2 NEWS

UPDATES
8 USA – Recycling top of the agenda in USA
10 CHINA – Flat-rolling capacity set to grow

ROLLING
15 Final batch anneal: Process issues affecting the quality of foil
18 Coolant strategy saves mill 90% of its waste costs during rolling
20 Work on Oman rolling mill continues
21 The world’s widest cold mill

HANDLING
23 Can simulating traffic in a potroom help bring cost savings?

CANADA FOCUS
26 Canada continues to thrive
30 Rodding shop technology made simple

OTHERS
32 Aluminium industry can learn from Deepwater oil rig disaster
36 Automotive leads US recovery
39 Automotive provides US cheer
42 A fused magnesium chloride containing refining flux
47 Cash solution helps Dubal growth
48 Seawater scrubbing to reduce SO2

ON THE WEB
Turkish company profile: Assan Aluminyum
**Indonesian approval**

A Nalco plan to set up a smelter and captive power plant project in East Kalimantan Province, Indonesia, has been given approval by the Indonesian Investment Coordination Board. A non-binding Memorandum of Understanding has also been signed with the Government of East Kalimantan.

Nalco said land had been identified for the project, has prepared a Detailed Feasibility Report and consultants short-listed for Environment Impact Assessment and Financial Advisory Services.

**Chalco reports loss**

Aluminium Corporation of China (Chalco) reported a net loss of RMB1.09bn in Q1 dented by higher costs and lower prices.

Chalco, the country’s largest aluminium maker also warned of a loss for its first half ending June 2012 due to weak prices and high raw material prices.

It reported 19% rise in revenue to RMB33.6bn in the three months ended March. Last year the company made a net profit in the same period.

**Brazilian award**

Novelis do Brasil has awarded Fata Hunter a contract for the supply of a Single Coat Continuous Coil Coating Line for Aluminium Can Stock.

The line is part of the investment plan that Novelis is carrying out at its facilities in Pindamonhangaba, São Paulo Province and is scheduled to enter production in Q2 2014.

Fata Hunter has now supplied 134 Coil Coating Lines for aluminium and steel applications.

**Bauxite tax**

Indonesia has announced a 20% ban on its bauxite exports.

The commodities tax came into effect on May 6 and applies to all bauxite exports.

Analysts said the tax was good for the Indonesian government but not for miners.

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**Gulf Aluminium dinner 2012**

More than 250 aluminium executives from producing companies, technology providers, power generation manufacturers, traders, service providers and aluminium users and government officials attended the Gulf Aluminium Dinner, 2012.

It was hosted by the Gulf Aluminium Council and took place at the Emirates Palace hotel, Abu Dhabi, UAE.

The welcoming speech was made by Mr Saeed Al Mazrooei, President and CEO of Emirates Aluminium (Emal), the lead sponsor of the event, who emphasised the role of the Emal smelter on Industrial Development in the UAE.

The key note speaker was HH Sheikh Nahyan bin Mubarak Al Nahyan, Minister of Higher Education & Scientific Research, Abu Dhabi who highlighted the economic, cultural and political significance of the UAE.

The second keynote speech was by Alcoa CEO Klaus Kleinfeld who described the importance and adaptability of aluminium for use in sophisticated applications such as aerospace, transportation, packaging and military.

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**Saguenay closure**

Novelis will close its Saguenay Works facility in Jonquiere, Quebec, Canada.

The plant will cease production in August 2012 and was announced after Novelis reviewed its manufacturing operations in North America.

The company said the decision was driven by the need to right-size production capacity in North America, along with the increasing logistics costs and structural challenges facing the location.

Saguenay Works produces hot band aluminium coils for supply to other Novelis plants. The facility opened in 1971.

**Voerde declares insolvency**

Germany’s third largest aluminium producer Voerde Aluminium has launched insolvency proceedings but said the business would continue to operate and it would seek to restructure.

The company, which produces around 115kt/y of aluminium annually and has 410 employees, said it had hit liquidity problems because aluminium prices had fallen since July last year while production costs have risen.

The smelter was sold by British group Corus in 2009 to BaseMet, owned in turn by investor Gary Klesch.

“I am confident that we will be able to find a suitable solution to continue operations which will be in the best interests of the company and creditors,” Chief Executive Wout Kusters said in a statement.

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**Alcoa cutbacks**

Alcoa has cut its alumina production capacity by approximately 390kt/y as a result of recent smelter cutbacks.

The cuts will reduce Alcoa’s refining capacity in the Atlantic region by about 4% and are already underway. The Atlantic region represents about 50% of its total global refining capacity of 18Mty.

In January, Alcoa announced the closure or curtailment of 531kt of smelting capacity. Of that, 291kt represented the permanent closure of capacity in Tennessee and Texas that had been idled since 2009. Another 240kt, represented curtailments to be taken in Portovesme, Italy and La Coruña and Avilés, Spain.

Alcoa has reached agreement with government authorities and unions in both Italy and Spain on the cuttings. The 90kt curtailment in the Spanish smelters has started and is scheduled to be complete by the first half of this year.

The smelter in Portovesme, Italy, with a capacity of 150kt, will finalise curtailment by the end of the year.

**Quebec boost**

Alcoa is to invest $75M in Quebec, Canada in 2012.

Alcoa Canada Global Primary Products (GPP Canada) will spend roughly $75M at Bécancour, Deschambault and Baie-Comeau.

GPP Canada plans to allocate about $62M to maintain its operations and reduce costs, while the remainder will be spent on health and safety projects.

It plans to modernise its Baie- Comeau’s port facilities, the refurbishment of a transformer also in Baie-Comeau, an amperage increase project at its smelter in Deschambault, and a major reconstruction of the baking furnaces of the carbon division of its Bécancour facility.

For more details see Canada Focus, this issue, page 26.
Vitex expands

New Hampshire, USA based Vitex Extrusions has spent $7M on an aluminium extrusion press and production line to double its annual output capacity.

The new production line installation completed in December, increased plant output capacity from 18,000,000 lbs to 30,000,000 lbs/yr.

The modernised equipment produces extruded aluminium profiles with tighter dimensional tolerances and superior surface finishes to what was previously available in the market.

Also, having strategic excess capacity shifts the service paradigm from reacting to and gearing up for sudden demand spikes to one of anticipating and fulfilling sharp up-ticks without any increases in lead times.

Vitex has taken a huge step in ensuring its customers that their manufacturing operations keep pace easily with increased market demands thus allowing them to focus on core business objectives and continued growth.

Chalco in the red

Aluminium Corporation of China Limited (Chalco) was in the red for the first three months of the year.

In its first quarterly report published by the Shanghai- and Hong Kong-listed company it warned of potential loss for the first half of the year.

Inroads into the global automotive industry with its aluminium products as part of industrial diversification in line with Qatar’s National Vision 2030.

Qatalum auto certification

Qatalum will soon be able to make inroads into the global automotive industry with its aluminium products as part of industrial diversification in line with Qatar’s National Vision 2030.

This has been made possible with it becoming the first company to achieve the ‘ISO/TS 16949’ certification in Qatar, announced by the certification body, Det Norske Veritas.

The ‘ISO/TS 16949:2009’ certification is a global standard for quality, awarded by the International Automotive Task Force. It defines the quality management system requirements for the design and development, production and installation and service of automotive-related products. It is applicable to the sites of an organisation where customer-specified parts for production or service are manufactured.

What this means to Qatalum is that we can continue our policy of economic diversification, allowing local business to tap into our high quality resource, to build value-added components in Qatar for export and local consumption, therefore furthering the downstream industrial base and increasing employment,” its CEO Tom Petter Johansen said.

Although the post-2008 economic downturn has hit many smelters hard, he said with this certification, Qatalum’s products could go a long way in supplementing orders to automotive customers.

