benefits of using aluminium in such applications can be more significant than the potential for improvement in process efficiencies during production and at end-of-life. The reduction of anthropogenic greenhouse gas emissions, for instance, is far greater than improvements in energy efficiency within aluminium industry processes. It can be achieved through the use of aluminium-intensive efficient machinery in industry; efficient cabling, turbines, solar panels; consumer durables and intelligent control systems in energy supply networks; lightweight vehicles; green buildings and protective aluminium packaging that preserves agricultural outputs.

**Transport**

The reduction of the weight of transportation vehicles is an important strategy towards improved fuel efficiency, reduced energy consumption and greenhouse gas emissions.

The all-aluminium monocoque body structure of the new, fourth generation Range Rover is 39 per cent lighter than the steel body in the outgoing model, enabling total vehicle weight savings of up to 420kg.

Transport-related greenhouse gas emissions amount to over 8 billion tonnes CO₂e annually. A 2004 study by the Institut für Energie- und Umweltforschung, Heidelberg (IFEU) concluded that about 660Mt of greenhouse gas could be saved at that time during the use phase if all transport units (including road vehicles, trains and aircraft) were replaced by lightweight models of current design with the same functional properties. Approximately 870Mt were possible with advance designs. Today, these figures are closer to 800 and 1,000Mt respectively.

In 2000, according to the market researcher Ducker International, automotive vehicles on average contained between 100 and 120kg of aluminium and in 2009 between 110 and 150kg. A more recent survey of North American automakers by Ducker indicates that they will increase the use of aluminium from 148kg per vehicle in 2009 to 250kg in 2025.

In 2010, over 65 million passenger cars and light trucks were produced globally. The achieved weight savings due to aluminium will lead to potential global greenhouse gas savings of over 300 million tonnes of CO₂e over the life of those vehicles. The total primary energy saved due to the application of aluminium during the life cycle of passenger cars and light trucks produced in 2010 is equivalent to about 100 billion litres of crude oil.

The transport website: (http://transport.world-aluminium.org) explores the lightweighting potential of aluminium, providing greenhouse gas and energy saving calculation tools to OEMs designing with aluminium, as well as qualitative and quantitative information on safety, cost saving, recyclability, durability and style aspects across all transport applications.

**Architecture**

Buildings account for up to 40% of global energy consumption and thus improving the overall systemic efficiency of buildings and their contents, while maintaining their sustainability performance data on the global industry, as well as highlighting regional case studies and production process information.

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Table 1 A selection of IAI “Aluminium for Future Generations” sustainability objectives and 2010 performance

<table>
<thead>
<tr>
<th>Sustainability Objective</th>
<th>Global Industry Objective</th>
<th>Baseline Year</th>
<th>Target Year</th>
<th>2010 Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina refining energy intensity</td>
<td>-10%</td>
<td>2006</td>
<td>2020</td>
<td>-9%</td>
</tr>
<tr>
<td>Smelter electrical (AC) energy intensity</td>
<td>-10%</td>
<td>1990</td>
<td>2010</td>
<td>-10%</td>
</tr>
<tr>
<td>Electrolytic process electrical (DC) energy intensity</td>
<td>-5%</td>
<td>2006</td>
<td>2020</td>
<td>-4%</td>
</tr>
<tr>
<td>Total fluoride emissions intensity</td>
<td>-33%</td>
<td>1990</td>
<td>2010</td>
<td>-50%</td>
</tr>
<tr>
<td>Perfluorocarbon (PFC) emissions intensity</td>
<td>-80%</td>
<td>1990</td>
<td>2010</td>
<td>-85%</td>
</tr>
</tbody>
</table>

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**Architecture**

Buildings account for up to 40% of global energy consumption and thus improving the overall systemic efficiency of buildings and their contents, while maintaining their
value as living and working spaces, is a key aspect of sustainability. Given the ongoing growth in urban populations, the potential for emerging economies to design and realise “green cities” from the bottom up is a positive opportunity for decoupling human well-being from environmental impact.

The most energy-efficient buildings start with aluminium – 25% of global aluminium demand is from the construction sector. Aluminium components and designs optimise natural lighting and shade, enhance energy management and support designs that make the most of the physical environment. Being durable and corrosion-resistant, aluminium contributes to reduced maintenance over time, while the metal’s unmatched recyclability gives architects a key sustainability design tool. Aluminium’s high strength-to-weight ratio makes it possible to design light structures with exceptional stability allowing for narrow window and curtain wall frames, maximising solar gains for given outer dimensions. Aluminium’s light weight also makes it cheaper and easier to transport and handle safely on site. In Europe, around 95% of architectural aluminium is collected and recycled (EAA, 2004).

Lighter packaging means less fuel consumption, reduced emissions from transport and easier handling at the retail level. A good example is the stand-up foil drink pack. Using aluminium foil-based pouches rather than standard 20cl returnable glass bottles means nearly twice as much product per truck load. The weight of the aluminium packaging materials is a mere 6% of the total weight of the load. Clearly, a far more efficient and environmentally friendly way to transport such products – not forgetting the advantages of shelf impact and product protection.

In North America and in Europe, a beverage can is produced, filled, distributed, consumed, collected and recycled back into a can within 60 days making it the most recycled beverage container in the world. The IAI’s packaging website (http://packaging.world-aluminium.org) is the last of the three ‘Use Phase’ websites, focused on quantifying the lightweight, decorative, recycling, conductive, formable, resource-saving, hygiene and safety potential of aluminium packaging products.

Packaging

Aluminium packaging is an “insurance” to protect the energy invested in producing, growing and processing food. It also ensures the additional energy used to get that food to us – in transport, retailing, shopping, storing and cooking – is not wasted. This insurance feature is paramount in the ability of aluminium packaging to protect medical and pharmaceutical products.

According to the World Health Organisation, 30% of the food in developing countries perishes due to the lack of packaging. Packaging saves 10 times more waste than it creates; if, due to being badly packed, the contents are spoiled, 10 times more waste occurs than that generated by the production of appropriate packaging.

A 2008 study of the coffee supply chain by the European Aluminium Foil Association has shown that only 10% of the total energy consumed between the production and use of coffee is attributable to packaging compared with 50% for the production of the coffee, 35% for its preparation and handling and 5% for the other parts of the chain. Incineration or recycling of the used packaging improves this ratio further. Thus, adequate protection of the food saves more resources than those needed for the production of the protective packaging. This is not only true of energy resources – land and water resources invested in the production of foodstuffs are also protected.

The aluminium story

The 21st century has started with seven billion people on the planet and the United Nations currently expects global population to reach 10 billion by 2100. The sustainability challenge shared by all is to provide not only for basic needs, but to meet expectations for an improving quality of life. Crucially, this socio-economic progress must be achieved ecologically and economically viable for future generations.

The products of human ingenuity, including aluminium in its many applications, have a vital role to play in successfully addressing this sustainability challenge. By working continuously to minimise its environmental impacts and maximise the benefits that its products offer to the world, the aluminium industry is committed to ensuring that aluminium is part of the solution for a sustainable future, all the way from mine to market – and back again.

Contact

The International Aluminium Institute

www.world-aluminium.org
Aluminium – a precious metal

Aluminium’s ubiquity is matched only by its world-beating performance in the global recycling arena. It can be endlessly recycled without losing any of its strength, making it a very desirable light metal.

By Heidi Brock*

Aluminium is something most people understand. It is found in cars, homes, cans and electronics and is a common mainstay in high school chemistry. In combined form, it is the 13th element on the periodic table and is the most abundant metal in the Earth’s crust.

As modern society looks forward to the future and examines its impact on the economy, planet and society, sustainability is a key word. The aluminium industry has undertaken a serious commitment to sustainability using the Triple Bottom Line. The Triple Bottom Line supports society, the planet and business.

Recycling is fundamental to the sustainability proposition for aluminium. Since 1888, 73% of all aluminium ever created is still in use today. In a recent hearing before the US House of Representative’s Subcommittee on Environment and the Economy, Aluminium Association vice president, Charles Johnson explained: “Recycling is good policy because it benefits industry, imperil used inability, contributes to our country’s energy efficiency goals, decreases solid waste in landfills and creates jobs.”

Benefits to society
The recycling of aluminium is a green job creator. In 2009, the US aluminium industry directly employed more than 106,000 workers and supported more than 350,000 jobs in dependent upstream and downstream industries.

In 2010, consumers in the US were paid nearly $1.6 billion for used beverage containers and the recycling rate was 58%. The stated goal of the industry is to achieve 75% recycling by 2015, which would bring the total of aluminium recycling jobs in the US to well over 100,000. Recycling improves the environment, conserves energy and further expands the sector, providing enormous benefits in terms of jobs and manufacturing capacity.

Benefits to the planet
Secondary production, or recycling aluminium, requires only five per cent of the energy and emits only five per cent of the greenhouse gases associated with primary production. Furthermore, aluminium’s infinitely recyclable nature means that it can be used for the same applications as primary aluminium, because recycling does not decrease the quality of the material. This highlights the chief advantage of aluminium when compared with competing materials that have a limited number of recycling options and often need to be “downcycled” into a less valuable material sector.

While the environmental benefits of aluminium recycling are massive; the industry is still working to decrease the impact of manufacturing even further, both for the environment and business. Over the last 20 years, energy demand has decreased 58% and greenhouse gas emissions have decreased 65%.

Benefits to business
In 1959, Bill Coors worked with industry leaders to invent modern consumer recycling with his aluminium beer cans and the idea has been around ever since. If it was not a business benefit, the industry would not spend over a billion dollars each year to purchase used cans from consumers or several billion more to purchase scrap metal from the transportation or construction sectors.

Recycling is green and good for people and the planet, but also a good business practice. The massive energy savings associated with recycling aluminium translates into realised cost savings for industry.

Fuel efficient transportation
Transportation is the largest aluminium market in North America, consuming more than a quarter of all shipments. Aluminium is used in planes, trains, trucks and spaceships, and within transportation the largest market is cars.

According to the Survey of Automakers: Aluminium in 2012 North American Light Vehicles, conducted by Ducker Worldwide, an average of 343 pounds of aluminium was used per vehicle for model year 2011. The report shows that aluminium is already the number two material in the automotive industry and expects to nearly double its usage by 2025 as a percentage of the material mix from 2009 levels.

Why the transition to aluminium? Aluminium is half the weight of steel but just as strong, so replacing steel with aluminium provides a more fuel-efficient vehicle and one that is safer and performs better than heavier vehicles. Down-weighting the global transportation fleet with aluminium can reduce greenhouse gas emissions by 660Mt, or nine per cent of global transportation CO₂ emissions.

In addition to use-phase application, aluminium’s high recycle value means it returns to road-worthiness in a new vehicle. At the end of a vehicle’s life, more than 90% of the aluminium is recycled. The high recycling rate translates into a more sustainable industry footprint. According to independent studies, aluminium has a 20% better lifecycle CO₂ emissions performance over...
steel and an eight per cent advantage over magnesium.

**Green building products**
Another long-term use of aluminium is building and construction. Aluminium’s durable, flexible, lightweight, strong and recyclable nature means it is a natural choice for builders looking to develop greener work and living spaces.

Credit standards issued by Leadership in Energy and Environment Design (LEED) – and administered by the United States Green Building Council (USGBC) – are awarded to materials with a high level of recycled content – aluminium fits the bill nicely.

Flat-rolled aluminium construction products have an average of 85% recycled content, 60% from post-consumer sources. Flat-rolled aluminium is used for diverse applications including panels, curtain walls, store fascias, door framing and fenestrations.

A 2004 study by Delft University of Technology found that 95% of the aluminium used in commercial construction in Europe is recycled at the end of its life. Currently, the Aluminium Association is replicating the study in North America and similar results are expected.

**Sustainable packaging**
Perhaps the most iconic use of aluminium is the beverage can. Sadly, it is one of the least recycled aluminium applications. In the US, 61 billion cans were recycled in 2011, for a recycling rate of 65.1%. That is the third highest rate since the Association began calculating it. That said, the US rate remains smaller than other countries. The aluminium industry has committed itself to a 75% recycling rate by 2015 and efforts continue to increase it.

While the rate of beverage can recycling is lower than the automotive and construction markets, the can enjoys the highest recycling rate of any beverage packaging container, as well as the highest amount of recycled content at 68%. Within municipal curbside recycling, aluminium is the only material that more than pays for its own collection and helps subsidise the recycling of other materials.

Huge opportunities exist to increase the recycling rate including: multi-family housing, expanding curbside recycling, recycling away from home and consumer education. If consumers do their part and put the can in the bin, the industry can have it back on store shelves in as little as 60 days. Aluminium’s infinite recyclability means that a can, if recycled over and over, will be re-used repeatedly, as opposed to other materials, which can only be recycled a few times or require ‘down-cycling’ into less valuable products. The challenge is to explain the massive energy savings gained by recycling. Recycling one can saves enough energy to power a 100-Watt light bulb for four hours or a 32-inch LCD television for three hours. When a can enters a landfill, that energy potential disappears with it and takes up precious space.

The sustainability benefits of aluminium cans are leading to new market growth, especially in craft beers. San Tan Brewing says, “its better for the beer, better for the environment.” According to Craftcans.com, 208 breweries in the US can 77 styles of 633 beers. Recent data published by Bloomberg showed that 53% of beers consumed in the US in 2011 were packaged in cans. The other 47% were packaged in glass bottles or aluminium kegs.

**Designing for sustainability**
Consumer electronics is another growing market for aluminium. Designers are seeking cleaner, sleeker and more tactile materials and an auxiliary benefit is the environmental gains from the light metal’s high desirability as a recycled commodity. According to Apple’s iPad2 Environmental Report, “iPad is made of aluminium and other materials highly desired by recyclers.” Additionally, aluminium uni-body enclosures increase the recyclability of the electronics by improving access to the internal components of greatest concern in e-recycling areas.

**Conclusion**
Regardless of market, demand for aluminium is growing, and most of the growth is related to aluminium’s recyclability. Recycling is related to the industry’s sustainability and overall position against competing materials. The massive energy savings, infinite recyclability and high desirability of aluminium by recyclers means that aluminium is in a position to compete and win against other materials. There is a marked advantage to being able to point at a can and say, “the industry can have that back on the shelves within 60 days,” or point at a drive shaft on a new automobile and say, “73% of all aluminium is still in use today.”
The importance of ‘lightweighting’

The use of aluminium in transport improves sustainability by reducing vehicle mass and improving safety. In 2010, transport accounted for 35% of aluminium applications. Despite this, vehicles are getting heavier due to added safety and comfort equipment and consumer demand for bigger cars.

By Bernard Gilmont*

Henry Ford said that excess weight kills any self-propelled vehicle. Using a lighter material, such as aluminium, reduces vehicle mass and, therefore, fuel consumption. A study published this year by Ducker Worldwide in co-operation with the EAA showed that the amount of aluminium used per car produced in Europe almost tripled between 1990 and 2012, increasing from 50kg to 140kg. This amount is predicted to rise to 160kg by 2020, and could reach 180kg if small and medium-sized cars follow the evolution pattern of the upper segments of the automobile industry.

On average, every kilogram of aluminium in modern European cars saves about 18kg of CO₂ during the car’s lifespan and about 17kg during its full lifecycle including production, use-phase and end-of-life recycling. Reducing the mass of a car by 100kg saves, on average, eight grammes of tailpipe CO₂ emissions per kilometre. Weight savings achieved based on the present aluminium content of European cars results in an average annual fuel saving of 65 litres per car.

The full benefit of aluminium in transportation, can only be realised if the full lifecycle, including production, fuel savings during use and end-of-life recycling are taken into account. Recycling aluminium saves up to 95% of the energy required for the primary production of the metal and generates material that can substitute primary material. End-of-life recycling, therefore, represents a huge environmental benefit that must be part of lifecycle assessments. By adopting this ‘full lifecycle’ approach, the environmentally friendly qualities of aluminium can be fully understood.

Current EU regulations aimed at reducing CO₂ emissions from cars and light commercial vehicles, however, do not recognise lightweighting as a CO₂ reduction technology. Indeed, under these regulations, heavier vehicles receive a higher CO₂ target, when lightweighting can reduce that target. Where the EU’s global CO₂ reduction targets are concerned, this is counter-productive and the EAA is calling for a better application of the principle of technological neutrality in the revision of the regulations, which is currently under discussion by the European Parliament.