IN BRIEF

IAI chairman
John Bevan, CEO of Alumina Limited has been appointed Chairman of the International Aluminium Institute (IAI) at its 81st Board of Directors meeting, held in Abu Dhabi.

Bevan replaces Svein Richard Brandtzæg, CEO of Hydro.

Henan agrees smelter build
Henan Yulian Group has signed an agreement with the local government of Shangwan county to construct an aluminium project.

The 1.20Mt/a smelter will be located in Xinjiang Uyghur Autonomous Region and cost $1.90bn. The company is also set to build a captive coal-fired power station for the smelter.

Potline freeze
BHP Billiton’s 700ktpy Hillside, South Africa smelter suffered a potline freeze. It is estimated the potline problems could cost the company up to $200M.

Chinese production up
China’s National Bureau of Statistics said aluminium production during April was 1.537Mt.

This equates to 51200t per day, a slight rise over the March number, and below the figure recorded in February. This equates to an annualised rate of 18.7Mt.

However, several large smelters in Xinjiang are due to start up operations, which could boost capacity. But the Weining smelter is still suffering from an accident, which could remove 200kt.

Asbestos scare
Asbestos was discovered at Alcoa’s Massena West plant after a recent fire. The investigation into the fire led investigators to find asbestos contained in the building’s ceiling. The Occupational Safety and Health Administration is conducting investigations into both the fire and the asbestos.

Alcoa will conduct tests on debris samples to look for asbestos fibers that may have entered the air. After the proper areas are tested and found to be safe, operation will resume.

For more
News & Views
www.aluminiumtoday.com

Rio can wait on Pacific sale

Rio Tinto Alcan is prepared to wait before it sells its Pacific Aluminium business to ensure it gets the best value from any asset sale.

Chief executive Jacynthe Cote said it would not be rushed into making any business decision on the business.

Speaking moments after delivering a presentation to the 17th CRU World Aluminium Conference she said: “On our Australia and New Zealand businesses, we are not rushing into any transactions and until now there has been no decision made on the methodology.”

A full report on the conference will appear in AIT July/August 2012. Several articles are on the AIT website:
www.aluminiumtoday.com

Rusal cutbacks?

UC Rusal could cut up to 600kt of capacity due to the continued economic downturn, it said.

Publishing its Q1 financial results the Russian company said it is currently considering cutting between 300kt-600kt of high-cost smelting capacity starting from H2 2012. The cut represents 4% to 6% of overall capacity, Rusal said.

Its alumina production could also be possibly idled to achieve a production capacity balance.

It posted an 84% drop in Q1 net profit as prices fell. Q1 net profit slumped to $74M in the three months ended March from $451M (5.0%) and the Americas (5.0%).

While global aluminium consumption in Q1 grew 5% y-o-y, the average price of the metal fell 13% to $2177/t, Rusal said.

Total aluminium output was up to 1.049Mt in Q1 2012 compared to 1.014Mt a year before. The rise was due to increased production at Sweden’s Kubal and certain Siberian Russia smelters.

Rusal predicted aluminium consumption to grow 7% this year, mainly in H2 with China the largest growing market (11.0% growth) followed by India (10.0%), Japan (5.0%) and the Americas (5.0%).

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In its first quarterly report published by the Shanghai- and Hong Kong-listed company it warned of potential loss for the first half of the year, citing low aluminium and high raw material prices.

Chalco suffered a net loss of RMB1.16bn ($183.4M) in the Jan-Mar period, compared with a RMB843.7M ($69.2M) net profit for the same period last year.

The company blamed the drop to a decrease in the selling price of its products, higher energy costs as well as higher interest rates in 2011.
Qatalum awards power contract

ABB has won an order worth about $16M from Qatalum to upgrade the power distribution network at its aluminium smelter in Mesaieed Industrial City, 50km south of the capital Doha.

The project includes re-engineering and reinforcement of the existing distribution system to help increase availability and reliability of power supply to key areas such as the substations, electrical equipment, server rooms, office buildings and workshop.

ABB is responsible for the design, engineering, supply and commissioning including civil work. The project is scheduled for completion by 2013.

ABB has previously supplied the electrical equipment for the power plant as well as the 220kV gas-insulated switchgear substation for Qatalum.

Qatalum is a joint venture between Qatar Petroleum and Norway’s Hydro Aluminium, operating one of the world’s largest aluminium smelters with a production capacity of 585kt/y. The complex is served by its own captive power plant.

Qatar all set for Arabal 2012

Qatalum is to host the 16th Arab International Aluminium conference (Arabal 2012) at the Grand Hyatt Doha, from 19-21 November 19-21 2012.

The event will be under the patronage of HE Dr Mohammed bin Saleh Al Sada, Minister of Energy and Industry and Chairman and Managing Director of Qatar Petroleum.

Qatalum has formed a special taskforce in preparation for the event, comprised of a number of the company’s highly qualified personnel and chaired by Mr. Ibrahim Fakhri to supervise all aspects of the conference from planning through to execution.

Qatalum is keen to ensure the event will be expertly organised and run to the highest standards.

Mr. Fakhri said: “Following consultations with the Arabal member companies, Qatalum has developed a new identity for the conference, as part of their endeavour to present the conference with a new and updated look; consistent with the on-going development in the Arab aluminium industry. Arabal’s fresh new identity will be launched soon on the conference’s new website.”

He added that his year’s conference would include key topics, discussion panels, and workshops related to the aluminium industry on both local and international levels.

Aluminij installs stripping press

Bosnian group Aluminij has put into operation a €489,000 thimble stripping press in its Anode Plant.

It also plans to install a €615,000 stub straightening machine. Both items were supplied by Outotec.

Anode Plant Director Ivan Grle said the press was fully operational, and was necessary to ensure the smooth production of rodded anodes, given that by changing the dimensions of the stubs on anode rods, the existing presses became a bottleneck in production.

The press replaced one of three existing presses, and unlike the old ones, the new press strips all the three rings at the same time. Production capacity with the new press amounts to 25 rods per hour, which speeds up production in the process of rodding.

Last year the Aluminij Anode Plant produced 72,986t of green anodes, 69,095t of baked anodes and 68,440 pieces of rodded anodes. This year it plans to produce 76,758t of green anodes, 72,920t of baked anodes and 71,140 pieces of rodded anodes.

Alcoa Icelandic expansion?

Alcoa Iceland is looking into the possibility of enlarging the Alcoa Fjarroaluminium smelter in Reyaroarfjörur, east Iceland, inviting representatives of pension funds to see if they can fund the project, Iceland Review reported.

Alcoa is preparing to increase capacity in the smelter, which would up its production capacity from 350kt/y to 370kt/y. The pot rooms must be modified and the project estimated to cost more than $96M.

Magnús Pór Asmundsson, Alcoa Iceland CEO said the company is also prepared to launch construction which would increase the smelter’s production capacity by 180kt, provided agreements are reached on funding and electricity purchase. The smelter would then produce 550kt/y.

The project could be launched next year—provided the conditions are fulfilled—with the larger smelter being fully operational by 2018. The enlargement is estimated to cost $724M and the addition would require 270MW of energy.

No formal discussions have taken place with Landsvirkjun, the national power company, but Magnus said they are aware of the company’s plans.

Among energy options are expanded operations of the Karahnjukar hydropower plant.

Datang Shaanxi Power is to build a coal-powered aluminium project in Chengcheng, China.

The RMB20.2bn project will be constructed in two stages. Phase 1 includes building two coal mines with a combined capacity of 3.9Mt/y, a thermal power plant equipped with two 350MW generators, and a 200kt/y aluminium alloy project.

In phase 2, two more 600MW generators will be built at the power plant, in addition to a 600kt/y aluminium alloy capacity and a 200kt/y aluminium deep processing project.