The EAA believes that lightweighting should be equally recognised as other CO₂ reduction measures, such as engine efficiency or aerodynamic improvements. Among the various lightweighting options, aluminium can already cut vehicle weight by one third, drastically reducing subsequent CO₂ emissions. To better reward investment in lightweighting, the EAA wants the utility parameter of cars to be based on vehicle footprint rather than mass as it believes that footprint is a far better indicator of a car’s usefulness.

Consumers base their choice of car on comfort, internal space and ease of use or ‘driveability’. Recalibrating emission targets to align with footprint, argues the EAA, would treat different emission reduction technologies in the same way. Unfortunately, the European Commission is sticking to vehicle mass as its ‘utility parameter’ and is focusing on the global reduction of CO₂ emissions.

Where heavy-duty goods vehicles are concerned, the EAA is engaged in defining CO₂ measurement procedures that are currently under development and may serve as a basis for future legislation. For the EAA, it is important that these procedures reflect the impact of lightweighting on CO₂ emissions. To support its case, the EAA has developed an online calculation tool that shows the payback period of lightweighting for various types of vehicles.

A study by Forschungsgesellschaft Kraftfahrwesen Aachen (FKA) on the passive safety of heavy-duty goods vehicles, commissioned by the EAA, shows that the severity of a car-to-truck accident could be significantly reduced if an energy-absorbing crash management system was used on road tractors. Using aluminium for this purpose would minimise weight and maintain optimal crash performance.

However, due to EU restrictions on the dimensions of heavy-duty vehicles, road tractors tend to be designed to maximise the volume of goods that can be carried. As such, they are compact and have a flat front-end that can maximise damage in a crash with a smaller vehicle. The EAA has been campaigning for longer “noses” both for aerodynamic efficiency and safety. The European Commission should come up with other solutions for the benefits of aluminium in mass production and the environmental benefits that can help reduce CO₂ emissions.

* Bernard Gilmont, building and mass transport director, the European Aluminium Association
with a proposal to amend the current directive by the end of the year, in particular by improving the cabin design and the aerodynamic profile of trucks. The development of electric cars, however, is hampered by the high cost of battery systems relative to the power and autonomy they can deliver. Making electric cars as energy-efficient as possible is the only stumbling block between market success and failure. The EAA recently released a study on aluminium in electric vehicles, which is now available online. The study shows that aluminium, once again, can play a role in weight reduction and thus energy consumption. Lightweighting is the obvious way of improving the energy efficiency of any vehicle, including electric ones, but the material used for lightweighting is often slightly more expensive than heavier, classical materials. In the aforementioned FKA study commissioned by EAA it was shown that an electric version of the VW Golf would be made 187kg lighter using aluminium instead of steel. The additional cost of building an aluminium version is more than compensated by the cost saving associated with light cars needing fewer batteries to travel the same distance as conventional models. In addition, a lifecycle analysis of the full-steel and full-aluminium electric vehicles shows that the latter emits 1.5 tons less of greenhouse gases over its complete life cycle than the former.

While keeping the same crash performances, the study demonstrated that lightweighting through aluminium reduces both the production and operating costs of electric vehicles and should be encouraged by legislators in order to encourage the market deployment of electric vehicles.

The EAA has developed an online Excel tool where users can define their own examples and calculate the savings related to lightweighting in electric vehicles. Demonstrations will be run during the Aluminium 2012 exhibition in Düsseldorf (stand 11E52).

Contact
www.alueurope.eu
Investment for a sustainable future

Rio Tinto Alcan’s cutting edge Straumsvik (ISAL) smelter in Iceland is a multi-million dollar facility that has placed great emphasis on sustainability and environmental considerations. Emissions per tonne of aluminium produced have decreased by approximately 75% due largely to ISAL’s aggressive targeting of perfluorocarbons.

In June 2012, the first aluminium billet was produced at Rio Tinto Alcan’s (RTA) new leading-edge casting facility at its smelter in Straumsvik, Iceland (ISAL). The US$140 million facility is in addition to a US$347 million investment RTA is making to modernise and increase the ISAL smelter’s capacity by 20%. The total investment is the largest of its kind to be made in Iceland since the 2008 financial crisis and Rio Tinto Alcan’s biggest investment in Europe in the last 15 years. The ISAL investment project is part of the company’s strategy of developing its top-tier assets and of being a stable supplier of high quality billet. Leveraging ISAL’s renowned clean energy source in hydro power, low CO₂ emissions and strong performance on health, safety and the environment, the investment is testament to RTA’s uncompromising commitment to a sustainable future.

As green as energy gets

Because of Iceland’s abundant hydro and geothermal energy resources, some 85% of all primary energy used in the country is renewable and locally produced. The history of ISAL is strongly linked to Iceland’s harnessing of its renewable energy resource, as the first major hydroelectric power plant in the country was built specifically to power the ISAL smelter more than 40 years ago. ISAL uses close to 3,000 gWh of electricity per year, or 17% per cent of the electricity used in Iceland. It is critically important that it sources electrical power produced through hydro energy, which causes negligible CO₂ emissions, to minimise the carbon footprint of its aluminium production.

Rio Tinto Alcan’s investment project to produce value-added billet at ISAL was facilitated after the smelter reached a landmark energy supply agreement with Landsvirkjun, the Icelandic national power utility. The new contract took effect on October 1, 2010 and will run until 2036. The long-term contract provides for 75mW of additional power, for the continued supply of energy currently purchased by ISAL under various agreements and the continued compliance with emission limits as well as the reliability of operations.

The new ISAL casting facility has been equipped with state-of-the-art technologies to supply the best available billet quality on the European market. RTA’s industry expertise and experience with billet technologies, as well as extensive knowledge of market expectations, were contributing factors in the selection. The casting technology has been used with great success at the Sor-Norge Aluminium AS (Soral) facility in Norway, a 50 per cent RTA joint venture.

The installed casting and homogenising technology allows ISAL to produce billets of the highest quality to customer specifications, providing a very low scrap.
rate and a high degree of reliability. The reliability and automated processes make ISAL the first “hands off” billet casting facility in Rio Tinto Alcan, a breakthrough achievement that sets new standards of safety. In addition to the use of new technologies, two furnaces in the casting facility were converted from oil to electricity to reduce the emission of greenhouse gases. The oil used to cast the billets is fully biodegradable and only one twelfth of it is used in new production when compared with the pre-modernised facility.

**Health, safety and environmental excellence**

The new billet casting facility is being built on a foundation of strong environmental stewardship, a tenet of RTA’s approach to sustainable development.

One of ISAL’s principal objectives is to minimise the emission of greenhouse gasses, which in aluminium production are carbon dioxide (CO2) and perfluorocarbons (CF4/C2F6). Since 1990, the total emission of greenhouse gasses, measured in tonnes, has decreased by about 50% despite a doubling of production volume.

The emissions per tonne of aluminium produced, therefore, have decreased by approximately 75%, due to ISAL’s targeting of perfluorocarbons. In 2008, ISAL achieved the best results among all aluminium smelters in the world.

ISAL’s total emissions of greenhouse gasses amounted to only 1.59 tonnes (CO2 equivalent) per tonne of aluminium produced in 2011, surpassing the smelter’s goals. The average greenhouse gas emissions intensity of aluminium smelters worldwide in last year was approximately 11 tonnes (CO2 equivalent) per tonne of aluminium produced. This includes GHG emissions from energy sources.

In addition to this significant achievement, ISAL is in partnership with the Agricultural University of Iceland to significantly reduce greenhouse gas emissions from the soil. In co-operation with various landowners, ISAL is preparing to reclaim lost wetlands at numerous sites around Iceland. These sites are big sources of greenhouse gasses and rehabilitating them can greatly reduce emissions.

Excellence in safety is another cornerstone of RTA’s approach to sustainable development and great importance is placed at ISAL on making the workplace incident-free. The facility strives to create a “Zero Harm Culture” and has achieved considerable success in this regard. No serious incident occurred at ISAL in 2011. As of December 23, 2011, employees had worked six million hours without a serious incident.

**Strong socio-economic growth**

It is estimated that approximately 4,800 people work in the aluminium industry and related sectors in Iceland, or approximately 2.7 per cent of the Icelandic workforce. Of this number, 2,000 are directly involved in aluminium production.

The hundreds of jobs required for the execution of the investment project – 90 per cent of which has been filled by the domestic workforce – is a welcome and timely addition for the local economy. However, ISAL’s economic impact is not only in the jobs it creates, but in all its activities, including the goods and services it purchases from Icelandic companies, payments to contractors and the resulting foreign currency income that it brings into the Icelandic economy. The total amount of purchased goods and services (excluding electricity) in Iceland in 2011 was ISK 14.3 billion, as compared to ISK 6.8 billion the year before. This considerable increase can be attributed to RTA’s recent investments in ISAL, which include the new billet casting facility. The activities have had a positive effect on the Icelandic economy and reinforce ISAL’s position as one of Iceland’s main exporters.

**Engaged with communities**

ISAL’s goal is to ensure that its operations are carried out in harmony with the environment and the community. A five-year community multi-year plan is in place to measure this goal, in addition to conducting regular opinion surveys of local residents. In the last public opinion survey, 64.8 per cent of local residents had a very or rather positive attitude towards ISAL. It is an engaged corporate citizen, providing ISK 46 million in grants and sponsorships in 2011, with special emphasis on support of activities for children and youth. Employees are connected with their communities and give generously of their time to local causes.

RTA’s significant investment in ISAL is reflective of its commitment to grow sustainably, focusing on modernisation projects that leverage renewable, low-cost hydroelectric power. The investment will reinforce RTA’s market position in Europe and demonstrate its long-term commitment to being a reliable supplier of high-quality billet for its customers.
Dubai Aluminium (Dubal) has always considered the potential environmental impact of its operations and closely monitors activities on-site in conjunction with independent authorities such as consultants advised by the International Aluminium Institute (IAI).

Emissions are tightly controlled with most internal targets being well within legal requirements. Strategically located ambient air monitoring stations are positioned throughout Dubal’s premises and measure the emission levels of NOx, sulphur dioxide (SO2), hydrogen fluoride (HF) and particulate matter (PM10). Every two hours, recorded data is delivered on-line to DUBAL’s environmental laboratory, enabling comprehensive reporting and quick decision-making.

A judicious capital investment programme, designed to sustain the company’s competitive advantage, is in place. Since the beginning of the new millennium, voluntary investments to minimise Dubal’s environmental impact have amounted to more than US$330 million of which US$269 million was spent on emission control equipment – including the best available technology for minimising air emissions, generated primarily by Dubal’s power plant and smelting operations. It’s an approach that is paying dividends as the volume of harmful emissions emanating from Dubal is on a continual decline.

The Dubai power plant generates carbon dioxide (CO2), SO2, NOx and PM10. The choice of a combined cycle power system has enabled marginal reductions in CO2 emissions through higher efficiencies and lower consumption of hydrocarbon energy. Since December 2010, roughly 30% of Dubal’s entire power generating needs (more than 510MW out of 1,860MW) has been supplied through steam turbines.

Dubal uses gas as a main fuel source, secured through a long-term contract. Gas is the ‘cleanest’ fossil fuel (as indicated by the lower emission volumes of SO2, NOx and PM10). The installation of six state-of-the-art combustion systems (low NOx burners (DLN1)) in the existing large power plant and additional built-in gas turbine burners has reduced Dubal’s NOx emissions in line with world standards: the overall plant level of NOx emissions at Dubal dropped by six per cent between 2008 and 2011.

Being a primary aluminium smelter, the major air emission from Dubal’s operations is HF. Under normal operations, chemical recycling via high-efficiency Fume Treatment Plants (FTPs) helps contain the plant’s HF emission levels. In 2011, DUBAL’s total fluoride emissions, at 0.55 kg/tonne aluminium were 11.6 per cent down on 2010 (0.63 kg/tonne aluminium) and 38 per cent lower than in 2000 (Fig 1).

Dubal’s on-site ambient air quality monitoring system ensures stricter management of air emissions and has been extended by way of a HF monitoring network, which provides real-time data for HF emissions – thus enabling quick remedial action in response to any detected change. A Continuous Emissions Monitoring System (CEMS) for HF has been installed in all of Dubal’s potlines.

The main sources of greenhouse gases (GHGs) at Dubal are: mobile equipment and vehicles; natural gas consumed in the furnaces, baking kils and rodding room; anode consumption during the reduction process; perfluorocarbon (PFC) emissions from anode effects; and power generation activities. Where PFC emissions are concerned, Dubal’s operations emitted 0.125Mmt of CO2eq in 2011 (a 52 per cent improvement, year-on-year). Total GHG emissions have dropped by 10 per cent since 2006.

Dubal has launched a programme to facilitate stricter control over anode effects and reduce PFC emissions. The primary aim of the programme is to decrease the number and duration of anode effects through changes in alumina feeding mechanisms, thus minimising PFC generation.

It is estimated that the programme will minimise Dubal’s annual GHG emissions by approximately 20kmt of CO2eq, supporting the Dubai smelter’s efforts to reach the IAI’s target on PFC emissions by 93 per cent by 2020 (from 1990 levels). By 2011, the volume of PFC emissions at Dubal was already 88 per cent lower than in 1990 (Fig 2).
Ever wondered whether it was possible to produce alumina without resorting to the Bayer process? It’s a subject that has kept Richard Boudreault, president and CEO of Orbite Aluminae, very busy – and now he’s perfected a system that might revolutionise the aluminium industry.

It all started with a type of red clay, said Richard Boudreault, founder of Orbite Aluminae. “A few years ago somebody came to us with a red mud problem; not red mud in the true sense of the phrase, but a type of red clay,” he says. “There was about 25% of alumina in there and they wanted to know if we could do something with it. I said we could do a Bayer, but nobody would give us authorisation because the process is too polluting,” he continues.

A materials scientist by trade, Boudreault pondered the problem. “What if we were able to produce, not smelter grade alumina, but high purity alumina?” he thought, and started work on a solution. “I drew up a process by which we could produce high purity alumina, which was then digested with hydrochloric acid. So it was a very biological process and it became fairly obvious that it was possible,” Boudreault continues.

According to Boudreault, there’s no need to be overly cautious about cost with high purity alumina because it’s worth about a thousand times more than smelter grade alumina. He developed a process based on neutralising the acid with caustic soda – or NaOH – and getting rid of it. When the Canadian aluminium industry – the third largest producer in the world – got wind of Boudreault’s fledgling process, that phrase ‘corporate social responsibility’ was front-of-mind.

“They said ‘this is great and it’s good for our CSR and we’ll support you because you’re doing alumina work and we have to give something to the Government in terms of job creation, so we’ll help you and then we can say we created those jobs’ explained Boudreault.

Smelter grade alumina

Canada needs smelter grade alumina, he said. “They say, ‘We don’t get supplied that often, we’re at the end of the production line and once in a while the boat doesn’t show up, it goes to China instead, and then we get into a bit of a turmoil’,” he added.

The current cost of smelter grade alumina is prohibitive, says Boudreault, as it’s produced from bauxite imported from Jamaica and East Africa at high cost. It generally takes three tonnes of bauxite to produce one tonne of alumina.

In recent years, Boudreault claims that Canada’s big mining companies – traditionally arch enemies – have been prepared to share ships rather than kiss goodbye to their process, so the idea of a new technology that could provide the Canadian industry with home-grown alumina was more than just intriguing.

While Boudreault had established that his process worked there was a real need to recycle the hydrochloric acid. “If we were to release it into the environment, it would be too much and it would need a lot of NaOH to neutralise it,” he said.

The Orbite process extracts alumina and other materials from clay and eliminates red mud in the process. The red mud remediation process and the red clay extraction are basically the same process, meaning that one single plant can do both.

To be able to reuse previously used acid, it was necessary was to clean the acid. “And when you do that you have to extract material that is still floating – magnesium, iron and other materials including a number of rare earths, such as scandium.