Datang Shaanxi Power will have a controlling stake in the integrated project. Chengcheng-based Jinyuan Aluminium and Shaanxi Sanqun Energy’s Qunsheng Power will also participate in the project.

Source China Metals
E-mail: infochn@public.bta.net.cn
**DIARY**

**2012 June**

06-08 Aluminium China
Shanghai New International Expo Centre, China
www.aluminiumchina.com

11-13 5th Aluminum Outlook Summit
The Westin, Chicago, Il, USA

11-13 2nd Aluminium Summit
Millenium Broadway, New York, USA
http://www.amm.com/EventDetail/4424/2nd-Annual-Aluminium-Summit.html

26-28 Aluminium - 21/Extrusion
Sokos Palace Bridge Hotel, Saint Petersburg, Russia

**2012 July**

11-13 Inasal 2012
Jakarta Convention Center, Jakarta, Indonesia
http://www.inasal.com/home.html

2012 September

5-7 Non-Ferrous Metal International Exhibition
Busining Center, Krasnoyarsk, Russia
http://www.nfmsib.com/

24-27 Environment, Health and Safety Aspects Related to the Production of Aluminium (EHSARPA)
Intercontinental Hotel, Montreal, Canada
Email davies@world-aluminium.org

**Sept 30 -Oct 3 51st Annual Conference of Metallurgists**
Sheraton on the Falls, Niagara, Ontario, Canada
http://www.metsoc.org/com2012.asp

**Events Diary**

Anode pins are subject to a harsh environment. Ring erosion of pins not only causes damage but also results in high iron levels in the aluminium, necessitating additional treatment in the cashtouse.

Ring erosion is caused by a higher than usual bath level relative to the top of the anode. A similar effect also occurs when the rod is lowered further into the pot than would normally be the case, often in an effort to achieve better carbon usage.

The VHE collar forming machine is fully automatic. The machine has a fast throughput and is easily installed in existing rodding plants. The machine is able to handle card or aluminium, loaded as a coil and automatically fed, cut to length, then formed into a collar around each pin and securely closed.

**Imports hurt Oz**

Action must be taken against Chinese dumping of cheap aluminium in Australia, said an industry CEO.

The outgoing CEO of the Australian Industry Group said cheap Chinese aluminium had contributed to production cuts and job losses at the Kurri Kurri smelter. Heather Ridout said Australia should be complaining more to the World Trade Organisation.

“The Americans seem to have a very well trod path to the WTO,” she said.

“In fact they’ve won a few cases, the Brazilians I think have taken about a hundred this year most of them against China. We’re pussycats, we have the most open economy in the western world and yet we don’t stick up for ourselves. That’s one of the arguments I’ve had with Canberra.”

**Fives buys coal tar pitch company**

The Fives group has bought the Carbo-chemical and Distillation activities (Proabd) of Litwin's Carbo-chemical and Distillation (MSC) purification for the chemical, pharmaceutical and food processing industries.

The group will continue to develop the whole Proabd portfolio including the processing of coke and coal as well as the processing of anode manufacturing for further integrating the know-how from pitch unloading and storage facilities, anode forming and anode baking.

The customers of the Proabd pitch process will benefit from Fives’ expertise in anode manufacturing which constitutes the main application for the product.

The group will continue to develop the whole Proabd portfolio including the processing of coke oven by-products and melt static crystallisation (MSC) purification for the chemical, pharmaceutical and food processing industries.

**BHP merger**

BHP Billiton is to consolidate its stainless steel materials and aluminium divisions into a single, larger business.

BHP said the new aluminium and nickel customer sector group, would be based in Perth, Australia, under the leadership of Glenn Kellow, currently president of stainless steel materials.

Together, its stainless steel materials and aluminium units made a loss of $66M at the half-year to the end of December, compared to BHP’s overall profit of $15.7bn.

The division will also include Cero Matoso in Colombia, Mozal in Mozambique, Hillside and Bayside in South Africa and two non-operated joint ventures, Alumar and Mineraços Rio do Norte in Brazil.

Despite the current challenges, BHP Billiton is committed to aluminium and nickel as commodities that may benefit from later phases of economic development in the emerging economies,” BHP’s Alberto Calderon said.

“However, individually, Aluminium and Nickel are small divisions relative to the other businesses in BHP Billiton,” adding the new unit would provide ‘appropriate scale’.

**Danieli buys Innoval**

Italian plant and equipment supplier Danieli has bought UK technical consulting group Innoval Technology.

Danieli will integrate Innoval into its Danieli Aluminium Strip Division group which will also include Danieli Fröhling and Danieli Wean United.

Innoval Technology will provide 'appropriate scale'.

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The group will continue to develop the whole Proabd portfolio including the processing of coke oven by-products and melt static crystallisation (MSC) purification for the chemical, pharmaceutical and food processing industries.
Recycling top of the agenda in USA

The Aluminum Association is continuing its efforts to encourage more recycling. It is in discussion with policymakers to promote a more sustainable outlook but one problem is persuading the general public to consider recycling more materials.

“We think we are uniquely positioned as manufacturers of a durable and infinitely recyclable material that creates energy saving applications, fuel efficient transportation, green building and sustainable packaging,” Tom Brackmann, president of Nichols Aluminum, Lincolnshire, Ill, told reporters during a press roundtable at the Arlington, Va,-based Aluminum Association’s recent spring meeting in Napa, California.

“At this point the progress of aluminium sustainability is growing at a time when the Association continues its efforts to develop more scientific data and to effectively communicate these results to policymakers,” added Brackmann, who is also the chairman of the Aluminum Association.

Industry commitment
Heidi Brock, president of the Aluminum Association also highlighted the aluminium industry’s commitment to sustainability and the need to communicate, among other things, that 75% of all aluminium ever produced is still in use and that the more aluminium is recycled the more energy is saved.

“We have begun discussions with policymakers to encourage them to consider recycling when they are developing their energy efficiency initiatives,” she says. “When you throw a can away, you are throwing away the equivalent amount of power that you need to run a television. If you recycle that can, you are saving that power.

“We think that we need to do a better job of letting the public know that it is not solved and every single materials industry – not just aluminium, but also paper, glass, steel, and plastics wouldn’t like get more recycled stuff back, but I do not think the public understands that.”

The aluminium recovery rate varies product by product, Brackmann declared, noting that only about 58% of aluminium cans are recycled, while aluminium recovery by the construction and automotive industries is much higher – over 90%. That, he states, is because their end of life recycling is not being done by an individual but by a company that understands the value of the materials involved.

In the construction industry the contractor is responsible for recycling. “That is part of his job,” Brackmann stated. “He knows when there is enough material generated to make it worth his while to load his truck up and to run it to the reclamation centre and get a return.”

When it comes to autos, it is a similar story. The person who buys a car once it comes to the end of its life understands the value of the materials in the car and that there is a ready market to sell it into reclamation.

“The trouble with the can is it is so convenient to a disposable society. It is too easy and too unimportant as a single use container for many people to part with. But in aggregate, when you add up all of these cans lost, it is a huge amount of dollars and energy that could be saved,” Brackmann stated.

Brock says the Aluminum Association has a goal of raising the aluminium can recycling rate to 75% by 2015.

End markets
The Aluminum Association officers also shared their view of several aluminium end markets at the roundtable, including the construction, automotive and aerospace markets. Of these, construction has been the slowest to recover from the economic downturn.

Brackmann says last year US aluminium sheet shipments to the construction market were down about 5%. “It was really a tale of two halves with first half shipments being pretty strong, but in the second half they fell off pretty dramatically.”

Thus far this year the pattern is similar with housing starts up in the first quarter. “There is cautious optimism that it will stick this time versus the false start last year.” He admits the recovery is still lacklustre at this time, although once the national employment rate increases and consumer confidence returns, there could be a surge of demand.

“We are continuing to grow households and population in the USA. At some point these folks have to live somewhere.”

Canada
Meanwhile the construction sector was not as hard hit in Canada, said Jean Simon, President of Primary Metals for Rio Tinto Alcan, Montreal, and Aluminum Association executive committee chairman. “While Canada also went through the economic crisis, it did so with less pain,” he states.

Domestic demand, whether in construction or in other aluminium end markets, however, only accounts for about 10 to 15% of the total aluminium market, with the vast majority of Canadian aluminium sales going to the USA. Because of this, Simon declared the Canadian industry is extremely dependent on US economic growth.

US automotive and aerospace aluminium demand is very positive, Brackmann says. For the auto market that is not only coming from increased auto output, but increased penetration of aluminium into automotive applications. Brackmann stated this has resulted in large capital investments to provide the finishing capabilities for sheet for those applications.

It is also definitely a time of growth for the aerospace market and the use of aluminium in aerospace, noting that, for example, the new generation of the Boeing 737 will be an aluminium plane. “That is a big deal as it sets aluminium up for a good period of time and keeps composites at bay.”

May/June 2012
Mr Wang said most of the projects are scheduled for completion in the next couple of years.

In contrast, China’s primary aluminium capacity increase in 2012 is expected to be less than 3Mt for the year. The gap leads commentators to believe that China’s aluminium market may become tight again due to a surplus in the near future.

Details of some of the projects are:

**Company:** Zhongwang Holdings  
**Location:** Panjin, Liaoning  
**Investment:** US$3.8bn  
**Capacity:** 3Mt/y (sheet and strip)  
**Time for operation:** 2017, with Phase 1 of 1.8Mt/y in H2 2014  
**Ground breaking:** 2011

**Company:** Aleis-Dingsheng Aluminium  
**Location:** Zhenjiang, Jiangsu  
**Investment:** US$0.85bn  
**Capacity:** 250kt/y (plate)  
**Time for operation:** Phase-1 of 50kt/y by end 2012  
**Ground breaking:** Early 2011  
**Equipment:** 4064mm HR mill capable of snake rolling with roll gap up to 800mm; 4000mm plate prestretcher; 120m solution treatment line.  
**Comment:** A copy of the Koblenz-based Aleris Aluminium Walzprodukte; expected to be a domestic material supplier for China’s large commercial aircraft C919, with main products being alloy plates of 7050-T451, 7475-T7351, 7075-T7351, 2024-T351, 2124-T851, 2524-T351, 5XXX series, 6XXX series, Hokotol alloy and Giantal alloy used in aerospace industry and transportation, petrochemical and machinery and moulds industry; all equipment imported from SMS Siamag.

**Company:** Dalishen Alloy Materials  
**Location:** Danyang, Jiangsu  
**Investment:** RMB1.02bn ($161.7M)  
**Capacity:** 150kt/y (sheet, strip and foil)  
**Time for operation:** 2012  
**Ground breaking:** December 2010  
**Equipment:** 2800mm four-roller reversible HR mill; four units of four-roller reversible CR mills of 1730mm, 1625mm, 1727mm and 1600mm; two 1550mm four-roller irreversible foil rolling mills and other finishing and auxiliary lines; all equipment imported from SMS Siamag.

**Company:** Jinning GKO New Materials  
**Location:** Zhongwei, Ningxia  
**Investment:** RMB48bn ($633.2M)  
**Capacity:** 1Mt/y (sheet and strip)  
**Time for operation:** Phase 1 of 400kt/y by March 2012  
**Ground breaking:** 2011  
**Equipment:** 1850mm (1+4) continuous HR mill; two 1850mm single-stand fourroller irreversible CR mills.  
**Comment:** Jointly invested by Zhejiang GKO Aluminium and Hangzhou Jinxian Group; main products being PS plate, HR blank, materials for cans and cabinets.

**Company:** Ruiqiang Aluminium  
**Location:** Binzhou, Shandong  
**Investment:** RMB4.82bn ($764.5M)  
**Capacity:** 200kt/y (sheet and strip)  
**Time for operation:** Phase 1 of HR capacity by first half of 2013  
**Ground breaking:** March 2010  
**Equipment:** (1+4) continuous HR mill; CR mill; and finishing equipment.  
**Comment:** Wholly owned by Shandong Loften; three-phase construction of HR, CR and casting process; main products being PS plate, materials for cans, clad plate/sheet/strip and foils with thickness below 0.001mm.

**Company:** Danjiang Aluminium  
**Location:** Danjiangkou, Hubei  
**Investment:** RMB20M ($3.1M)  
**Capacity:** 50kt/y (ultra-wide strip/foil)  
**Time for operation:** End 2012  
**Ground breaking:** 2010  
**Equipment:** Five units of double-roller continuous casting and rolling mills; one single-stand irreversible CR mill.

**Company:** Longding Aluminium  
**Location:** Luoyang, Henan  
**Investment:** RMB4.2bn ($644.8M)  
**Capacity:** 600kt/y (foil)  
**Time for Operation:** 2013 (Three-stage construction, with Phase 1 of 250kt/y having been operational since July 2011, and Phase 2 of 200kt/y in 2012)  
**Ground breaking:** March 2010  
**Comment:** 190kt/y foils with thickness below 0.01mm, 100kt/y foils with thickness below 0.001mm, 100kt/y foils for making auto air conditioners, 60kt/y PS plate, 100kt/y curtain wall and 50kt/y other products; jointly invested by Zhenjiang-based Dingsheng Al and Luoyang-based Longhai Investment Co.

**Company:** Qianjiang Al-Power Project  
**Location:** Chongqing  
**Investment:** RMB85bn ($129.5M)  
**Capacity:** 200kt/y (sheet and strip)  
**Time for Operation:** 2014, with Phase 1 of 100kt/y in 2013  
**Ground breaking:** 2012  
**Comment:** Al-Power integrated, also including two units of 300MW thermal power plants and 100kt/y carbon capacity; jointly invested by Beijing Songjie Huarong Investment Holdings Ltd, Qianjiang District local government and Chongqing Wujiang Electric Power.
China Aluminium Rolling Industry report 2010-2012

The China Aluminium Rolling Industry Report, 2010-2012 is published by ResearchInChina business intelligence group.

China is currently the world’s largest producer and exporter of aluminium sheet, strips and foils. In 2010, China’s sheet & strip capacity was 7.25Mt, sharing roughly 23.2% of global total; aluminium foil capacity 2.13Mt, making up about 35.7%.

The rolling industry is the area with the fastest-growing investment in today’s Chinese aluminium processing industry. Investment in new industrial products is primarily focused on high-precision aluminium sheet & strip, aluminium thin-sheet for cans, electronic foil, packaging foil and others. Domestic processing companies including Southwest Aluminium, Nanshan Aluminium, Weiqiao Aluminium & Electricity, China Zhongwang have all increased.

According to the current investment development tendency in the industry, there will emerge seven ‘mega’ size manufacturers of aluminium sheet, strip & foil during the 12th Five-Year Plan Period (2011-2015).

The report highlights the financials, product mix and investment planning of 15 major players in the industry. It is based on analysing the supply-demand structure of global aluminium sheet, strip & foil market, as well as the output, consumption, import & export volume, upstream & downstream sectors and other aspects of Chinese aluminium sheet, strip & foil industry.

Southwest Aluminium is one of the largest integrated aluminium companies in China. It boasts advanced hot strip rolling production lines for high-precision aluminium and aluminium alloy sheet & strip. In 2010, its revenue from its sheet, strip & foil products was 81.9% of total operating revenue.