By extracting just the alumina, our cost to produce the alumina is around $210/tonne, but if the other materials are taken out it drops to $98/tonne. “Essentially you have a negative cost alumina and that doesn’t make sense so
It's a big environmental problem," he said. "Alumina you get two tonnes of red mud. And then the silicon, iron and aluminium to form that threesome and is damn near impossible to break up," he added, explaining how the Bayer process allows the silicon, iron and aluminium to form and then float in a caustic solution in order to separate them. "So the first process you have out of the Bayer method is this pollution material and for every tonne of aluminium you get two tonnes of red mud. It's a big environmental problem," he said.

While using bauxite with a low iron and silica content is ideal, but the best refiners in the world still produce two tonnes of red mud for every one tonne of alumina. Orbite’s solution is to place the aluminium, iron and silica into a very strong acid and then, as the material floats in the acid, change the pH rapidly so that one of the materials — silica — falls out. Once the silica is out, the deadly combination of aluminium, silica and iron that ultimately forms ‘red mud’ is eliminated. "The first thing that will come out is alumina and then the iron in an oxide form," said Boudreault.

But what about existing red mud ponds where the threesome has already joined forces to form red mud? "Our process can separate these three elements even after they have merged, and at the same time extract alumina and other by-products," says Boudreault.

He claims that Orbite’s new process eliminates red mud. "There’s no problem anymore because essentially you don’t have this marriage of the three elements and that’s how complex it is," he said.

The Orbite process separates these three elements even after they have merged and, at the same time, extract alumina.

"Producing alumina was the big thing, but we discovered two years ago that a lot of the pollutant materials we had to extract from aluminous clay were worth a lot of money. The iron is a 99.9% hematite, which is used to make magnets for electric motors, and one of the rare earths is scandium, which we expect to be the next revolution in the aluminium industry," he explains, adding that the content of aluminous clay (red clay) is pretty much typical; other red clay samples contained similar alumina and by-product content.

So what exactly is Orbite Aluminae doing and why is it so revolutionary? The company has developed a process that Boudreault claims can extract alumina and other valuable properties, including rare earths and metal oxides — like Yttrium, Erbium, Scandium, Dysprosium, Neodymium, Gallium and Cerium — from clay and, ultimately, eliminate the Bayer methodology from the aluminium production process. In other words, you don’t need bauxite to make alumina.

**Making Bayer obsolete**

"This technology allows you to produce alumina locally from basic dirt in the ground such as clay, bauxite and kaolin. If you’ve got any of these materials, you’re in business. We can produce alumina from anything, including bauxite, but also a lot of different things. The Chinese are importing bauxite from Indonesia — they don’t need to do that anymore. They can produce it from their own backyard and save so much CO₂," he says.

"We can produce alumina in any country in the world and the plant doesn’t have to be far from the smelter, so you eliminate all the costs of transportation," Boudreault explains.

He claims that Orbite’s patented process will sound the death knell of the industry’s big nemesis: red mud. "Aluminium, iron and silicon: the thing they want to do most is get married and form a threesome and when they lock together, they form red mud," says Boudreault.

"The red mud which is produced from the Bayer process is essentially the formation of that threesome and is damn near impossible to break up," he added, explaining how the Bayer process allows the silicon, iron and aluminium to form and then float in a caustic solution in order to separate them. "So the first process you have out of the Bayer method is this pollution material and for every tonne of alumina you get two tonnes of red mud. It’s a big environmental problem," he said.

The company has a commercial scale pilot plant in operation that produces alumina, which is a little bigger than half scale in terms of size. The company is already working on a full-sized plant to be built in Eastern Quebec that will be producing high quality alumina in Q1 of 2013 and is talking to different people around the world about licensing the technology.

"There are a lot of alumina plants and they’re all stuck with a lake of red mud. We can empty them," claims Boudreault, adding that most red mud ponds are at their limit. Plants in Germany, he said, will have to close within the next two to three years as their permits expire. In Canada it’s 10 years.

Orbite’s next step is to ‘go commercial’. "We’re producing a high purity alumina plant in Cap-Chat on the Gaspe peninsula in Quebec. It has multiple lines and will produce about five tonnes per day of high purity alumina and we’re planning to have another plant beside it in 2014/2015 that will produce 540kt/yr of smelter grade alumina," he said.

Boudreault is naturally excited about the possibilities for his new process. "What we expect is that the industry — and this is happening already — will come to us and say ‘I have a big red mud pond and I would like to transform it into these products’. And because our process can work with any type of raw material — it can work with bauxite or clay — it can work with red mud and we’re turning it into alumina," he said.

There is no red mud left over after the process, says Boudreault, and what’s more, the Orbite process transforms red mud into alumina at a lower cost than the Bayer process transforms bauxite into alumina. "Bayer only creates the red mud, it can’t remediate it," says Boudreault. With the Orbite process, the alumina recovered is negative cost if the rest of the materials recovered, including the rare earths, are taken into account.

**Above:** red mud on the left and after treatment

**Above and below:** high purity alumina
Some of the rare earths that can be extracted using the Orbite process.
A prospective EU tariff on Gulf aluminium means that European consumers will pay more than necessary, says Mahmood Daylami.*

Gulf Euro exports dampened by tax

In April this year the Gulf Aluminium Council (GAC) held its annual dinner in Abu Dhabi where around 300 invited guests representing the aluminium producing companies, technology providers, power generation manufacturers, traders, service providers, bankers and government officials from different parts of the world gathered at an occasion which has become the top meeting place for the global aluminium industry. One guest remarked, “Such high level executives in one place is unprecedented.”

The next day, the IAI held its board meeting in Abu Dhabi for the first time and during the same week over 450 delegates attended the CRU Aluminium Conference. Arrangements are now completed for the ARABAL conference in November in Qatar. Such vibrant activity is not without foundation. Ma’aden’s US$10.8 billion investment is progressing well for start-up in 2013 and Emal has started its Phase II development using Dubal’s DX Technology.

Meanwhile a number of downstream industries are being established to take advantage of the availability of aluminium as a raw material – rolling mills in Oman, extrusions in Abu Dhabi and Qatar plus the possibility of expansion at Alba.

Looking back we sometimes forget that aluminium production in the Gulf started more than 40 years ago. The first smelter in the Middle East was built in Bahrain in 1971 to meet the country’s need to diversify its industry and economy, create jobs for its growing population, and improve the utilisation of its energy resources.

In 1979, Dubal started its second smelter in the Gulf. Then, almost 30 years later in 2008, the Sohar smelter started production in Oman, followed in 2010 by Qatalum in Qatar and Emal in Abu Dhabi. Currently, Ma’aden, the fully integrated project (mining, refinery, smelter, cast house and rolling mill) is under construction and production will start in 2013. Emal has also embarked upon its phase II expansion project to double its production capacity. This will be completed in 2014.

During the last 40 years, primary aluminium production in the region increased from 120kt/ year in 1971 to 3.6Mt in 2011, contributing 8% of total world production.

With the Ma’aden project and Emal expansions completed by 2014, the region’s production will reach around 5Mt/ year, which will equate to 10% of world primary aluminium production. In 2014, four of the top 10 primary aluminium producers in the world will be from the GCC.

With the increase in world demand for aluminium growing at an average of 5% annually, demand from the Gulf is expected to grow. This will drive Gulf producers to expand their production capacity even further.

The growth of the aluminium sector has led to the creation of a number of downstream industries in the region. Together with the smelters, the aluminium industry’s investment in the region is around US$40 billion.

With the fully integrated Ma’aden project in Saudi Arabia, an additional US$10.8 billion investment will be added, plus US$4.5 billion through Emal’s Phase II expansion project. Each country in the Gulf has downstream semi-fabricators, built mostly by local businessmen to replace imports required for local markets. Extrusion for the construction industry was the first of these investments, others have followed.

Currently, Gulf downstream industries produce profiles for construction, automobile parts, cables, rolling products for packaging, and many diverse premium secondary products for local and world markets. There is strong potential for more investment, as each Gulf state with a smelter has developed a plan to attract investment in their respective country as a part of the regional drive for industrial diversification. Accordingly, a number of downstream industries are under

![Fig 1 GAC primary aluminium production in Mt 1971-2011 Source: GAC](image)

*Mahmood Daylami, secretary general, Gulf Aluminium Council
construction in Abu Dhabi, Oman, Saudi Arabia and Qatar. The current emphasis is on new products such as casting automobile parts rather than adding on to what is currently being produced.

**Business development**

The dynamic nature of the aluminium industry in the Gulf is well-recognised by organisations associated with the business. Most of the well-known producer companies have already established themselves in the region and there are others who are in the process of doing so by building manufacturing or service facilities to meet the growing needs of the region.

**EU tariff**

Aluminium production in the Gulf remains export-oriented despite growing local consumption mainly in the construction industry. Some 80% of the total primary and 50% of downstream production are shipped to different parts of the world. There are growing exports to Europe despite the European Union imposing a 6% tax on alloyed aluminium products from the Gulf and 3% on the non-alloyed product. This commercial barrier has been maintained through aggressive lobbying by the major European producers and is not only fundamentally wrong when it comes to free market principles advocated by the West, but also works against aluminium consumers in Europe. Such tax remains a bone of contention between two very important trade areas – the GCC & EU. The continuity of this tax, despite reducing aluminium production capacity in Europe, is having a negative impact on European manufacturing competitiveness. The fact that the removal of the tariff is being resisted by European aluminium producers indicates that they alone are currently benefiting from maintaining such a tariff while European downstream, and ultimately European consumers, have to pay a higher premium than necessary.

**Table 1:** Primary smelters’ capacity in the Gulf

<table>
<thead>
<tr>
<th>Country</th>
<th>Company</th>
<th>Annual production capacity</th>
<th>Year commissioned</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>Alba</td>
<td>880,000</td>
<td>1971</td>
<td>Bahrain – 67.5% SABIC – 21.5% Public 11%</td>
</tr>
<tr>
<td>Dubai</td>
<td>DUBAL</td>
<td>1,002,000</td>
<td>1979</td>
<td>Dubai Government – 100%</td>
</tr>
<tr>
<td>Oman</td>
<td>Sohar</td>
<td>370,000</td>
<td>2008</td>
<td>Oman Oil Co – 40% Abu Dhabi water &amp; elec. Authority – 40% Rio Tinto Alcan – 20%</td>
</tr>
<tr>
<td>Qatar</td>
<td>Qatalum</td>
<td>585,000</td>
<td>2010</td>
<td>Qatar Aluminium – 50% Hydro Aluminium – 50%</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>Emal</td>
<td>750,000</td>
<td>2010</td>
<td>DUBAL – 50% Mabadala – 50%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Ma’aden</td>
<td>740,000</td>
<td>2012</td>
<td>Ma’aden – 74.9% ALCOA – 25.1%</td>
</tr>
</tbody>
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Aluminium International Today September/October 2012
Dubal’s leading regional role

With a production capacity in excess of 1Mmt, Dubal is currently the largest single-site primary aluminium smelter in the Gulf Co-operation Council – and the largest in the world using pre-bake anode technology. The company has a 50% share in Emal and claims to be quietly confident of future success both regionally and globally.

In 2007, the primary aluminium industry in the Gulf Co-operation Council (GCC) region of the Middle East comprised two major smelter complexes: Aluminium Bahrain (Alba, established in 1971) and Dubai Aluminium (Dubal, commissioned in 1979). Their combined production of 1.8Mmt/yr in 2007 represented five per cent of the 38Mmt/yr global aluminium production that year.

Since then, the industry in the GCC region has grown rapidly. Three greenfield smelters – Sohar Aluminium (370kt/yr), Emirates Aluminium (Emal, 740kt/yr) and Qatalum (585kt/yr) – have come on stream; and operations at Dubal and Alba have expanded. As a result, the region produced 3.6Mmt/yr in 2011, equivalent to 7.9 per cent of the 45.5Mmt produced worldwide. Further growth is already underway, with the new Ma’aden smelter under construction (1.4Mt, built in two phases) and brownfield expansions planned, announced and at various levels of progress at Sohar Aluminium, Emal, Qatalum and Alba (totalling another 2Mmt/yr). These projects will lift the primary aluminium production capacity of the GCC region to 5Mmt by 2015 (nine per cent of forecast total world production), ultimately topping 7Mmt.

Importantly, three of the new smelters in the region are owned in part by major Western aluminium producers – Rio Tinto Alcan (Sohar Aluminium), Norsk Hydro (Qatalum) and Alcoa (Ma’aden). Dubal owns a 50% share in the fourth new smelter, Emal. The investment made in the GCC aluminium industry is indicative of the operating benefits in the region – specifically the ready availability of energy; relatively low labour costs; and convenient location, with reach across the globe – and reflects the growing stature of the GCC as an important global aluminium hub.

Indeed, the advent of the new smelters has boosted the profile of the GCC aluminium industry in several dimensions. Apart from the increased regional contribution to global production levels, the deployment of newer technologies has ensured that the newcomers are more environment-friendly than older installations elsewhere in the world: a distinct advantage in today’s business climate. Moreover, lower operating costs offer greater economic sustainability against the cyclical fluctuations of the aluminium price.

Further underscoring the role of the GCC in the global aluminium industry, the primary aluminium producers in the region officially launched the Gulf Aluminium Council (GAC) in 2010. This independent body represents, promotes and protects the interests of the regional aluminium industry. Dubal played a pivotal role in the formation of GAC, and its president and CEO, Abdulla Kalban, is its chairman. The collaborative efforts facilitated by the GAC in research and development, skills development, and optimised performance will contribute to the longer-term strength of the aluminium industry in the region.

Dubal: a regional and global leader

With a production capacity in excess of 1Mmt, Dubal is currently the largest single-site primary aluminium smelter in the GCC; and the largest in the world using pre-bake anode technology. Having completed the last in a series of ambitious expansion projects in 2008, the Dubal smelter complex comprises 1,573 reduction cells in eight pot lines. No further major expansions are planned on the site. Instead, by concentrating on improving its operations, Dubal intends to gain better production returns on its expanded infrastructure.
With this in mind, Dubal continues to focus attention on optimising the business through diverse initiatives. For example, ongoing research and development has yielded Dubal’s proprietary, in-house-developed DX and DX+ reduction technologies: the first company in the Middle East to do so. Both technology variants operate at high amperage levels and thus yield increased energy efficiency, greater productivity per cell and reduced environmental impact.

During 2005, Dubal formulated a quantitative vision “to be among the world’s top five primary aluminium producers by 2015”. In pursuit of this, the company invested in Emal with joint venture partner Mubadala Development Company and, following the announcement of Emal Phase II in mid-2011, Dubal has virtual certainty of fulfilling its vision by 2014. A quantitative vision “to be one of the best companies in the global aluminium industry in production, markets, people and results by 2020” was, therefore, adopted at the start of 2012.

The remarkable success of Emal to date is largely attributable to the knowledge and expertise of Dubal: the company has seconded key personnel for the construction and operating phases; transferred skills through extensive operator training initiatives; licensed its proprietary DX and DX+ reduction technologies (to Emal Phase I and II respectively); facilitated raw material procurement for Emal; and provided full marketing and sales services for its entire production. For Emal, the advantages of piggy-backing on Dubal’s established sales infrastructure have been substantial – especially as both smelters are niche-focused in the premium purity, highest quality segment of the market.

Dubal is also reviewing, together with Mubadala and partners, other aluminium projects which, after feasibility studies are completed, will benefit from Dubal technologies, project execution and operational expertise. In addition, Dubai is keen to license the installation of its cutting-edge DX and DX+ reduction technologies in new green- or brown-field smelter development projects. Moreover, the company has invested in various upstream bauxite/alumina development projects – notably in Brazil, Republic of Guinea and Cameroon – with the objective of securing equity alumina for the future operational security of both Dubal and Emal.

A culture of excellence and progress through innovation pervades all aspects of Dubal’s operations. It’s an approach that consistently delivers benchmark results. For example, on the safety front, the total recordable injury frequency rate (per million man-hours) at Dubal’s Jebel Ali site declined to 3.55 in 2011 — down from 13.12 in 2004. In terms of occupational health, 2011 was the fifth consecutive year in which no lost days due to heat-related illnesses were recorded. Environmentally-speaking, Dubal’s endeavours to reduce energy consumption and harmful emissions (particularly fluoride and perfluorocarbons) yielded results ahead of targets set by the International Aluminium Institute (IAI) for 2010.