The company is conducting a 220kt/y alloy casting expansion project, which will raise its aluminium processing output to 1Mt/y. Henan Mingtai Aluminium is one of China’s major manufacturers of aluminium sheet, strips and foils. Its capacity in this field amounted to 350kt/y in 2011, and will hit 400kt/y in 2012 after the completion of an IPO project. Its focus products for future development include CTP aluminium substrate, high-precision aluminium alloy sheet, electronic foil, composite aluminium sheet, strip & foil.

Shandong Loften Aluminium Foil is China’s largest manufacturer of pharmaceutical foils, as well as the second largest household foil producer, currently enjoying a 70% share of the domestic pharmaceutical foil market. The company’s aluminium sheet, strip & foil projects under construction mainly cover 80kt of aluminium foils and 450kt of aluminium sheet and strips.

Final batch anneal: Process issues affecting the quality of foil

Aluminium foil remains a key material for the food and pharmaceutical packaging industries. Formability, printability and excellent barrier properties make aluminium foil the right choice for protecting and preserving the items in complex food supply chains despite the developments in barrier films from the plastics industry. By Vicente Martin*

The manufacture of top quality foil for converting applications, despite its long tradition spanning more than 100 years, is often viewed as something of a black art, where many areas of the process are thought to lack scientific understanding. Under these conditions, there can be therefore, unexplained variations due to the complex and numerous interactions of the different manufacturing steps involved from casting the aluminium to the final packaged form.

Given this situation, manufacturers devote a significant amount of technical resources to maintaining process stability so as to minimise changes that may lead to quality problems. This means a significant portion of company know-how resides in the collective experiences of long-serving operators who can be both dogmatic and conservative.

Practices thought to be proven are implemented, but these may be inflexible to changing conditions and in some extreme circumstances give rise to defects difficult to eradicate downstream or which keep repeating without clear origin.

Fine tuning
An appreciation of the factors involved in the manufacturing of foil and their interactions during the different stages allows processes to be tuned.

These give the best results, as well as ensuring the correct response to variations in either the incoming materials or the input and output settings of the machines. Knowledge of the expected risks involved in a process change comes only with a deep understanding of the process.

Final batch annealing of thin foil is an example of an individual process where a large number of different factors can interact to produce good or bad results. It is one of the most critical operations in foil manufacturing which has a direct impact on customer performance.

For example, after annealing, a coil with an incompletely degreased surface will lead to adhesion problems during conversion process, or a coil may have poor unwinding quality, which will cause tears or holes in the material when it is used in a converting process by an end user. Both instances will result in the client returning coils with the loss of reputation as well as the direct costs of lost production.

Although batch annealing is recognised as an imperfect process that leads to non-homogeneous coil conditions, up to now the aluminium industry has not found a workable cost effective in-line solution that could simplify the removal of residual oil from the surface of thin foils and make the product defect-proof.

A coil of the 6-micron thick converter foil is far from being solid; there is a gap between layers of less than 1μm, which makes the effective density of the coil lower than that of aluminium (Fig 1).

Right after coiling, this gap will be mainly filled with residual oil from the mill, while after annealing it should be mainly air. In the process of the final anneal, oil needs to vapourise and flow through the width of the coil to the edges through this small gap.

This distance is commonly around 1000mm from the centre of the coil to the edge of the coil.

The physics of the oil diffusion through these gaps is a long way from normal fluid dynamics, and the pathway resembles more a porous structure than a tunnel.

As the metal roughness is of the same order of magnitude as the gap, this convolutes the path the oil has to percolate through (Fig 2).

Knudsen number
The Knudsen number relates to the mean free path for diffusing molecules and the mean characteristic length of the diffusing geometry. For typical foil rolling oil annealing temperature and normal coiling gap geometries, Knudsen numbers will be in the range of 0.02 to 0.15.

This is a clear indication that the normal continuum flow equations are no longer valid and the process is governed by rarefied flow regimes. This type of flow through long micro channels has recently received considerable attention from the microelectronics industry and several expressions have been developed that account for the governing parameters of these types of flows.

As expected from industry experience there are strong influences from the air...
gap between laps, the coil geometry, oil characteristics, temperatures and vapour pressure. The chemistry of the oils and additives used during the rolling of foil products means the dynamics and energies relating adsorption to the surfaces needs to be fully considered.

An expression developed for micro channel flow of gases is:

$$\dot{n} = \frac{G^2 WP^2}{24 \mu d L R T} \left( P^1 \div 12\frac{\sigma}{\sigma - \sigma} K_0(P - 1) \right)$$

It is possible to estimate from it the relative influence of parameters on the process. G represents the gap and will have a key influence in the dynamics of the oil removal. L as the length of channel will determine, along with the coil heating up effects, the variation of anneal time with coil width. P accounts for the vapour oil pressure at the evaporating interface and, along with \(\sigma\) (a surface accommodation factor), will be affected by a change of physical characteristics due to oil chemistry.

This relatively simple expression needs to be tuned to account for non-uniform gaps, blocked channels, roughness, composition of the oil and chemical interactions that complicate the problem for each particular situation.

**Performance**

Factors affecting annealing performance span through the entire rolling process:

– Rolling mills will deliver coils with rolling oil on the surface of the foil that needs to be removed. Containment systems in the mills need to be set up and maintained so as to minimise the oil residuals and avoid oily patches or contaminants on the foil surface. Rolling oil chemistry and good quality control will play an important role on the process, so correct monitoring systems need to be set up. These are critical when preblended products and oil recycling are used. Adequate controls, both analytical and using the maintenance systems will ensure performance stability.

A good understanding of oil contamination is needed to assess potential problems. Foil flatness will also affect subsequent coating quality in separators.

– Separators are the final coil preparation stations which affect the strip dimensions. Correct coating densities ensure adequate and uniform gaps between the laps for the oil to escape, yet sufficient separation between laps to avoid stickiness due to oxide growth bridging between foil surfaces. Precise start up practices and correct maintenance of the separator actuators will ensure correct coating quality at the core and minimise fretting corrosion defects and core stickiness issues. Good trimmed edge quality will also allow passage of oil vapour out of the coil.

– The furnaces in which the oil removal treatment occurs need to ensure uniform temperature distribution, precise atmosphere control and purging.

Therefore, correct maintenance of furnaces is important. Variable coil geometries (both in coil sizes and material thicknesses) need to be addressed by different annealing practices. Measures can be put in place to minimise overheating of the support cores which significantly influences unwinding performance close to the core.

**Trouble shooters**

If, in spite of these measures, problems arise, forensic surface chemistry techniques and experienced trouble-shooters are invaluable in quickly detecting and identifying the origins of the problems. The correct mix of plant data analysis, field measurements and laboratory analytical measurements combine to pinpoint weak points in the process and identify the likely origin of defects.

A key approach to assess the suitability of a surface for coating involves the use of both FTIR and surface carbon measurement, both of which are offered by Innova! Technology, a provider of independent technical expertise to the aluminium industry.

FTIR is used to measure the chemical nature of the aluminium surface and it can detect the presence of hydrocarbon products on the surface or the state of hydration of the outermost oxide layer. The nature of the oxide layer has a strong impact on the performance of coating adhesion. A technique has been developed that allows precise quantification of the thickness of the oxide layer in the foil. Changes in oxide thickness and chemistry will alter the adhesion response of the foil.

Surface carbon measurement is another useful technique that gives quantitative values to the amount of residual carbon products on the surface remaining after anneal. The traditional wettability measurement approach only gives semi quantitative information about the surface tension with water, whereas measurement of the total amount of carbonaceous residues present can be quantitatively linked to adhesion performance (Fig 3).

The use of thermal programmes during the test can highlight the presence of heavy ends from the lubricant or polymerised species. In Fig 4, material A shows a higher amount of higher weight products that evolve at higher temperatures. It is expected that anneal of this material is comparatively more difficult and adhesion performance will be poorer.

With sound analytical capabilities and field technical expertise, and strong thermal modelling capabilities, the team at Innova! Technology can play a key role in optimising annealing processes. They can also assist with troubleshooting product performance in foil manufacturing, setting reliable process controls and staff training.

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Fig 3 Relationship between carbon content on the surface and adhesion performance

Fig 4 Behaviour of surfaces with different species
Minimising waste during sheet rolling is a challenge. Large quantities of water, lubricants and rolling oil are consumed due to the coolant system maintenance. This requires that process coolants are renewed regularly and contaminated auxiliary oil removed periodically.

By Rick Pruhs* and Mark Bohr**

The following case study details how Quaker facilitated the volume reduction of coolant being discarded by as much as 90% at a customer site, while simultaneously converting the contaminated coolant into a positive revenue stream.

The Quaker aluminium customer runs a traditional hot line with a single-stand reversing breakdown mill using an 115,000-litre coolant system and a three-stand tandem mill using a 350,000-litre system. When the coolant reaches a level of contamination that affects rollability and quality, the production team performs a 'partial dump' of coolant.

This 'dump' results in large quantities of wastewater that are removed to an off-site waste treatment facility.

In 2010, Quaker’s customer was generating an average of 12 tank loads of coolant waste per month and costing the mill approximately $1200 per load for waste removal transportation, more than $170,000/y.

Looking for a viable alternative that would cut waste and reduce costs, the customer presented the challenge to Quaker in 2011. Part of Quaker’s proposed solution was using a centrifuge to separate the fluids. Although the separation technology has been in existence for some time, Quaker advised the customer to rethink its established coolant management practices to overcome the known problems.

Following the recommendations, the coolant waste is first separated from the water. Then, the recovered water is recycled back into the coolant instead of adding fresh water daily. This reduces the sheer volume of water used. Quaker estimated the number of tank loads of waste could be reduced from 12 to roughly two per month, if the reconfiguration was successful. Furthermore, the customer assumed the separated oil could be concentrated and sold as a fuel source — creating a new revenue stream for the customer.

**First trial**

During the spring and summer 2011, an initial trial took place of a 75l/min centrifuge on the customer’s tandem mill coolant system, which is designed to allow the excess oil from contamination to settle or float to the top of the coolant tank for ‘skimming’ or extraction.

In the past, this typical procedure involved lowering a weir and diverting the floating oil without removing usable coolant. The new strategy meant capturing the skim and using the centrifuge to separate the water and oil so that the skim could be transferred off site for treatment.

However, this separation technology caused several problems: continual clogging of the centrifuge filters causing the unit to shut down and excessive solid material in the resulting oil reducing the resale value of the oil. In April 2011, the resulting oil contained high solids levels making it unacceptable as a fuel.

Therefore, the customer received no compensation for this batch of waste oil. In contrast to the number of problems, the number of coolant waste tank loads were reduced by almost half — saving the customer $6000 in freight costs. This was enough to encourage further trials.

**Fine tuning**

After several processing adjustments, the performance of the centrifuge improved and the solids level of the oil reduced. In fact, the second load of extracted oil was 96% oil. This load of oil generated approximately $3300 in revenue or 0.16$/l for the customer.

In addition, the customer avoided $9600 in freight charges and, as planned, the coolant water was recycled as recovered water in the system.

An additional trial was completed on the substantially different, smaller reversing mill coolant system. Unlike the tandem mill system, where the primary source of contamination is heavy auxiliary lubes, contamination in the reversing mill coolant system is dilute, soluble hydraulic fluids. This type of contamination does not float to the top of the coolant tank for skimming, but rather becomes trapped in the solution as a result of emulsification.

The target coolant concentration for this range from 5 to 6%; however, when the contamination can cause increases in the coolant concentration above this range, as high as 8%, which causes the mill to slip.

Commonly, usable coolant is removed from the system and replaced with water to reduce the oil concentration, eliminating the slip condition.

In connection with the reversing mill coolant system, the centrifuge performed during the first trial.

A portion of the reversing mill coolant was transferred to the centrifuge while the oil phase of the reversing mill coolant was combined with the tandem mill waste oil. Similar to the tandem mill operation, the water phase was reused as reversing mill-recouped water.

Over a two-month period (April-May), roughly 265m³ of contaminated coolant and skim was successfully centrifuged.

During this time, the customer reduced its tank loads by approximately 55% from

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the 24 tank loads to 11. This translated
into $15,600 in savings from reductions in
transportation and treatment costs, and
the avoidance of using 250,000l of fresh
water to top up the emulsion.

Two bulk loads of extracted oil were
generated during this time. The first load
contained excessive solids content and
was removed from the plant at no cost (ie
the oil reclaimer did not pay the customer
for the oil nor did the customer pay the oil
reclaimer for transportation).

However, after the extraction process
was optimised, the second load of oil
generated $3,300 in revenue for the rolling
mill.

Next steps

In 2012, Quaker plans to conduct another
phase of the centrifuge trial, building on
the success of the initial trial, with the aim
of implementing a coolant waste reduction
strategy into the everyday mill operation.
Areas under consideration are:
– Investigating optimisation of tandem mill
skim practices, ie artificially adding water
to the thick tandem mill skim to facilitate
improved separation. Determining the
necessary waste tank, pump and pipe
configuration to minimise set-up and break
down times, while maximising
automation.
– Working with centrifuge manufacturer to

establish industry best practices.
– Determining if multiple units are
economically warranted.
– Developing an automated method to
track real-time savings and communicate
success to operations.
– Determining if the separated waste oil
can be effectively used as a process
lubricant (ie rolling oil as opposed to fuel
oil).

Conclusion

The collaboration between Quaker and its
customer demonstrate the volume of
coolant removed from an aluminium hot
rolling coolant system and bound for
treatment can be efficiently reduced.
Contaminated coolant can also be
converted into a continuous revenue
stream while reducing the environmental
impact through reuse of extracted water
from the coolant, reduction in the volume
of treated waste, and minimisation of the
number of trucks on the highways.

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Fig 1 Combined actions produced 90% savings

Average monthly cost before employing the centrifuge
changes - 12 tankers

$14,400 net spend

April ‘11 first trial tandem mill
- 7 tankers, $0 oil revenue

$8,400 net spend

$6,000 savings

May ‘11 after adjustments - 4
tankers, £3,300 oil revenue

$1,500 net spend

$3,300 net spend

$12,000 in monthly savings

$ in thousands

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Work on building the Oman Aluminium Rolling Company (OARC) facility in Sohar, Sultanate of Oman is progressing on schedule, and the plant will be ready for commissioning by August 2013.

The turnkey EPC contract was awarded to Fata EPC, a division of Fata SpA (a Finmeccanica Company) in April 2011, but the engineering works started in January 2011 under an interim agreement.

Completion of civil and building works is currently ongoing, equipment has been purchased and is in manufacturing. Shipments will begin in May.

Fata currently has 800 people on the site, which will go up to 1500-1600 people at the peak of construction in September-October this year.

Partial hand over is scheduled for August 2013 to begin initial production with production ramp up to the 160kt/y design capacity.

The $396M project is a full EPC LSTK package for setting up a complete aluminium flat product facility and will be the largest downstream user metal from Sohar Aluminium.

A Hazelett Belt Caster and the latest technology in aluminium rolling will enable the plant to use molten aluminium for manufacturing rolled coils.

This will enable OARC to produce aluminium sheet of very thin gauges and high surface quality with shorter product delivery time and world class production costs. The project will provide 275 direct jobs at full production and will also generate many other jobs required to support the operation of the plant.

Oman Aluminium Rolling Company will have 100 employees in place by the end of 2012 to initiate the plant operations. Additional employees will be added as the facility ramps to full production capabilities. The rolling mill will serve the aluminium food container and food preservation foil markets, along with material for the automotive heat exchanger and commercial and residential air conditioning markets.