Other harmful emissions from Dubal’s operations are also declining: oxides of nitrogen volumes have been maintained from 2008 to 2011, even though hot metal production increased by 15 per cent over the same period; the metric tonnage of sulphur dioxide emitted per metric tonne of aluminium produced decreased measurably. The volume of hydrogen fluoride emitted has continued to decline such that in 2011, Dubal’s total fluoride emissions were 38 per cent lower than in 2000. Similarly, the volume of perfluorocarbon emissions has fallen and in 2011 was 88% lower than in 1990.

Although Dubal has a captive power station generating 2,350 MW (at 30°C) and is, therefore, self-sufficient, the company places substantial emphasis on conserving energy through efficiency-improving measures. For example, by implementing the directives (April to December 2011), Dubal saved 6.9MKWh. A further 4.4MKWh have been saved in the first six months of this year (January to June 2012), bringing the total savings over the 15-month period to 11.4MKWh while simultaneously reducing CO2 emissions at Dubal by 5.7kT.

As a member of the Dubai Supreme Council of Energy (DSCE), Dubal has implemented the directives issued to all DSCE member companies in April 2011 to minimise energy consumption in fulfilment of the Dubai Integrated Energy Strategy 2030. In the first nine months of implementing the directives (April to December 2011), Dubal saved 6.9MKWh. A further 4.4MKWh have been saved in the first six months of this year (January to June 2012), bringing the total savings over the 15-month period to 11.4MKWh while simultaneously reducing CO2 emissions at Dubal by 5.7kT.

Dubal’s most recent biennial employee survey (conducted in the first quarter of 2011) revealed high levels of satisfaction, both overall and across many of the dimensions measured. Some 84% of employees participated in the third Voice Your Opinion survey, which was conducted by Hay Group (an international management consultancy) and analysed using industry benchmarks. Dubai ranked seven per cent above the global industry norm, four per cent above the Middle East norm and on par with the high performing companies norm. These results reflect the mutual trust and respect between employees and leadership at Dubai; the world-class training and development opportunities offered to all employees; and the loyalty of the workforce. These attributes are endorsed by Dubai’s strong ‘Emiratisation’ track record, with 15.4% of employees comprising UAE nationals at the end of December 2011, rising to above 65% at senior management level (extremely favourable figures against Dubai’s average
industrial Emiratisation level of 4%; and the inherent stability of the workforce. At the end of 2011, approximately 24 per cent of employees had served at Dubal for 10 to 20 years and around 8% boasted service tenure longer than 20 years.

The GCC aluminium industry: a promising future
Analysts believe that demand for aluminium will continue to grow for the foreseeable future. With a relatively limited market for local usage, the GCC will remain a net exporter of aluminium for years to come. Indeed, with net longs in production the region will be a dominant global player – a strong position to occupy given the increasing shortfall in domestic metal supply within developed markets such as North America, Japan and Western Europe.

Solid growth in infrastructural development is charted for the greater Middle East, which will inevitably increase the consumption of primary aluminium in the region. Greater emphasis is, therefore, being placed on establishing sustainable downstream aluminium industries to complement the smelters in the GCC countries.

Development of the Khalifa Industrial Zone Abu Dhabi (KIZAD) will comprise an integrated mix of raw material production and downstream manufacturing in industrial clusters assembled in an area larger than 400km², with Emal as its anchor tenant. KIZAD’s location gives easy access to large sea and airports in the region as well as access to global markets. Part of KIZAD’s aim is to attract downstream producers of semi-fabricated aluminium products – using liquid metal or value-added products from the Emal smelter. The overall development of the downstream market will complement the existing, well-established downstream sectors in Bahrain and the UAE, contributing to job creation and socio-economic development in the region.

With such depth of potential, the GCC aluminium industry faces the future from a position of strength. Dubal, as the regional leader, remains quietly confident of continued growth.

Contact
www.dubal.ae

Aluminium International Today
Turkey’s strategic advantage

Turkey has the potential to maintain sustainable growth and become the region’s centre for aluminium semi-finished products, thanks to its strategic location between Europe and Asia.

By Kemal Mert Demirci*

Sustainability is the buzzphrase of the moment. If you conduct research into aluminium or participate in a conference, you will definitely encounter many articles, speeches or studies regarding the sustainability of aluminium.

Aluminium is, without doubt, a sustainable metal, but the big question is: will Turkey demonstrate sustainable growth in the aluminium market?

If we evaluate Turkey’s position in the world aluminium market through the value chain, we must start with bauxite (Fig 1).

As of 2010, world bauxite reserves were approximately 38 billion tons and this was made up as follows: Guinea (23%), Australia (21%), Vietnam (14%), Brasil (7%), Jamaica (7%), China (6%), India (4%), Guyana (2%), Greece (2%), Surinam (2%) and Kazakhstan (1%). These nations account for 89% of world bauxite reserves.

World bauxite production reached 214 million tons in 2010.

In Turkey, bauxite reserves total just 69kt, according to Mineral Research & Exploration General Directorate (MTA) data.

Alumina

World alumina production reached 82Mt in 2010. China is the global leader with 29Mt, followed by Australia with 21Mt and South American countries with 17Mt. These three regions comprise 72% of alumina production capacity. Turkey produces 200kt.

Global primary aluminium production reached 39Mt in 2010. China leads the way with 16Mt and accounts for 41% of premier aluminium production. China also has the highest number of primary aluminium production plants in the world with 71 smelters. Turkey, on the other hand, has 60kt of aluminium production capacity and just one smelter.

There are three major factors in primary aluminium production costs: energy, alumina and labour respectively. Energy is most critical as the cost varies between 20% and 45% of total production. Energy accounts for 25% of alumina production costs.

*Sustainable aluminium production in the world (Mt) — primary and secondary aluminium production in Turkey (Tons)

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costs and primary aluminium production is highly dependent upon energy prices.

High energy costs
While China is the global leader in primary aluminium production, it is also among the most expensive producers, due to high energy and alumina costs. Despite high production costs, China’s domestic demand – which is higher than production – offsets the cost disadvantage.

Europe boasts the highest aluminium production costs, due to high energy and labour charges. Because of this, the highest number of plant shut-downs occur in Europe especially when the price of aluminium quoted on the London Metal Exchange (LME) falls to below the cost of production. High energy and labour costs are the leading factors behind the lack of new smelter projects in Europe. The position is similar in Turkey.

The Gulf
The Middle East has experienced rapid growth in primary aluminium production. The gulf region offers abundant energy resources. Smelters in the area are increasing their share of primary aluminium production, which is expected to reach 4.6Mt by 2015. Closeness to raw materials and the market and energy prices are the three determining factors for success in terms of bauxite, alumina and primary aluminium production. While some countries and regions are better placed than others in respect of these factors, those that are well-placed in all three determine the direction of the market.

Global players operate bauxite mines and alumina refineries in countries with bauxite reserves. They invest in smelter projects in countries offering inexpensive energy resources and produce primary aluminium in the most favourable conditions. Geopolitics plays a crucial role in the strategic plans of global players.

Increasing energy costs are making the secondary aluminium industry more attractive as energy consumption is lower when compared to primary production. Secondary aluminium can be produced using only 5% of the energy spent on primary production.

Bearing this in mind, secondary aluminium will increase in line with demand for primary aluminium over the next 10 years.

While world primary aluminium production approached 18Mt. While primary aluminium production approached 18Mt. While primary aluminium production remained unchanged at 60kt in 2010, secondary aluminium production increased 150% and reached 150kt tons in Turkey (Fig 2).

Semi-finished products
Turkey stands out in the aluminium market with semi-finished products being the fourth link in the value chain. Turkey is strengthening its position in the sector by

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Table 1: Ranking of flat-rolled aluminum product exporting countries by year (quantitative) (*Republic of South Africa)
rapidly increasing production especially in extruded and flat-rolled products. According to 2010 date from the Turkish Aluminium Industrialists’ Association (TALSAD), 275kt extruded, 198kt flat-rolled products, 213kt in unwrought (primary and secondary) aluminium and 60kt foil was manufactured. Turkey’s secondary aluminium industry has facilitated an increase in ingot production with 60kt unwrought manufactured from primary aluminium and 153kt tons from secondary (scrap) (Fig 3). In 2010, Turkey exported US$1.2 billion worth of aluminium, making it number 20 in an imaginary aluminium exporters’ league (Fig 4).

Turkey’s total aluminium export figure in 2010 was over 500kt. Flat-rolled aluminium products are by far the biggest export at 146kt. Extruded products are second with 134kt and unwrought are next with 79kt.

Foil stands at 44kt and conductive products boost 26kt. Turkey exports more than 50% of the aluminium products it manufactures (Fig 5).

Turkey has steadily increased its flat-rolled aluminium exports, moving up the world ranking from 17th to 12th place over a three-year period from 2008 to 2010. In 2008 it exported 89kt, increasing to 91kt in 2009 and 147kt in 2010. The ranking of flat-Rolled Aluminium exports

Turkey is very low, the country imports most of it. Primary aluminium accounts for 81% of total aluminium imports. In fact, Turkey can only produce 10% of its...
primary aluminium demand – the rest is imported (Fig 8).

Turkey’s imported primary aluminium is processed and exported as extruded, flat-rolled products and semi-finished goods.

Turkey is the seventh largest importer of unwrought aluminium products (Table 3). It imported 598kt in 2008, 570kt in 2009 and 744kt in 2010. Despite an increase in demand for primary aluminium, steady domestic production is the main reason for an increase in imports.

Turkey’s primary aluminium imports from Russia, Tajikistan, Norway and Kazakhstan account for 76% of total imports. Turkey imports 49% of its primary aluminium from Russia, demonstrating that diversity has not been achieved in the import market.

A lack of raw materials

Turkey does not have the raw materials to meet its rising production and export needs. If investment in this field falters then export volume is likely to remain the same. If this is the case, total imports for 2020 is predicted to be 1.6Mt of which 1.2Mt will be primary aluminium (Fig 9).

If planned investment is put in place for primary aluminium production in the medium-to-long-term, then whether or not Turkey’s bauxite reserves can meet demand should be considered. If the investment is realised then Turkey’s current bauxite reserves of 69Mt can meet demand for 13 years at most. Demand for primary aluminium in Turkey stands at 1.2Mt (Fig 10).

Turkey’s strategic location

Turkey has the potential to maintain sustainable growth and become the region’s centre for aluminium semi-finished products, thanks to its strategic location between Europe – which is one of the three largest aluminium markets – and the Middle East and Russia, which dominate energy resources, inexpensice and skilled labour, investment in high technology and consistent economic and political structure.

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New generation of pot ramming machines from Brochot

Reliability and quality
The Brochot pot ramming machine is the industry standard ramming machine. In the aluminium smelting industry, the Brochot pot ramming machine has become a reference for lining and re-lining electrolytic pots. Originally designed over 30 years ago, the machine has evolved considerably over the years. It has become an international standard for the aluminium industry, with units installed in all five continents.

Brochot has delivered 125 machines to 91 smelters. The company is able to deal with worldwide enquiries from smelters with different technologies, in which pots are of various shapes and sizes. For example: AP and Rio Tinto Alcan technology, Alcoa technology, Rusal, Hydro, Dubal, VAW Technology, VAMI technology, National Southwire, ASV, Alusuisse-Lonza, HA 230, MCS technology, Harvey Technology, Elektrokemisk Pechiney Sumitomo, Montecatini, Reynolds and Kaiser.

Brochot, through its experience, possesses different machine ranges, from 180kA to more than 400kA. It’s clear that we have to adapt the machine to different configurations: so the machine needs to have an overall dimension and weight to fit our customer’s constraints. The machine is always tailor-made.

Today, Brochot continues to bring improvements to the machine. After the all-electric ramming, the remote control, and the data box, it is going to reorganise the machine’s components in order to meet the requirements of new smelters and keep the machine as efficient possible.

Brochot works also on de-lining, which means removing all materials within the pot, and reusing the potshells for a new lining.

Reducing noise levels
Vibration is part of the process. First of all, thanks to remote control, the operator doesn’t feel anymore vibrations. All functionalities are remote-controlled, which massively improves working conditions. But Brochot’s ambition doesn’t stop here. The company is re-configuring the system’s components in order to isolate and reduce noise levels further, bearing in mind that the standard requirement is under 85dBA. Brochot will continue to improve on the system’s noise levels.

Improvements
By isolating the switchgear cable, Brochot is able to use the machine beyond 200 gauss and is working on a permanent solution in order to meet the needs of smelters.

High quality
The pot ramming machine can ram the paste into the gaps between the blocks in the cell at high density and can achieve this with hot, tepid, or cold paste. Brochot pot ramming machines are compliant with specific procedures, the repeatability from one pot to the other. This expertise and certification (to AP technology), allows to increase pot’s life.

A data box is incorporated into all Brochot pot-ramming machines and automatically records each step in the ramming process, storing the information on the main computer database. Such a practice provides the smelter with a clear and unmistakable picture of the entire pot-lining operation. Each step of the ramming operation is easy to control using the data box.

Workshop cleanliness is improved by the system’s paste feeding machine, which also reduces operating costs due to less handling and avoids paste wastage. The paste feeding machine’s ability to reduce handling improves working conditions and eliminates tar fumes. Working conditions and noise reduction are two of Brochot’s key priorities.

Four pot-ramming machines were installed at the Ma’aden smelter in Saudi Arabia in 2011 and more recently – at the beginning of 2012 – at Emal in Abu Dhabi and at Rio Tinto’s Kitimat plant. Both Ma’aden and Kitimat (Rio Tinto Alcan) have two pot-ramming machines.

Make no mistake, the pot-ramming machines of tomorrow are on the march!

Do not hesitate to contact us to discuss further opportunities as well as technical improvements and how we can meet your requirements.
Reducing roof vent emissions

When anode changes or metal tapping are performed on a pot line, the process demands that hoods and doors are opened, thus reducing efficiency where the collection of pot gases is concerned. Rio Tinto Alcan has developed the Jet-Induced Boosted Suction system – JIBS – to lower emissions during these critical operations. By Jean-Nicolas Maltais*

Global production of primary aluminium is increasing every year as demand grows. This leads to the construction of bigger aluminium smelters and the expansion of existing plants.

All industries are under pressure to reduce the carbon footprint of their operations and processes. The aluminium industry is no exception. Smelters are under ever-increasing pressure to minimise the environmental impact of the process for both existing and planned operations. This is particularly challenging when production is increased or when a giant smelter is built.

The chief emissions from the aluminium industry are carbon dioxide, fluorides, particulates, sulphur dioxide and greenhouse gases. For many years, the industry has been developing innovative tools and systems to reduce emissions, but efficiency and cost are an important consideration.

How fluoride emissions are produced

Aluminium production has been using the Hall-Héroult process since the beginning of the 20th century. For that process, a pot (or cell) is filled with a salt melt (electrolyte) that is used to dissolve alumina into ionic aluminium and ionic oxygen. Alumina is fed into the pot on a regular basis. With a consumable anode on top and a cathode on the bottom, electricity flows through the salt melt to reduce aluminium from its ionic form to liquid form, and producing CO₂ as a sub-reaction of the oxygen with carbon from the anode. The salt melt (electrolyte) is composed principally of cryolite (Na₃AlF₆), with other additives such as aluminium trifluoride (AlF₃) and calcium fluoride (CaF₂). The salt melt generates fluorides on a continuous basis, but since the pot is closed and connected to a scrubber, most of the fluoride emissions are collected through the gas collection system and brought to the scrubber where more than 99% of the fluoride is scrubbed (Fig 1).

Unfortunately, some operations carried out in the pot require that hoods and/or doors must be opened. These operations are anode changes, metal tapping, adding anode covering material and different samplings and measurements. These operations are of a short duration (between one and 20 minutes, depending on the type of work) but have a high impact on emissions (Fig 2). At such times, the pots are opened, gas collection efficiency drops and emissions to the building roof vents increase, especially fluoride emissions.

Collecting these fluoride emissions when the pot is opened is quite a challenge, and in many aluminium smelters, nothing is done at present to capture/reduce these emissions. A few aluminium smelters in the world are equipped with Dual Double Duct Boosted Suction (DDBS) systems, which are composed of a complete separated duct system with fans, in addition to a basic gas collection system. This DDBS system doubles the pot flow during work that requires doors/hoods to be opened, but it’s not cheap.

Jet-Induced Boosted Suction System (JIBS)

Boosted Suction systems aim to significantly increase exhaust flow when hoods/tapping doors are opened, mainly during the anode change and tapping shift. The objective is to maintain a minimum negative pressure inside the pot’s superstructure and collect most of the emissions. Traditional Dual Duct Boosted Suction (DDBS) systems require substantial capital investment and this has prevented their widespread deployment. With this in mind, Rio Tinto Alcan has developed a lower cost patented alternative to this traditional design, the JIBS.

The company’s patented JIBS system relies on two phenomena to boost pot flow. First, removable pivoting orifice plates replace the existing fixed orifice plates, which balance the flow among pots connected to the same dry scrubber. When flow has to be boosted, the restriction created by the orifice plate is released, thus mechanically increasing pot flow (typically +40% to 50% in partial JIBS). Partial JIBS are used principally during tapping operations because a slightly boosted flow will considerably reduce roof vent emissions when tapping doors are open.

*Jean-Nicolas Maltais, research & development scientist, Rio Tinto Alcan
In order to boost flow further – and in addition to the pivoting orifice that releases restriction – a blower is added. The blower feeds a jet of low-pressure air at each individual pot outlet inside the ductwork using a purpose-built nozzle. It entrains the surrounding air to provide extra boosted flow (typically +80%-100% in full JIBS). See Fig 3. The full JIBS is used principally during operations that require hoods to be opened.

The final design of the JIBS system is dependent upon the aluminium smelter where it is installed. The jet efficiency co-efficient depends on nozzle design and the overall ductwork arrangement. The objective is to maximise the jet efficiency using the minimal entrainment air mass flow rate to entrain the maximum air mass flow rate for the specific amount of gas flow rate at each individual pot outlet. As the JIBS system requires less equipment than traditional DDBS, capital investment is 40% to 50% cheaper than a typical DDBS set-up.

The JIBS system has been developed steadily. The first was on an AP2x pot in 2005 followed by trials on an AP2x smelter in 2008 – this was in Tomago, Australia. Development on the first AP3x pot was in 2008 followed by trials on an AP3x smelter in 2011 – in Dunkerque in France and Alma in Canada. The next step will be AP6x pots in 2013 (Fig 4).

Impact on pot flow and roof vent emissions.

In 2009 and 2012, detailed articles were published for the Light Metals conference – TMS (2, 3), disclosing all results related to the impact of the JIBS system on roof vent fluoride emissions of AP2x and AP3x pot technologies. A summary of the results on AP3x technology will be published shortly.

Between September 2010 and March 2011, the basic equipment – comprising blowers, duct, pivoting orifice, air injecting probe and manual control box – has been installed on a 36-pot AP3x section at a smelter in Alma, Canada. The system has been set up to have a maximum of three pots on partial JIBS and three in full JIBS simultaneously. That’s a total of six pots with doors/hoods opened out of 36.

After two months of pre-operational verifications and control/mechanical adjustments, the JIBS system was officially started in mid-May 2011. The first measurement of JIBS-induced pot flow increase took place in June. Exhaust flow from pot gases is a critical performance parameter for JIBS. Boosted flow created by the JIBS leads to improved gas collection when working on pots with open hoods or doors. Pot exhaust flow measurements were taken to confirm that flow reached the partial JIBS (pivoted duct orifice) and full JIBS (pivoted duct orifice) and the addition of high speed air).

These measurements confirmed that target pot flows were achieved, in partial and full JIBS, even at two different air injection pressures for the full JIBS mode.

During the June 2011 pot flow measurements, continuous emission monitoring equipment (Boreal laser) was installed at the roof vent over the 36 pots with the JIBS to continuously measure gaseous fluoride emissions and demonstrate the impact of the system on emissions. The strategy to measure the impact of the JIBS on roof vent gaseous fluoride emissions was to use different periods of time, one after the other, with the JIBS system ON and OFF. The aim was to minimise the variations caused by different work teams operating the pots as well as the different seasons. The test section was also compared with a reference pot section in the same line. Gaseous fluoride emissions at the roof vents were measured from 6 July to 19 August 2011 and from 21 October to 15 November 2011. During these periods, measurements confirmed that the JIBS system decreased gaseous fluoride emissions at the roof vent by 15%. These results are consistent with the reduction of gaseous fluoride emissions at the roof vents measured for the AP2x technology equipped with the JIBS system. It has been confirmed that the JIBS system will reduce roof vent fluoride emissions on both AP2x and AP3x pot technologies by 0.05 to 0.15 kg total fluoride/ton of aluminium produced, depending on baseline emissions. Different emission reduction results using JIBS are directly related to the quality of the pot room’s standard work practices, the number of pots opened simultaneously and the duration of the work.

Energy consumption

During the Alma smelter’s 2011 test, the JIBS’ demonstration section was providing the average amount of time per day the blower would be in operation (in full JIBS mode). The blower would operate approximately 500 minutes per day, resulting in a consumption of 224MWh per year on a system installed on 36 pots (1/12 of the Alma’s smelter), or 6KWh/t Al. This parameter can sometimes be improved as it is directly linked to the standard practices for pot room works.

Lastly, while the JIBS system can be operated manually using a selector/press button box next to the pot-tapping doors, Rio Tinto Alcan has developed an automatic control logic, which uses thermocouples to measure the temperature of the gas in the pot gases outlet duct. Temperatures measured are analysed by a computer that detects if a door or a hood is open, and activates the JIBS in the right mode: partial JIBS for an opened door and full JIBS for an open hood. When doors/hoods are closed, closure is detected and the JIBS stops. The first version of the detection system had on 85% opening/closure detection efficiency and Rio Tinto Alcan is still working to improve the control/detection formula.

Conclusions

The latest series of tests carried out last year have allowed JIBS technology to be demonstrated on AP3X pots, confirming both its operability and efficiency in reducing fluoride emissions. The JIBS’ demonstration section at Alma is providing encouraging results for reduction of emissions, with an estimated gain of approximately 0.10 kg Ft/t Al. This is
consistent with the 0.05 to 0.15 reduction expected from previous development/trials on AP2x and AP3x technologies.

A hood/door opening/closure control logic is available to operate the system automatically and to minimise the impact on pot operations. Finally, combined with the ability to accurately define the required boosted suction flow rate, JIBS technology is a cost-effective alternative to traditional dual-duct boosted suction systems. It is now being considered as part of the Rio Tinto Alcan AP60 pot development.

References

Contact
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Hydrogen fluoride emission reduction from anode butts using covered trays

Located in the heart of an agricultural region in the province of Quebec, Alcoa Deschambault (ADQ) has always worked at reducing emission levels. Many improvements and refinements have been performed on the equipment and operational techniques. By Neal R Dando¹, Mike Gershenzon¹, René Minville², Jean-Pierre Gagné², Alain Moras³, Harold Frenette³, Gilles Dufour³, Steve Lindsay⁴

The Deschambault plant was the first aluminium smelter to develop and implement covered anode trays and crust bins, which facilitated a 69% reduction in hydrogen fluoride (HF) emissions from the anode cooling area. In addition, a dual-draft system, that increased the air flow from the pots on demand during active pot work, was installed to further reduce HF emissions from the potroom roof vents. Over the years, emphasis was shifted to refining and improving the methods and equipment used at the plant: improving dry scrubber efficiency and working in strict compliance with best practices, to name a few. All these efforts contributed to achieving annual total fluoride emissions of 0.24kg TF/T Al.

A series of tests were carried out to measure the effect of different design parameters on anode tray covers in order to further refine the cover design for the new Alcoa Fjardal plant in Iceland. During this period, however, sub-optimal test conditions and limited availability of the test equipment made it difficult to gather large controlled test populations of data. Even so, the new design was an improvement over the previous configuration.¹

In 2009, the Alcoa-STAS R&D team developed a custom-designed experimental set-up to study HF emissions from covered anode trays and crust bins. The primary goal was to measure the temporal fluoride emission performance of anode tray and crust bin covers as accurately as possible. This data has since played a key role in helping to design the next generation of confinement devices.²

Over the past two and a half years, more than 100 tests have been conducted in many different configurations to measure emissions from various anode trays and crust bins whether covered or not. In our previous publications,¹,² we used the actual plant operational methods as our test basis. The anode trays were evaluated after loading with three pairs of anode butts. However, waiting for three pairs to be placed into the anode trays made it impossible to directly record the emissions for the first 25 to 30 minutes from the removal of the first anode pair from the pot.

To account for fluoride lost while the anode tray sits in the electrolysis hall and during transit to the test garage, the anode tray emission profiles were extrapolated back to the time of extraction of the first pair of anodes. The exponentially decreasing emission profile made it necessary, in the case of covered trays, to extrapolate approximately 50% of the total HF mass emitted.

We sought to reduce the extrapolation uncertainty of HF emissions as much as possible by using improved test methods to reduce the initial extrapolation time to a minimum, that is, in the order of two to three minutes instead of 25 30 minutes. To measure emissions closer to the anode butts’ extraction time, we performed a series of emission performance tests with only one pair of anode butts placed in the centre of a tray. Using this profile, we could construct full anode tray emission profiles by superimposing three curves (two butts each) and by shifting the second and third curves by 10 and 20 minutes respectively, to simulate the time gaps between three consecutive anode butt pair extractions. We were thus able to get the anode tray into the test garage usually in less than three minutes after anode butt extraction from the pot.

To calculate the overall HF emission profile even more accurately, we combined the temporal emissions profile of bare anode butts with that of a covered anode tray. In this manner, we were able to more accurately model the full emission pattern from anode butts, including the emission component that is not measured directly while the butts are carried from pot to tray. Automated rod height gauging compared to manual gauging. Automated rod height gauging compared to manual gauging.

¹ Alcoa Technical Center, 100 Technical Drive, PA 15069, United States.  ² STAS Inc. (Société des Technologies de l’Aluminium du Saguenay Inc.); 1846 Outarde, Chicoutimi, Canada G7K 1H1.  ³ Alcoa Canada, Aluminerie Deschambault; 1 Blvd. des Sources; Deschambault (Que.), Canada G0A 1S0.  ⁴ Alcoa, 300 North Hall Road, Alcoa TN 37701-2516
gauging is a commercially available option for reducing the period of time the anode butts are exposed to air between removal from the electrolysis cell and insertion into the covered tray. Summer conditions prevailed during all data shown in this report to allow us to measure fluoride emissions occurring during higher ambient air temperature and humidity ranges typical in Quebec (16°–25°C, ~ 40–70% RH).

Experimental method

The same test garage set-up described in 2010 was used to perform all the temporal fluoride emission measurements shown in this report. The same purpose-built 24’ x 16’ portable garage (Fig 1) covered with a fireproof fabric was used as a fume collector. The bottom edge of the fabric walls and doors were three feet above the ground to allow free entrance of convective cooling air, as representative of smelter buildings. The top of the garage roof was equipped with a 16 inch wide vent extending the entire length of the structure. This opening allowed heated air to escape without restriction. In order to accurately measure the mass flow and the HF gas level exiting the vent, an optical flow sensor (OFS2000, Optical Scientific, Inc.), a gas HF detector (GasFinder FC, Boreal Laser, Inc.) and four thermocouples were installed in the roof opening. Other instruments employed in the test garage sensor array included an ambient air thermometer, a hygrometer, one thermocouple to measure the temperature of the anode butt pair, and one additional thermocouple to measure the gas temperature in the centre compartment of the anode tray cover. All data were recorded on an SM2000 ABB 12-channel data logger equipped with a graphic interface allowing visual inspection of the sampled data during test periods.

We performed two series of tests. The first had only one pair of anode butts placed in the centre of a covered anode tray. For the second, we used the same anode pairement on an uncovered anode tray. The pots used for these experiments were selected to be as close to the test garage as possible to minimise vehicle transit times. The vehicle used to transport the anode butts tray was waiting for the anode butts pair and provided immediate transportation to the test garage. By doing so, we were able to reduce the extrapolated emission time to approximately 2.5 minutes.

The average total test duration was 20 hours to assure that the anode butts were no longer evolving HF after their removal from the test area.

The measured HF evolution profiles observed for given test configurations were repeatable, exhibiting a relatively standard representation of the total evolved mass HF (kg) of 4.52%. The average emission performance of individual test conditions was comparatively evaluated with respect to tray loading and environmental factors to identify additional levers impacting HF emissions.

As discussed in prior research, a strong correlation (R²=0.90) was observed between the carbon weight and the total quantity of HF released by anode butts during cooling. In order to compensate for variations in the weight of the anode butts, emission results were normalised using the residual carbon weight for each anode tray.

The humidity level of ambient air was expected to play a role in the HF generation process. However, the measurement data acquired during the summer months did not evidence a significant correlation between evolved HF and ambient humidity. The independence of the total amount of generated HF with respect to ambient humidity levels can be attributed, perhaps, to the large excess (>300 times) of available water vapour in ambient air compared with HF concentrations measured during these tests. In a similar manner no significant correlation between HF emissions and air temperature was observed from the cooling tray study. However, the limitation of all tests to warm months restricted the temperature range evaluated in this study.

To extend the investigative potential of these results, the recorded observations consisted of the following data: the time at which each pair of anode butts was extracted from the pot, the weight of carbon and the weight of bath in each tray. We also recorded comments regarding the anode butt tray cover condition. The complete data set was recorded on one single sheet. Pictures of the anode tray covers being evaluated in the test garage were taken in order to keep a visual record that could help explain any anomalies observed during subsequent data analysis.

The accuracy of all instruments was verified before testing. The GasFinder unit was calibrated using an HF permeation oven procedure. The OFS output was checked against a well-calibrated vane anemometer. The ambient thermometer and hygrometer outputs were compared to referenced instruments. Finally, all the inputs in the data recorder were calibrated using a Fluke 787 process meter. Baseline/background noise measurements were performed over a period of three days with no anode butts in the test garage and showed no reading drift or instabilities on any instrument.

Extrapolation of emission profiles

To build the results presented here, we used data produced with one pair of anode butts placed in the centre of a tray, regardless of whether the tray was uncovered or covered. The raw temporal emission data was first extrapolated, assuming an exponential decay profile, to the time (T=0) when the anodes were pulled out of the electrolysis cell. In both cases, uncovered and covered anode butts, all extrapolations were performed assuming there was no change in confinement conditions, from the initial extraction time to the end of emission recording. Fig 2 shows such an extrapolation of HF concentration, normalised to the maximum HF concentration reading recorded in the ‘open tray’ case.

The green temporal emission profile shown in Fig 2 gives a visual representation of the potential impact of covering anodes from the time of initial removal from the pot. This scenario is unrealistic, however, since there is no practical means for covering extracted anodes during transit by the crane. A more
practical representation of the butt emission profile would be a composite of both emission profiles, since the butt transit time for either condition would be represented by the open tray condition. This condition is the basis of the composite combination profile approach discussed below.

From the data shown in Fig 2 we can construct the temporal HF emission profile observed for the case of three anode pairs placed in one single tray. This particular extrapolation and combination gives us an emission performance profile of a full (three-pair) anode tray, that includes (via extrapolation of collected data to ‘zero’ time) the emissions during transit between the electrolysis cell and the tray. Assuming an average cycle time for an anode extraction of 10 minutes, the emission profile of each anode pair was shifted by this amount of time. Fig 3 shows such an extrapolation for an open anode tray condition.

**Composite emission profiles**

To more accurately calculate the overall effective relative reduction in emissions, owing to the use of covered anode trays, we must take into account the fact that part of the emission occurs while the anodes are traveling, openly exposed, from the electrolysis cell to the covered tray. This can be achieved by constructing composite emission profiles using the covered and uncovered anode tray data shown above. An average transit time from the cell to the tray of 60 seconds was used to represent current plant practice. Fig 4 shows a composite emission profile constructed from open tray data for the first 60 seconds and from a covered tray for the remaining time. Given the "front-end loaded" nature of the emission profile shown in Fig 4, reducing the anode butt transit time (open exposure time) to a minimum is a complementary lever for reducing overall fluoride emissions, in conjunction with the use of covered trays.