The mill is positioned for growing regional demand and sales are expected to also reach international markets.

Sales agreements with Garmco in Bahrain are in place to market the mill’s products until an in-house sales and marketing team is established.

The project fits with the strategy of adding value to existing local raw material and developing economically attractive downstream investments in Oman industries that in turn contribute to creating sustainable employment, expand the local industrial network as well as increase and diversify revenues for the local economy.
The world’s widest cold mill

Danieli has received an order for the world’s widest aluminium cold mill. The order from Kamensk Ural’sky Metallurgical Works (Kumz), Russia is for a 6-High single stand cold rolling ‘Diamond Mill’. The mill supplied to Kumz will produce flat coiled sheet up to 2800mm wide for aerospace applications in the thickness range of 8mm to 0.2mm.

It will produce the world’s widest material and makes the mill the world’s widest cold rolling mill. The technological challenge of the requirement will be met by the Diamond Mill 6-Hi design. It will enable Kumz to roll products including a wide material width range and strip thickness’s as well as alloys including military aerospace products.

Key technological features of the mill include a 6-High stand design with Intermediate Roll dynamic side-shifting utilising parallel rolls and a mill-stand stabilisation design required for the stability of the roll stack across material parameters and rolling phases. Other features are Danieli’s Hi-Res Coolant spray design with constant stand-off distance which uses electrical valves with 26mm pitched spray nozzles across the complete strip width coupled with Hot Edge Sprays (HES) covering the strip edge, Dan-Eco2 Fume Cleaning & Coolant Recovery System to ensure emission standards are achieved with reduced operating costs obtained from the recovery of the rolling oil.

Other highlights include the Dan-Purity Coolant Plate Filter to ensure improved process performance and product quality with the additional benefit of extended coolant life; Danieli Automation’s HiPac TCS, Dynamic model based Level 2 system, Level 1 electrics; coil movement utilising a pallet conveyor system around the mill and linking to a coil preparation station, coil inspection station and High Bay Storage System and Innova Technology process and product support.

All equipment is being supplied from Europe and all technological parts manufactured in Danieli’s European workshops.

Kumz is situated in the Urals and is one of the largest downstream companies in Russia. It was founded in 1944 as a manufacturer of semi-finished products in aluminium, magnesium-based and aluminium-lithium alloys. The quality achieved by Kumz are demonstrated by its qualification as an aerospace supplier to Boeing and Bombardier.

Danieli has set-up a team from its excellence centres worldwide including its Danieli Fröhling’s UK and German offices, Danieli Wean United (Cold) Italy, Danieli Automation and Innova Technology.

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Hencon is a supplier of purpose-designed vehicles for potrooms and casthouses in the aluminium industry. It is active in consult, design, production, maintenance and service of mobile equipment. It is this integrated approach that help its customers become more cost effective and successful in producing aluminium and aluminium products for their markets. As part of its consulting activities it noticed the use of mobile equipment (including cranes) is underestimated when it comes to the impact it can or will have on the stability of the pot in the potline or cycle time of the furnace in the casthouse. As a consequence it sees that valuable capital investments are used less effectively as a result of the operational choices made for cranes, PTM’s and vehicles. This article intends to show what added value it offers by using object-orientated logistic software. 

Objective
Most cell technology programmes and casthouse optimisation programmes are chasing targets to lower the production cost of aluminium with $100 to $200/t. In both cases research programmes were formed to improve the electrolysis process or in the case of a casthouse, purifying and alloying cycle successfully. That is not what our research programme is about. When we started our discrete flow analysis we used a flow analysis programme to evaluate the PTM, crane and vehicle behaviour, relative to the requirements of the individual electrolyse cell and melting or alloying furnace. This idea was not new. Companies such as Hydro, Rio Tinto Alcan, Bechtel, SNC Lavalin and Hatch, used similar programmes to evaluate investment and decide on infrastructural consequences for smelter technology. However Hencon’s target to consider an electrolyses cell as an individual production unit that needed to be supported by a PTM, crane and vehicle as per its needs was new.

Past papers
There are many papers that deal with using simulation tools to optimise the flow of discrete materials within a potroom. A number of experts within the industry have also used discrete flow simulations to take educated investment decisions or improve the safety of a factory lay out.

Discrete modelling
In 2006 Hencon started with an Excel-based model that allowed it to quickly monitor general production requirements. It calculated the day to day requirement for anodes (anode pallets) and ladles to calculate the fleet of vehicles required for that production. At the end of 2006 this resulted in the first cycle time analysis for a ladle flow between electrolyses cells (32hr tapping cycle with a capacity of three cells per ladle) and a number of furnaces (60t capacity). Based on this, it has reduced the fleet of tapping vehicles required from 16 (in the original request) to 12. In 2007 Hencon started on the same technique to determine the requirement for an anode transport system for a 560kt/y smelter. A request was made soon after to evaluate this in combination with the tapping cycle to determine the vehicle density during peak hours in the centre alley after the second expansion of the smelter. Although Hencon has simulated and calculated the requested design data, the discrete model software Hencon used got stuck after two years of virtual production on unforeseen events. In this project Hencon staff realised they could not develop a fast, reliable evaluation tool if they did not change to new object-orientated analysis tools. These allow the simulation of the real behaviour of objects such as cells, anodes, vehicles, PTM’s, cranes, rodding shops, crushers, ladle’s, drive lanes and pallets. Therefore in 2008 the platform it used was changed to a pure object-orientated platform, allowing it to reuse objects and model them quickly into a new (virtual) operating environment.

From 2008 until 2012 fundamental research was executed to have ready available objects that act realistically: cell, furnace, road, anode, vehicle (uni and bi
These are used to execute processes such as: producing aluminium, changing anode, pot delineing, breakdowns, maintenance and all other aspects that do influence the day to day production targets of an integrated smelter.

Today, the objects used can be combined as per the existing or future smelter lay out. These can be used to discuss, test and optimise a new ‘lean manufacturing’ concept, which supports the requirements of electrolysis cells and furnaces in an optimised process.

The simulation can help the operational team pinpoint their targets to strive for higher operational effectiveness, removing interface steps, hold points, team efforts and equipment use.

**Lean manufacturing**

Electrolysis cells have always been studied and optimised within the industry.

There is a tradition in this technology to use fluid dynamic calculations and test electrolysis cells to come to a reliable and stable cell design tested for many years. Typical examples of these research programmes are: Development of the AP60, the new Flagship of AP technology and DX Pot technology powers green field expansion. Although this research pays off from a discrete point of view these development programmes still have room for further optimisation of the material flow and a discrete approach towards anode handling and metal tapping.

The room for optimisation is clearer if the shift pattern and material flows of a modern smelter are studied. Most smelters organise their electrolysis lines in several sections. Each section is treated in more or less the same pattern.

Anode setting periods and tapping periods follow each other up, per section in a regular pattern. Per section a PTM or GP crane is dedicated to the pots to assist operators in completing the task on time.

This operating regime is used by most smelters as the ideal and most reliable way operators in completing the task on time.

Periods follow each other up, per section. Each section is treated in more or less the same patterns or metal delivery patterns during the shift.

Unoptimised metal flows to the casthouse, resulting in an overflow or underflow of metal to the casthouse.

Empty rides between the section and the different vehicle stations.

Early or late anode changes to keep cells in the desired shift pattern per section.

Accidental tapping of liquid bath.

Generation of dross due to the cycle time of the ladle. Increased emissions during anode change and straight after that due to cooling. Cell instability due to incorrect anode hide setting, lack of crushed bath.

All this indicates there is room for improvement with regards to a lean distribution of materials into the potline. However, it also indicates that the material handling system is not optimised to the knowledge collected in running stable pots at a high current density.