**Construction of full anode tray composite emission profiles**

The HF emission behaviour expected from full (three-pair) anode trays can be constructed by combining and extrapolating the temporal profiles shown above, as shown in Fig 5. The HF emission profile shown represents three pairs being withdrawn from the electrolysis cell at 10-minute intervals and exposed to the atmosphere for 60 seconds before being inserted into covered anode trays. Three integrating total HF emission profiles are also shown in Fig 5, corresponding to different anode exposure times and cooling configurations. The red line in Fig 5 (total HF open) is identical to that shown in Fig 3, corresponding to the HF emission profile expected from a three-pair anode change using an uncovered anode tray. The orange line in Fig 5 (total HF type 60s) represents the HF emission profile expected for an anode change where the average transit time for each anode pair between the pot and covered anode tray is 60 seconds. The light blue line in Figure 6 (total HF type 30s) represents a 30-second transit time using a covered tray. As can be seen from inspection of the comparative emission profiles shown in Fig 5, emissions from anode butts after placement in/on the tray account for a major fraction of the overall integrated HF emission of the butts.

**Discussion and conclusion**

The anode butt HF emission tests discussed in this paper present a quantitative evaluation of the efficiency of the tray covers currently in use at Alcoa plants. While using well-maintained anode tray covers, we have measured a 49% reduction in total anode butt HF emissions using a 60-second butt transit time and a 52% emission reduction when using a 30-second anode butt transit time. These anode butt transit times (60 or 30 seconds), shown in Fig 6, are intended to reflect work practices expected at modern smelters that use manual anode rod gauging or automated anode rod gauging, respectively.

The measurement strategy employed in...
this study allows for a reduction of the extrapolated portion of the temporal HF emission profile to a minimum in order to reduce uncertainties in the calculated emission data. Reducing the extrapolation time from 30 minutes to 2.5 minutes raises the proportion of actual measured values from 50% to 83% of the total calculated HF emissions over an anode butt extraction and cooling cycle.

When comparing our 2010 results with current results, the relative HF capture efficiency values for the covered trays are basically the same (0.23% difference). However, the absolute emission values were over-estimated by a large proportion (47%) in the initial work, since extrapolating backwards from the 30th minute severely over-estimates the first two peaks in the temporal emission profile of the three-pair anode tray. The excellent agreement (to within 15%) observed between the relative HF emission reduction efficiencies in the earlier and present work, regarding temporal emissions while butt trays were inside the test garage, attests to the reproducibility of the experimental conditions employed in this work.

As is evident in the results presented in this study, the highest peak HF emission occurs at the time of initial anode butt extraction from the electrolysis cell. Unfortunately, there is no commercial solution currently available for eliminating this initial anode butt exposure period. As shown in Fig 5, the use of covered anode trays offers a presently available, practically implementable option for significantly reducing HF emissions from extracted anode butts.

The covered anode tray performance observed in this study (49% reduction in total HF) tallies with our plant observation of a 69% reduction in butt cooling room emissions and corroborates transferability of experimental conclusions to field conditions. This performance data contrasts what has been observed by others and may reflect substantial differences in test garage or anode tray design.

The hydrogen fluoride generated during the anode butt cooling process accounts for an appreciable portion of the total HF emissions from an aluminium smelter. At Alcoa Deschambault, work practices and equipment have been improved and implemented over the years to systematically reduce the plant’s annual fluoride emission levels. The anode tray cover is one of the engineering improvements contributing to this effort. Since 2000, this technology has proven effective in reducing both the total mass and concentration level of HF in the potrooms.

The spent anode and bath cooling tray technology described above is commercially available through STAS Inc.

Acknowledgements
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References
For the aluminium industry the ‘star’ of Aluminium at Farnborough traffic that is doubling every 15 years. to keep up with the growth of global air 25 years and will need to be replaced – just to the end of their useful lives in the next show that around 6,000 planes will come towards emissions. The most recent data in energy costs and growing sensitivity criteria established before the massive hike made up of planes that meet performance event.

bomber, also made an appearance at the of the RAF Memorial flight, and the Vulcan trainer. The historic Lancaster and Spitfire Gripen Fighter and the Korean T50 jet Boeing V22 vertical take-off Osprey, a Saab 800 seater, which was there for the full six days of the show – and the Airbus A380 – a 500 to 800 seater, which was there for the full seven days.

Flying display highlights included the Bell Boeing V22 vertical take-off Osprey, a Saab Gripen Fighter and the Korean T50 jet trainer. The historic Lancaster and Spitfire of the RAF Memorial flight, and the Vulcan bomber, also made an appearance at the event.

Current commercial airliner fleets are made up of planes that meet performance criteria established before the massive hike in energy costs and growing sensitivity towards emissions. The most recent data show that around 6,000 planes will come to the end of their useful lives in the next 25 years and will need to be replaced – just to keep up with the growth of global air traffic that is doubling every 15 years.

Aluminium at Farnborough

For the aluminium industry the ‘star’ of the show was undoubtedly Constellium – formerly Alcan Engineered Products. The company introduced three new alloys in its Al-Li-X Airware range, bringing the total to six. At a press briefing by Fabienne le Tadic, vice president, global marketing, of Constellium’s global aerospace, transportation & industry (Global ATI) division and Bruno Chenal, research and development director at the company, the merits of these Al-Li alloys, which contain additional elements of Ag and/or Cu to improve corrosion resistance and increase strength, were explained.

Airware, claims Constellium, offers the following advantages:

- 25% lighter when used in a suitably designed component due to a combination of the lower density of lithium and the greater mechanical properties, which enable optimised structural designs leading to aircraft with no weight gains, a reduction in fuel consumption and CO₂ emissions.
- Greater corrosion and fatigue resistance enables 12-year intervals between major maintenance inspections, twice that of conventional aluminium aerospace alloys.
- 100% recyclable without any loss of its properties thanks to a patented process, which retains the volatile Li during melting. Should it be melted in the conventional manner, the value of the Li will be lost, but the remaining metal can be used to produce conventional aluminium alloys.
- Because of the above attributes, Constellium believes that Airware contributes to the development of a sustainable aerospace industry.

Airware was first introduced in 2010, but this year Constellium launched three new aerospace alloys, bringing their total to six. The new alloys are:

- Airware I-GAUGE. This is the thickest low-density alloy plate available in gauges up to 165mm. It offers original equipment manufacturers (OEMs) better performance while minimising weight and simplifying manufacturing and/or assembly of complex monolithic shapes, it is claimed. It is particularly suited for wing ribs and nose landing gears, and has already been selected by Airbus for its A350 XWB aircraft.
- Airware I-FORM is a highly formable sheet enabling the design of complex 3D curved shapes such as the nose cone or leading tail section of an aircraft with no loss of mechanical properties. Its high
formability provides a reduction in manufacturing steps and it has been selected by Bombardier for its C-Series.

- Airware I-CORE is a high-strength extruded product which comes in a low density alloy and is best fitted for a hybrid structure environment. Its ability to absorb energy reduces the risks of structural damages and makes it an ideal choice for cargo floor beams.

**Greater corrosion resistance**

Constellium says there are plenty of additional advantages to its Airware range, including its compatibility with composite materials – meaning it does not require an intermediate section of titanium alloy like most conventional products. Furthermore, greater corrosion resistance means that there is no need to clad it with zinc as is necessary in vulnerable areas where conventional alloys are concerned. The new product offers a 30% improvement in strength, the company claims.

The alloy can be rolled or extruded, much as a conventional alloy, but greater control of solution treatment and ageing is required to ensure precipitates remain sub-micron in size, thereby improving mechanical properties.

Airware can be friction-welded with joints several metres in length being possible. This offers the potential to improve the 'fly-to-buy' ratio of plate products in which as much as 95% of the plate is machined away to reduce the weight of the monolithic structure in which only strengthening ribs remain to the full thickness of the plate. If these ribs could be welded to the skin plate rather than machined, this ratio would be greatly enhanced.

Constellium has introduced a patented process for recycling the chips removed during machining. Known as OFELIA, it aims to maximise the lifecycle eco-efficiency of parts using Airware and can process a mixture of alloy types.

**Customer relations**

Constellium is shifting to a customer-driven culture. The company is deploying programmes, tools and customer-focused teams to ensure the client is at the centre of its strategy.

An internal communication and engagement programme called 'AllStars' is being deployed. Its objective is threefold:

- To make the customer known to shop floor employees via exchange forums and customer visits;
- To foster cross-functional collaboration during projects;
- To continuously assess customer satisfaction.

The need to closely involve the customer is well-illustrated in the history of Al-Li alloys which were first introduced in the 1980s in an attempt to produce a lighter alloy, but suffered in service due to poor corrosion resistance and cracking. Today, the composition of these alloys has been modified by the addition of silver, copper and other elements to overcome these problems and satisfy consumer demand for lighter components to meet the demanding fuel consumption, and emission standards of airline operators.

Key customers of Constellium include Airbus, Bombardier, Boeing, Dassault Aviation, EADS, Embraer, Kai, Lockheed Martin, Mitsubishi Heavy Industries and SpaceX.

**Investments**

Constellium is investing in both its production capacity and R&D facilities including:

- $54M in the production site at Issoire and the R&D Centre at Voreppe, both located in France. Issoire was the first site to be equipped with an industrial casthouse capable of producing Airware. The Voreppe R&D centre can also cast the product on its industrial scale caster. A third casthouse, exclusively for Airware, is being built in Canada. The Voreppe R&D centre focuses on the development of new Airware products.
- $46M has been invested in a new stretcher at Ravenswood (USA). This 30 million pound (13.6kt) stretcher is a critical piece of equipment to remove distortions from plate enabling the production of high quality and value-added thick gauge aluminium plate.
- Sierre (Switzerland) is currently being qualified as an aerospace plant. This will add to Constellium’s overall manufacturing facilities offered to the aerospace industry.
- Constellium invests continuously in its equipment at different industrial sites to ensure their reliability.

In May, Constellium announced a multi-year agreement with Airbus estimated to be worth approximately US$2bn to support all the leading aircraft programmes of Airbus and its parent company, the European Aeronautic Defence and Space Company (EADS).

Under the agreement, Constellium will supply Airbus with a broad range of aluminium rolled products for airframes, including wing skin panels and stringers, aero-sheets for fuselage panels and rectangular and pre-machined plates for structural components. In addition, Constellium’s aluminium products will accompany the evolution of the A320 family of aircraft to provide advanced solutions for upper and lower wing skin panels. Constellium also collaborates on the longest 34-metre wing panels and largest structural components seen to date in the aviation industry.

The contract builds on a 10-year partnership agreement signed with Airbus in 2010 marking the introduction of Airware technology on the wide-bodied A350 XWB.

Between Airbus and Constellium there is a common drive to adopt the latest technologies for ever higher performance aircraft, containing as much as 37% composite materials by weight, including much of the fuselage, and wings reinforced with metal ribs.

The products covered by the contract will be supplied from Constellium’s major plants in Ravenswood (United States), Issoire (France) and Sierre (Switzerland).
Optimised grain refinement

Optimising the grain refining process in the production of aluminium alloys has appreciable cost and quality benefits for the casthouse, says UK-based MQP.

By John Courtenay, Rein Vainik & Michael Bryant, MQP*

MQP’s Opticast System is a process for the in-line control and optimisation of grain refinement while Optifine is a TiBAl grain refiner that can achieve the required level of refinement to avoid ingot cracking at up to 80% lower addition rates than standard TiBAl grain refiners. This results in improved quality and reduced operating costs over a wide range of aluminium alloy compositions.

The Opticast system and Optifine grain refiners are routinely used in casthouses worldwide.

Grain refinement of aluminium alloys

We start with some essential statements regarding grain refinement of aluminium alloys:

- The sole purpose of grain refinement is to decrease the grain size in the cast product in order to avoid ingot/billet cracking during casting or downstream processing.
- Aluminium grains are nucleated by boride particles present in the master alloy, but only a fraction – one per cent – of the added particles are useful as nucleants.
- Grain refinement should be performed so that the addition rate of the grain refiner can be optimised to a minimum and safe level.
- Grain refinement is generally performed with Ti/B master alloys.
- Regardless of master alloy Ti/B ratio, the active nuclei is TiB2.
- It is only the number of particles that nucleate the aluminium grains that are important.
- As a user, the prime interest must be to add a minimum number of nucleating particles at the lowest possible cost.

TiBAl master alloys

Here are some important considerations concerning the manufacture of TiBAl master alloys and their use:

- The master alloy production process leads to a natural range of efficiencies in the finished product.
- In master alloy optimisation work, the efficiency variations must be considered and the worst case scenario applied to set the minimum addition level.
- In the aluminium industry, adding too much grain refiner than needed is commonplace leading to higher inclusion levels in the end-product and increased cost.

What is the Opticast system?

- Opticast(1) was developed to control and optimise grain refinement. Grain size samples are taken in the casting furnace and the necessary master alloy addition amount is calculated using a database built on calibration measurements made for each aluminium alloy (AA) series.
- Based on the fact that borides are already present in the casting furnace, and will act as nuclei, large variations in grain size are observed depending on the amount and type of scrap used.

Fig 1 (right) Grain refinement curves for two alloys. Regions A, B and C are explained in the text

Below: milling, preparation and grain measurement

The Opticast System has been applied at 18 casthouses around the world in order to check the optimisation potentials. Savings in grain refiner additions of between 30% and 60% have been achieved at all 18 casthouses.

Opticast is in continuous use at four plants: AMAG (Austria), Hammerer Aluminium Industries (Austria and Romania) and Hulamin (South Africa), and it is being evaluated at two other major aluminium producers.

Theoretical considerations

Grain refinement is the combined effect of nucleation and growth. Based on an understanding of the basic mechanisms of grain refinement, the inherent grain refining ability of a given melt can be enhanced by:-

- Determining and adjusting the factors controlling the growth rate of the nucleated aluminium crystals;
- Adding sufficient nucleating particles to obtain the desired grain size.

Growth and nucleation

The growth rate of crystals is controlled by the ‘Growth Restriction Factor’ (GRF), which is related to the solute diffusion...
layer that builds up ahead of the growing crystal front.

The element titanium (Ti) has a higher growth restriction effect than any other element. Most grain refining agents contain an excess of Ti, which goes into the melt. Thus, the GRF can be controlled by increasing the amount of Ti in the melt using a master alloy or a titanium briquette.

Each aluminium alloy responds differently to additions of fresh nucleants, but the basic shape of the grain refining curve remains the same. This is shown in grain refinement curves for two alloys (Fig 1), where the change in grain size is plotted in conjunction with the amount of grain refiner added.

In this graph there are three distinct regions:

A - The very steep slope leading from large grain sizes to a transition region, which is where the effect of new nuclei is predominant.

B - In this region the GRF becomes more predominant and there are differences between alloys depending on their composition and the GRF factor.

C - Very little happens to the grain size in this region, since the melt has, in principle, been saturated with nucleants.

In background calculations used to apply the Opticast system, the three regions of the curves are dealt with by the use of either linear approximations or by applying the general equation for the grain refinement curve.

**Opticast methodology**

Implementing the Opticast system in the casthouse comprises the following steps:

1. **Calibration:** This involves establishing how a specific alloy responds to the addition of fresh nuclei via the grain refining rod – and that means finding the equation for the grain refinement curve of the type shown in Fig 1. Furthermore, it is also important to consider the layout of the casting line and how it influences the recovery of the grain refiner used. The calibration routine in the Opticast method is designed to take care of these parameters.

2. **Sampling in the casting furnace,** solidification and quenching – takes between four and five minutes.

3. **Milling,** preparation and grain measurement in the laboratory takes between six and eight minutes.

**Optimisation and the Alcan TP-1 test**

The TP-1 test is universally used in the aluminium industry to give a measure of the grain refinement efficiency of master alloys. The standard procedure is to add 2 kg/ton of grain refiner under evaluation into pure aluminium. When a master alloy containing 1% B is used, this means that 20 ppm B is added.

The drawback is that this addition level is much higher than usual and may not reflect the performance of different grain refiners at normal addition rates, well below 20 ppm B, as shown in Fig 2. This point is emphasised in Fig 3, which shows two master alloys, one giving 140 μm and the other 110 μm with the TP1 test. The relatively small difference in grain size at the TP1 addition rate of 2 kg/ton does not satisfactorily reflect what happens at lower addition rates.

Assuming that 160 μm is a sufficient grain size to avoid ingot cracking, it is evident that this can be obtained with an addition rate of 0.1 kg/ton with the 110 μm grain refiner.

If the 140 μm grain refiner is used, nine times more is needed i.e., 0.9 kg/ton. This difference is not reflected in the TP1 test.

The Opticast method can be used to characterise and control the different factors in the casting line such as the melt nucleation level and the effects of metal treatment processes to minimise variations in ingot grain size. Nevertheless the inherent variation in the efficiency of standard grain refiners remain a significant factor.

This led MQP to develop a new high-performance grain refiner with LSM to complete the optimisation process.

**Optifine – a superior TiBAl grain refiner**

To complement the Opticast system, and under an exclusive manufacturing agreement with LSM, MQP supplies 3% Ti and 1% B master alloy grain refining rod known as Optifine. Optifine’s development is based on more than 10 years of experience gained with Opticast.

According to the TP-1 test Optifine produces grain sizes in the range 100 – 110 μm as compared to 100 - >200 μm.
for standard TiBAl grain refiners. In production conditions, Optifine can achieve the level of refinement needed to avoid ingot cracking at up to 80% lower addition rates than standard TiBAl grain refiners and this results in improved quality and reduced operating costs over a wide range of aluminium alloy compositions.

Optifine is now in routine usage in casthouses worldwide.

Experience with production-scale usage of Optifine at Hulamin Rolled Products, Republic of South Africa. Work has continued with full-scale trials at Hulamin, South Africa, involving a number of alloys(2) and optimisation using the Opticast method.

This sampling technique has been designed to give a slow solidification rate in order to exaggerate grain size differences when compared to rapidly cooled samples.

Results have confirmed earlier findings that Optifine is at least twice as efficient as standard grain refiners and that addition rates can be reduced to extremely low levels without the risk of cracking ingots or billets. The low level of additions brings major cost savings and metal cleanliness benefits especially in respect of the amount of hard boride particles present. The reductions in addition levels achieved with Optifine are shown in Table 1.

Crucible tests were performed in some of the casts to determine the grain refinement curves for the alloys in Table 1. Two examples of these curves, for alloys of AA3000 series and AA6000 series are shown in Figs 4 and 5.

These results show that the grain size is progressively reduced by very small additions of the Optfine rod and particularly in the case of the AA3000 series alloy that a fine grain size can be achieved by extremely small additions. It would be useful to know the precise grain size for a particular alloy to avoid cracks. However, there is no direct way to calculate this as grain size depends on a number of parameters, including ingot size, casting speed, cooling rate and seasonal variations. In the development of the Opticast method the approach has been to evaluate each casthouse individually and to set the grain size limit to a safe level, which will cope with the possible fluctuation in production parameters and seasonal variations.

In the Hulamin casthouse, most of the grain sizes achieved during the trials are considered to be capable of stopping the propagation of cracks in the ingots. There is also a possibility to further decrease the addition levels since it is likely that grain sizes of up to approximately 200μm may be allowed for some of the alloys. It appears that less than 0.03kg/t would be sufficient for some of the alloys, and about 0.07kg/t would be able to give a grain size in the order of 200μm for other alloy groups.

The results also indicate, that even for some of the crack sensitive alloys a very fine grain size can be obtained with as little as 0.1kg/t, using Optifine.

To summarise, consumption of standard TiBAl grain refiner at Hulamin in the production of 200kt of aluminium per year was 180 tonnes. With Optifine the current annual consumption is just 43 tonnes.

Recent work at a major industrial casthouse
Optifine is currently under evaluation in the production of AA 5182 alloy. Initial results show that that a 0.2kg/t addition of Optifine gave the same grain size, 170 μm, as the routinely used standard master alloy gave at a 0.9kg/t addition rate. This is indicated by the horizontal red line (Fig 6).

Conclusions
- The Opticast system has proven to be capable of achieving significant reductions in the level of TiBAl grain refiner additions in casthouses without the risk of cracking the ingots or billets.
- Optifine in full scale production usage has proven to be substantially more efficient TiBAl grain refiner than others currently available. Furthermore, the grain refining efficiency of Optifine is consistent, which means that the final grain size can be guaranteed and the addition rate can be kept at a constant and low level.
- Overall, when used in conjunction with the Opticast system, Optifine has the following economic and practical benefits for the casthouse:-
  - Large cost reductions for grain refining.
  - Cleaner end-products, since less impurities in the form of boride particles are added to the melt, due to the low addition rate.
  - Additional benefits, coupled to a dramatic decrease in master alloy usage, including reduced transportation costs, less frequent change of coils and minimised storage requirements.

Casthouse characterisation
MQP can provide casthouse customers with a complete survey of their present grain refinement processes, offering a much more detailed picture compared to traditional TP-1 tests.

Various testing techniques are utilised and a full program may involve the set-up of equipment on-site but simpler solutions are available.

More than 100 different alloys in all AA-groups have been analysed by Opticast system.

When Optifine is adopted as the routine grain refiner, its high efficiency allows a minimum addition level to be set of at least 50% addition-reduction compared to standard master alloy additions.

References

Contact
MQP Ltd www.mqpltd.com

Table 1 Results achieved in production by AA alloy series at Hulamin

<table>
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<tr>
<th>Alloy Series</th>
<th>Number of casts</th>
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<tr>
<td>AA 3000 Series</td>
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</table>

Fig 6 Optimisation results for an AA 5182 alloy
Jean Simard, president and CEO of the Aluminium Association of Canada talks to Aluminium International Today.

1. After three years into your job as CEO of the Aluminium Association of Canada, how would you describe the overall situation in your industry?

AAC represents the three world class aluminium smelting companies present in Canada: Alcoa, Alouette and Rio Tinto Alcan. With their 10 plants and 10,000 strong employees, they are a key industrial player in Canada’s economy. Their concentration in Quebec, with 90% of the overall capacity, accounts for over 10% of Quebec’s annual exports, ranking as the third largest sector in importance.

These plants, while being hydro-based, are highly energy efficient and their on-going modernisation and technical upgrade makes for one of the most energetically efficient group of assets in the world.

Modernisation and capacity-increase projects in the order of $8 billion have been announced for the next eight years in Canada. As emerging areas of production in the world are ever more competitive, these investments should contribute to keeping our plants at the top of the class and certainly confirm the well-established network of local suppliers and world class equipment manufacturers.

This being said, we are directly affected by the on-going crisis in the market, and our members are literally ‘leaning’ their way through an eventual recovery.

2. What’s your view on the current state of the global aluminium industry?

Low prices lead to speculative buys which in turn lead to an eventual market glut. We can’t seem to pull away from the 2009 crisis. The slowdown in China, the ever-fragile European economy and the instability in the Middle-East are impacting us as piled-up inventories are merely being added up to. The treadmill is running slower than we can walk.

3. What is the AAC up to at the moment?

The Association has embarked upon a long-term plan to develop such a culture by fostering the use of aluminium in areas where it can contribute to reduce greenhouse gases: light-weighting of vehicles, increased energy efficiency in buildings and optimal design in infrastructures.

We have been pushing for the integration of aluminium in subways, cars and buses as well as bridges and institutional architectures. Although we have a small market, we have a short window of opportunity as post-war road and traffic infrastructure is being renovated and replaced. The reduction of our economy’s carbon footprint is predicated on two key sectors: urban mass transit and energy management in buildings. They are two sectors where we believe aluminium can play a strategic role while creating wealth in our economy.

We have developed a curriculum to train architects, engineers and designers in the use of aluminium. A new course will be offered throughout this fall on aluminium in bridges. The interest is genuine and we are confident that in the years to come aluminium will make its way.

4. Aluminium is an energy-intensive process and in many parts of the world it is encountering not only high electricity charges, but also punitive carbon taxes that, in some cases, have led to smelter closures. How should the industry approach the issue?

While Canada’s aluminium industry is totally hydro-based, it has invested through the years to reduce its PFC emissions. We now produce very low carbon aluminium, and we are actively involved in the recently established Quebec Cap & Trade market. The industry is striving to improve its already high performance, but we have almost reached the upper limit of the scorecard.

Having done our best, we can only invite other production areas in the world to do the same.

5. Plant closures can lead to job losses, and governments around the world have to balance the social cost of green taxes with the need to meet carbon reduction targets. Is there a middle ground in your opinion?

The key elements are a deeper understanding of the economics of the industry, phasing through time, better internalisation of market mechanisms, and sustained research and development. But at the end there will be fatalities, unfortunately not always where they should be.

Our carbon footprint is the lowest in the world, we have entered into a Cap & Trade market, one of the few outside Europe, and we are efficient in our use of clean and renewable energy. We are often competing with subsidised energy, even though there are not always green taxes involved. In the long term the carbon reality should take over and level the playing field and a new middle ground will appear.

6. As a metal, aluminium has so much to offer, not only in terms of its recyclable qualities, but also its versatility and its wide application throughout many sectors of industry – particularly automotive and aerospace. While the process is energy-intensive, would you say that its benefits as a metal far outweigh any environmental disadvantages?

It is only when one looks at the total lifecycle including post-use recycling of any aluminium solution that the real story can be told. Properly designed for the right function, aluminium will successfully carry its weight by reducing its consumption during its useful life, and by providing 95% of the energy required to transform it into a new product after recycling. Through various sustainability initiatives under the International Aluminium Institute, the industry is actively pursuing its world-wide sustainability agenda and improving its footprint year after year.

As an industry we have to reposition ourselves in a forward-looking manner in
order to stake out the emerging value-added markets of the future. The world is changing, consumers are better educated, have higher incomes and want to make informed choices. Developing economies are adding exceptionally large new markets for our material as the overall income level goes up. They are leap-frogging into the future and are open to integrating at the onset the next generations of consumer goods. Look at the recent announcement by Tata of a compressed air two-seater automobile, with no motor. Or the new aluminium bus fleets being built around the world, not to mention Ford’s F150 light-weighted with aluminium.

They are all part of the same quest: more efficient design to reduce energy consumption. We must stop looking at the future with the eyes of the past. There is a change of paradigm and there is a brighter future than we think or perceive for aluminium.

7. Where do you see the most innovation in terms of production technologies – primary, secondary or further downstream?

We should look at how we make products that make products. New methods such as additive manufacturing certainly deserve our attention if we want to position our material at the value-added end of the food chain. I don’t know what the exact answers are, but there are some low-hanging fruits out there that deserve to be looked at.

8. While there is an element of doom and gloom within the aluminium industry at present – electricity prices, green taxes and the low price per tonne – how optimistic are you for the short-to-medium-term prospects of the industry?

It’s a tough game and it seems to be a matter of staying power. The long-term outlook is very positive in general, but the short-term is tough. The stars are not aligned the right way, government policies, stretched between international commitments and local perspectives are often not in sync with changing market parameters, and industrial growth policies in emerging economies. We are too often competing on unlevelled playing fields.

The industry’s future lies in its capacity to invest and demonstrate its commitment to a sustainable contribution to the world economy. Efficient use of energy and reduced carbon footprint should give us the license to grow in the future. But we are not there yet. Many plants in heavy carbon areas of the world have access to subsidised energy, keeping them alive in the short-term and maintaining over-capacity. The real issue in the short-to-medium-term is the financial capacity to invest in our assets in a low-price market.

Canada’s aluminium producers have done everything right, and we believe that we are part of the future!

9. Speaking of the industry’s future, what is the best way to create a dialogue on these issues?

There are already discussions going on around the world, in different venues. The Aluminium Association of Canada will add to these by launching the first Canadian International Aluminium Conference in Montreal in October 2013. Entitled Crafting a Lighter Future, the week-long conference will integrate other international meetings on aluminium such as Inalco and Alu-Solutions. It will focus on Aluminium applications in infrastructures, transport and architecture, while opening the door to cutting-edge innovations and potentially new market applications.
‘We should promote recyclability’

Allan G Roy, president of Spokane, USA-based Pyrotek talks exclusively to Aluminium International Today and argues that the industry should push home the recycling message to emphasise the light metal’s healthy ‘green’ credentials.

1. How are things going at Pyrotek? Is the aluminium industry keeping you busy?

We have enjoyed steady growth in annual sales following the economic downturn in 2008. We continue to build out our geographic footprint, expand our product offering and globalise our manufacturing capabilities.

2. What’s your view on the current state of the global aluminium industry?

The global aluminium industry is continuing to evolve and hold its own against competitive materials. Stock/share prices are down for some of our major customers; others, like Dubai are announcing record earnings. Aluminium goes through cycles and the current softness in the market is possibly short-lived. The price of aluminium is down and there appears to be a short-term excess in capacity. However, we are seeing some reductions in global inventories, which will help turn the situation around.

3. In which sector of the industry does Pyrotek conduct most of its business?

Pyrotek’s business is strong in all the countries that are major aluminium producers. When I say “major aluminium producers,” I am referring to both smelting and secondary operations such as remelt, rolling and extrusions.

4. Where in the world are you busiest at present?

The major areas that appear to be growing are the Middle East, China, and Russia. We are also seeing some new opportunities opening in the USA where our customers are looking at lithium alloys and upgrading casting facilities.

5. Can you talk about any major primary and/or secondary contracts you are working on?

As a general rule we don’t do contracts, as the bulk of our business is with consumables and other products used on a regular basis in the aluminium industry. Our TAB division is engaged in a large furnace lining contract for the new smelter in Saudi Arabia. Also, many customers establish an annual Vendor Managed Inventory and/or maintenance program which has us stocking, rebuilding, or maintaining their refractories, pumps, degassers and other consumables. These programs typically reduce stock-out risks and lower maintenance costs for customers.

6. Aluminium is an energy-intensive process and in many parts of the world it is encountering not only high electricity charges, but also punitive carbon taxes that, in some cases, have led to smelter closures. How should the industry approach the issue?

In small industrial countries, like Australia, the carbon tax is both a deterrent for aluminium companies to invest in new capital and also adds an additional burden on the companies that are already there. From our perspective, this has been an additional cost the Australian companies have to absorb. It has made them less competitive in the global market. The industry should put pressure on governments to have this tax removed.

7. In your dealings with primary and secondary aluminium producers, are you finding that they are looking to companies like Pyrotek to offer them solutions in terms of energy efficiency and sustainability? If so, what are you offering them?

Yes, our customers are looking for Pyrotek to offer assistance particularly in energy efficiency. We have an abundance of solutions to improve furnace efficiency, metal quality and casting productivity, all of which combine to reduce the impact on the environment.

8. How quickly has the aluminium industry responded to ‘green politics’ in terms of making the production process more environmentally friendly and are they succeeding or fighting a losing battle?

Aluminium companies’ green policies do not appear to be a major factor in their operations. In some parts of the world, aluminium companies are under a lot of pressure because they are large electric consumers. I believe what the industry can do best to combat the energy consumption is through recycling. The recycling of aluminium is to increase their promotion of the recyclability of aluminium. Through the remelting of the metal the industry can build a genuine case for aluminium being a very effective “green” metal.

9. Plant closures can lead to job losses and governments around the world have to balance the social cost of green taxes with the need to meet carbon reduction targets. Is there a middle ground in your opinion?

Balancing social costs vs. energy consumption is a tough battle. In the last few years, we have seen a number of older aluminium plants close with a result of big write-offs by companies and the loss of thousands of jobs in local communities across the globe. In some cases, aluminium plants are located in isolated areas, where their closure can be devastating. It is one of the reasons why Pyrotek is so focused on helping customer’s improve their performance and their competitiveness.

10. As a metal, aluminium has so much to offer, not only in terms of its recyclable qualities, but also its versatility and its wide application throughout many sectors of industry. While the process is energy-intensive, would you say that its benefits as a metal far outweigh any environmental disadvantages?

Yes, the benefits of aluminium far outweigh the disadvantage of its energy consumption during manufacture. The metal has shown a steady growth, which is far superior to other competitive metals and...
its light weight is one of the main reasons. The weight to strength ratio of aluminium significantly reduces the in-use energy consumption of all applications in transportation, be it airplanes, trucks or automobiles. A good example is the planned F150 Ford Pickup, which will have both an aluminium body and chassis to boost fuel efficiency without giving up utility.

On the production of aluminium, over the years one of the big breakthroughs in aluminium technology has been the development of large, high amperage, pots for smelting. Pyrotek is helping customers produce higher quality metal in the casthouse by providing filters, degassing boxes (SNIF), improved refining agents (PROMAG), and a wide variety of metal transfer improvements.

11. Let’s look at aluminium production technology. What are the big trends at present and in what areas does Pyrotek lead the field?

We see a continual evolution in aluminium technology to reduce costs and improve metal quality, and Pyrotek will play a significant role in helping our customer’s improve performance.

We recently hosted a four-day Metal Quality Workshop in Dubai with co-host Dubai where 250 attendees from 30 countries shared ideas and technology to not only improve their own performance but the competitiveness of aluminium.

We are the largest global player in what we do. More specifically we are a world leader in filtration, degassing, furnace treatments, furnace linings, metal deliver systems and casting consumables.

12. How do you view Pyrotek’s development over the short-to-medium term in relation to the global aluminium industry?

Pyrotek has research centres in both Quebec and the UK. They are continually developing new and improved products for the aluminium industry. Pyrotek’s sales engineers are charged with the responsibility of solving customer problems and helping them improve their operating performance. This, in itself, often results in a range of new products.

We work closely with our customers through our team of field engineers backed up by our specialists, R & D team and our metallurgical services.

The unique Pyrotek package of in-plant service and technical resources has allowed us to more than keep pace with the industry while continuing to broaden our customer offering of goods and services.

13. India, China and the Gulf are three regions of the world where there’s a lot to talk about in terms of aluminium production. What can you tell me about Pyrotek’s involvement in these countries?

I would like to take a few minutes to talk about each area separately.

a. India – Pyrotek entered India with its first manufacturing plant in 2001. Since that time, we have built a major manufacturing facility in Pune, acquired a weaving operation in Chennai, and established a sales office in Kolkata. We see India as one of Pyrotek’s long-term growth markets.

b. China – Pyrotek built its first plant in China in Nanning in 1995. Since then we have expanded it, built a major facility in Dongguan (just outside Hong Kong), and another manufacturing plant in Xi’an. We expect to add another facility in China in the medium term.

c. The Middle East – Pyrotek has had a presence in the Middle East for 40 years. In 1999 we acquired a facility in Dubai that services Dubai, Emal and Sohar. Since then we have built a new facility in Bahrain, in 2011.

14. Outside of India, China and the Gulf, where else in the world is up and coming as a centre for aluminium production?

Russia has been one of our top growth markets since the end of the financial crisis. We have been active there for a couple of decades and have an office in Moscow and a manufacturing plant in Krasnoyarsk. We also provide support to the Russian market from our manufacturing plants in the Czech Republic. We see continual growth for aluminium in Russia. They are building a number of new plants and changing some of the older Soderburg ones to prebake.

15. Where do you see the most innovation in terms of production technologies – primary, secondary or further downstream?

Smelting in the Middle East with new plants and new technology, composite materials and the new lithium alloys.

16. While there is an element of doom and gloom within the aluminium industry at present – electricity prices, green taxes and the low price per tonne – how optimistic are you for the short-to-medium term prospects of the industry?

We are mildly optimistic, but confident about the future of aluminium in a changing world. We do see multiple hurdles in the short-term, but long-term we see demand for the metal steadily increasing. I believe when you look at actual growth in the industry you have to break it down into two separate areas.

a. Smelting – This is controlled by low energy, low capital and low labour costs. Based on this you can see the newer plants are going to be in China, India, the Middle East and Russia. Also, you may find smelters starting up in non-traditional aluminium countries, like Jamaica, Indonesia and Malaysia.

b. Remelt/secondary operations – I think these will continue to be important in the western industrial world and will also grow in countries like USA, Europe, and China.

These countries will continue to be consumers and will be in an excellent position to manufacture finished products and supply local markets.

17. Aluminium 2012 is almost upon us. What does Pyrotek have planned for this exhibition?

This current show is a major event for Pyrotek. The theme for Pyrotek’s stand is the “Improving Performance Café.” We will be featuring a broad menu of goods and services to help our customers compete and grow. It is also aligned with our mission to reach out to aluminium customers and assist them with Pyrotek’s global resources to grow through improved operating performance.

18. What other shows will Pyrotek be attending this side of 2012?

Pyrotek attends all the major shows such as GIFA and TMS, and the aluminium technical shows in most areas of the world.

19. Pyrotek is based in Spokane, Washington State, USA, but what’s happening aluminium-wise on your own doorstep?

Pyrotek has been located in Spokane for 56 years and, while the market has changed over the years, we are still a strong supplier and continue to grow in what remains of our local aluminium market. This currently includes Alcoa Intalco, Alcoa Wenatchee, and Kaiser Trentwood. These customers continue to grow and offer us new opportunities as Pyrotek continues to broaden its offering of products and services.
Aluminium International Today

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A good business outlook

Aluminium has a well-established place in all aspects of life, says Max Wiestner, a senior manager at Switzerland-based ABB.

1. How are things going at ABB? Is the aluminium industry keeping you busy?
   In aluminium we seem to have a slowing down with very little new projects being realised. But as we have a large installed base, our customers keep us busy with upgrades and mostly additional power conversion units to keep up with the production creep in their smelters.

2. What’s your view on the current state of the global aluminium industry?
   Aluminium has a well-established place in all aspects of life and with an increasing global population, more aluminium will be required. In the past we have seen typical ups and downs over a six-year cycle. We are at the bottom of the cycle now.

3. In which sector of the industry does ABB conduct most of its business?
   Electrification and automation of whatever is built. For example, the total power distribution within the Burch Kalifa, the world’s largest building in Dubai, is from ABB, as are most of the 380kV power distribution sub-stations in Saudi Arabia.

4. Where in the world are you busiest at present?
   For aluminium, it’s the Middle East.

5. Can you talk about any major primary and/or secondary contracts you are currently working on?
   The largest project we are working on at the moment is the Ras Al Khair smelter in Saudi Arabia: ABB supplies products and systems for upwards of US$300m. From 380kV gas-insulated substations to the large rectifiers designed to supply the two AP39 potlines, which will produce nearly 800kt of aluminium per year. We are busy with the electrification of Rio Tinto’s new smelter casthouse in Iceland.

6. Aluminium is an energy-intensive process and in many parts of the world it is encountering not only high electricity charges but also punitive carbon taxes that, in some cases, have led to smelter closures. How should the industry approach the issue?
   ABB supplies the most efficient power conversion systems with the highest power quality levels. We offer on-line upgrades of a smelter’s potline power conversion stations with new and high-rated rectifiers going up to 2200VDC which enables the interconnection of two or more potlines and reduces electrical energy consumption.
   In addition, we study and design power quality systems that reduce power generation to an absolute minimum and decrease CO₂ emissions. In one project, our power quality system made it possible to reduce plant power by one 200MW generation set.

7. In your dealings with primary and secondary aluminium producers, are you finding that they are looking to companies like ABB to offer them solutions in terms of energy efficiency and sustainability? If so, what are you offering them?
   Very much so. In 2011, ABB invested 3.6% of its revenues in research and development of new technologies. We are presently installing our state-of-the-art heat recovery system in two cement plants in Switzerland. This system turns low temperature waste heat into electrical energy. We are also working on a similar system for aluminium smelters. At Sohar Aluminium, the power factor correction and harmonic current filtering was demanding due to the overall utility grid set-up. ABB installed a power quality system directly on a 220kV level; in RTA Isal on a 60kV level and in Nordural on a 24kV level.

8. How quickly has the aluminium industry responded to ‘green politics’ in terms of making the production process more environmentally friendly and are they succeeding or fighting a losing battle?
   Our equipment and systems have helped reduce the anode effects that cause the most environmental pollution. We have developed a precise fibre optic potline current measuring system that controls the potline current and detects possible anode problems early, allowing counter measures to be taken. We know that off-gases have to be treated with new systems offering a low environmental impact.

9. Plant closures can lead to job losses, and governments around the world have to balance the social cost of green taxes with the need to meet carbon reduction targets. Is there a middle ground in your opinion?
   As a supplier of power conversion, electrical distribution and control systems, we do not have much influence on political decisions. Our contribution is to offer efficient and environmentally friendly solutions.

10. Aluminium has so much to offer, not only in terms of its recyclable qualities, but also its versatility and its wide application throughout many sectors of industry – particularly automotive and aerospace. While the process is energy-intensive, would you say that its benefits as a metal far outweigh any environmental disadvantages?
   With energy efficient systems and products we aim to minimise the environmental impact of aluminium production. Our Expert Optimiser process optimisation system has achieved outstanding results in alumina production by reducing CO₂ emissions and energy consumption by 7.3% and increasing production by 4.5%.

11. Let’s look at aluminium production technology. What are the big trends at present and in what areas does ABB lead the field?
   The trend is for very large pots – up to 600kA – and potlines of 2000VDC. ABB is market leader in both areas. Since 2008, we have offered 2000VDC rectifier
systems and in 2008 we commissioned the largest (113kA at 1650VDC) at Sohar aluminium in Oman. At the moment, the largest rectiformer units (250MVA) are being commissioned for Ma‘aden’s Ras Al Khair facility in Saudi Arabia.

12. How do you view ABB’s development over the short-to-medium term in relation to the global aluminium industry?

We have seen many ups and downs in the aluminium market, compounded by the global economic situation, which will continue for some time. However, the fact that there will be more people on our planet and all of them deserve a comfortable life, can only be good news for aluminium consumption. ABB will continue to serve the industry as best it can through the development of new environmentally friendly systems and products designed to reduce energy consumption.

13. India, China and the Gulf are three regions of the world where there’s a lot to discuss in terms of aluminium production. What can you tell me about ABB’s involvement in these countries going forward?

We recently completed a US$300m project for Qatalum and are working at Ma‘aden Saudi Arabia, Alba Bahrain, Dubal and Emal. The total value of ABB’s current contracts in this region is US$500m. Many Indian smelters use ABB’s power conversion stations, and in China we are increasing our market share.

14. Outside of India, China and The Gulf, where else in the world is up and coming as a centre for aluminium production?

We only see projects where low-cost electrical power is available. Iceland has been very active and we think that two more smelter projects could be developed there over the years. Brazil and Venezuela both have unlimited resources and would be ideal locations for totally integrated aluminium production facilities.

15. Is ABB active in Russia at present?

Yes and we have been very successful there on high voltage distribution products as well as key products like ABB FOCS (Fiber Optic Current Sensor) for highly accurate potline current measuring.

16. Where do you see the most innovation in terms of production technologies – primary, secondary or further downstream?

We still expect technological advances from various pot technology suppliers, but innovation in the primary sector seems limited. For the secondary and downstream industries we supply products and sub-systems, but can’t giveaway any trends because we don’t develop the technology.

17. While there is an element of doom and gloom within the aluminium industry at present – electricity prices, green taxes and the low price per tonne – how optimistic are you for the short-to-medium term prospects of the industry?

Demand for aluminium will increase in line with the high growth potential in many developing countries. At various conferences we have been told that demand may double over the next 20 years. We envisage a good business outlook and expect increased demand for our systems in 2014-15. In the longer term, only regions with low power costs will be able to compete in the market. At present, our customers renew their installed base or add conversion power to creep their production. We have been market leader in power conversion systems within the aluminium industry for the past 20 years and have a large installed base, which we need to maintain, upgrade and replace.

18. Aluminium 2012 is almost upon us. What does ABB have planned for the exhibition?

We are not participating.

19. What other shows will ABB be attending this side of 2012?

We will be at ARABAL in November and at various other industry conferences or exhibitions.

20. ABB is based in Switzerland, but what’s happening aluminium-wise on your own doorstep?

ABB is based in Zurich, Switzerland, but we operate globally and are still producing the cost-effective elements of our systems in Switzerland. Transformers rated up to 250MVA are manufactured in Germany and high voltage switchgear, like the GIS 380-245kV, is produced in our new factory in Zurich. We have built an aluminium centre in Canada serving the Americas and are continuing to develop new rectifiers (2200VDC) and control our high-quality FOCS measuring system from our corporate development centre in Switzerland. In June 2012, we held a two-day aluminium seminar in Switzerland and we plan to conduct our next one in Germany in 2014.
1. How are things going at Arun Technology? Is the aluminium industry keeping you busy?
   Arun Technology is having a good year and, as in previous ones, analysis equipment for the aluminium sector makes up about 60% of our output.

2. What’s your view on the current state of the global aluminium industry?
   Our customers are extruders, die-casters and other users or dealers of aluminium and parts. This sector is holding up well.

3. Where in the world are you busiest at present?
   China has always been a good market for us and although there is a slight downturn at present, we see no reason why the market will not return. Whether it is for global exports from China or increased domestic consumption, aluminium parts for houses, cars, motorcycles will always be required.

4. Aluminium is an energy-intensive process in many parts of the world it is encountering not only high electricity charges but also punitive carbon taxes that, in some cases, have led to smelter closures. How should the industry approach the issue?
   If the politicians insist upon making domestic industry uncompetitive with carbon and other taxes, the business and the jobs and the spin-off industries will move elsewhere. The industry should try to explain the advantages and benefits of good, sensible basic industries and lobby against ill-conceived taxes.

5. As a metal, aluminium has so much to offer, not only in terms of its recyclable qualities, but also its versatility and its wide application throughout many sectors of industry – particularly automotive and aerospace. While the process is energy-intensive, would you say that its benefits as a metal far outweigh any environmental disadvantages?
   Steel, aluminium and glass have all been recycled in vast quantities for many years and saved immense amounts of energy when compared with primary production. The increase in aluminium usage has come from alloy development and innovative design uses in cars, high-speed trains and planes.

6. How do you view Arun Technology’s development over the short-to-medium term in relation to the global aluminium industry?
   We try to stay in touch with the latest trends in new methods, alloys and materials through ALFED and Aluminium International Today.

7. India, China and the Gulf are three regions of the world where there’s a lot to talk about in terms of aluminium production. What can you tell me about Arun Technology’s involvement in these countries?
   We are active in all three areas but more so in China and India as the secondary sector is less developed in the Gulf. We work through dedicated local distributors and agents in all these territories.

8. Where else in the world is up and coming as a centre for aluminium production?
   We have had success in Turkey, Vietnam, Mexico, Colombia and Indonesia recently.

9. Where do you see the most innovation in terms of production technologies – primary, secondary or further downstream?
   Most innovation seems to come from automotive and aerospace designers who need different characteristics and properties, which leads to the quest for improved materials.

10. While there is an element of doom and gloom within the aluminium industry at present – electricity prices, green taxes and the low price per tonne – how optimistic are you for the short-to-medium term prospects of the industry?
    I am always optimistic and think we just need to weather the Euro Zone crisis.

11. Aluminium 2012 is almost upon us. What does Arun Technology have planned for the exhibition?
    We will be there with working instruments to remind people we are still in business, still a small private company and a valid alternative to other suppliers who are mainly parts of large multinational corporations.

12. What other shows will Arun Technology be attending this side of 2012?
    We were in Shanghai in June and will shortly be at Ankiros in Turkey for that general metals show.
    Next year, we will be at shows in China, India and Indonesia.

13. Arun Technology is based in the UK, but what’s happening aluminium-wise on your own doorstep?
    In the UK our home market business has been better than usual in 2012 with several companies increasing production and even repatriating parts that had gone to Asian producers.

“THE INCREASE IN ALUMINIUM USAGE HAS COME FROM ALLOY DEVELOPMENT AND INNOVATIVE DESIGN USES IN CARS, HIGH-SPEED TRAINS AND PLANES.”