Today’s pot control systems collect enough information to plan these activities in a manner according to the demand of the pot and casthouse. However, the operating regime and lack of knowledge on discrete logistics applied to the industry stop it from changing operational behaviour. The risk of failure when introducing a new system is considered one of the main reasons to accept today’s limitations and ignore potential improvements that have a fundamental impact on the operational regime.

Setting up a discrete model of the smelter appeals to the need to introduce a ‘safe environment’ realistically enough to allow for operational experiments, test run these experiments and predict the long term effects of operational improvements. It takes a long time before these experiments are implemented. Once tested, models will be used more and more to generate the necessary operational input to increase the efficiency and effectiveness of capital investments.

**A good model**

Like in any good model, the biggest dilemma is how to reflect the reality without modeling the reality in every detail. Therefore for every model an evaluation takes place as to what level of detail is needed?

This issue was solved by using an object-orientated approach. This results in objects (for instance a cell) with a fixed set of variables that successfully simulate a cell.

This allows information to be reused and make objects as smart as they need to be. Processes are simplified.

Database input of real historical production data (if available) is allowed or randomly generated production data is validated for realistic behaviour.

**Validation of the model**

Validation of results will always be important. This is a part where the stakeholders of customers play the most important role.

If they do not recognise their own manufacturing process in the model, the model is not suitable to run new experiments and to suggest alternative manufacturing processes. Without this step the model cannot be used to evaluate future processes and decide if they are valuable to invest in. Once validated, process behaviour of the modeled event and reality should be the same.

**Experiment**

So does simulating traffic in a potroom bring real cost savings? The answer to this question is not straightforward. Simulations cannot help to exceed the possibilities of the original design envelope. However, the experiments can be a help in understanding how to use the operations more effectively to come closer to the limits of the design envelope of specific technology.

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Canada continues to thrive

The Canadian aluminium industry is in an enviable position. It is the third largest producer in the world, is host to some of the largest aluminium companies and suppliers and can also boast of being one of the most environmentally friendly producers of aluminium worldwide.

By Greg Morris, Editor, Aluminium International Today

Canada's CO₂eqv output/tAl could now be around 1.1 900 people. If all the supplier and engineering companies are included the this figure rises to 30 000 people.

The province's smelters employ a total of 2% of the Quebec workforce.

Aluminium is the main export revenue for the province and makes it more money than the aerospace, mining and paper industries. The province contains nine smelters. Boosted by financial backing from the government and cheap hydroelectric rates, the sector has played a starring role in the province's economic development. Aluminium production represented 10% of the total value of manufactured exports in 2010.

Quebec is a huge source of hydropower, which in turn supply energy to the smelters. Canada is the world's second largest producer of hydroelectricity and one of few countries to generate most of its electricity from hydroelectricity (59% in 2006). In 2007, it produced 368.2 terawatt-hours of electricity using hydroelectricity, 11.7% of all the electricity generated in the world. Some provinces including British Columbia and Quebec produce 90% of their electricity in this manner.

**Kitimat modernisation**

Rio Tinto Alcan announced in December last year the US$2.7bn expansion of its Kitimat, BC smelter.

The Kitimat Modernization Project will increase the smelter’s current production capacity by 48% to approximately 420kt/y from its current 282kt/y.

The modernised smelter will be powered through a combination of dual fuel firing and increased use of local and hydroelectricity.
exclusively by hydroelectricity from Rio Tinto Alcan’s Kemano generating station and will use the company’s AP technology to reduce its carbon dioxide emissions intensity by nearly 50%/y (Fig 2).

First metal is expected to come on stream in the first half of 2014, with an expected ramp up of nine months.

The Bechtel Corporation, headquartered in San Francisco, California but with a dedicated Kitimat Modernization Project office in Montreal shared with Rio Tinto Alcan, is providing Engineering, Procurement and Construction Management (EPCM) for the project. It will act on behalf of Rio Tinto Alcan to manage the project and deliver construction completion on time.

The smelter complex is located on the Douglas Channel, a year-round ice-free ocean port on the northwest coast of British Columbia (BC). It is situated to meet the aluminium market demands of customers located in the Pacific Rim. The smelter is 57 years old and exports its aluminium to the Asia-Pacific region. Rio Tinto Alcan said the smelter contributes $500M/y to the Canadian economy, of which more than $269M stays in BC.

Rio Tinto’s combined operations in BC and Alberta provide employment for 1400 people. The modernised smelter will provide employment for the next 40 years.

### Baie-Comeau

Alcoa’s Baie-Comeau is also the scene of a modernisation project, which will last until 2016. The smelter is located about 420km (260 miles) north east of Quebec City and is located on the shores of the Saint Lawrence River, near the mouth of the Manicouagan River.

The $1.2bn project provides for the replacement of the Söderberg cells by a new series of prebaked cells that use the technology developed at the Baie-Comeau smelter (BC 240).

The project includes converting the prebaked cells of the North Plant to the new high-amperage technology.

### Baie-Comeau Modernisation

Its south plant will see the dismantling of the Söderberg series (equipment and buildings), Excavation and site preparation, construction of two new prebaked cell potrooms (F-Series), the addition of related equipment (scrubbers, rectifiers) and dismantling of the Paste Plant. The North Plant will see more electrical equipment to implement the new technology and a cell upgrade without production loss.

Construction works will begin in 2013 with the demolition of C-Series potlines and site preparation for the new potrooms. In 2014 B-Series will be modernised while D and E Series will be creamed.

The construction of F-Series will also begin with start up expected in 2015. In 2016 the demolition of A-Series will take place. In addition, the plant’s port facilities will also be modernised during the course of the programme.

The overall project will reduce the plant’s greenhouse gas emissions by 40% and increase production to 547kt/y.

### Education

The three members of the AAC are actively involved in partnerships with Canadian universities and support research projects aimed at improving the efficiency of industrial processes and reducing the environmental footprint.

The industry is also a member of the REGAL (Regroupement Aluminium) aluminium research group in Quebec, which aims to bring universities and industry together and promote the transfer of knowledge within the industry.

Universities and research groups that receive financial backing from the industry are the University of Quebec at Chicoutimi, the Ecole Polytechnique, Sherbrooke, Laval and McGill universities and the TransAl research group.

These six groups are involved in a total of 20 aluminium-related research projects. It will also ensure future generations of Canadians will be involved with aluminium for some time yet.

### Follow up

The Alusolutions conference and exhibition takes place in Montreal in October 2013. Visit www.alusolutions.com to find out more about the event.

It is organised by Aluminium International Today and is in partnership with the Aluminium Association of Canada. The association’s website is www.ledialoguesurlaluminium.com.

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Table 2 Canadian smelters, owners, capacity and technology used
Rodding shop technology made simple

A number of technologies in the rodding shop can be simplified, to save costs and improve operating efficiency. By Maheswar Behera*

Utilise liquid bath in liquid form

Aluminium smelters presently tap excess liquid bath from the electrolysis cells (pots) into moulds in the pot line. This bath is known as ‘pure bath’ because of its purity and is reused in pots as demanded. Not all pure bath excess is reused in the pots as the demand for liquid bath in-process pots varies. Pure bath is kept in the moulds in the pot room for transport to the rodding shop area where it is fed to the bath treatment plant after cooling to solid and removed from the mould. Before the solidified bath is fed to the bath treatment plant the solid material is ground up and any aluminium metal is separated, and the remaining solid bath is taken for grinding to powder. Fig 1 details the present practices. Energy is lost during solidification, grinding and eventually remelting this pot material.

In the first stage, while the liquid bath cools in the mould heat energy is lost which could be prevented if a system was available to store the pot material in molten form.

In the second stage, the solid bath is handled manually and mechanical energy is required for the size reduction mill, the solidified metal is then put into a re-melt furnace for recovery of metal present.

This can be avoided by holding the liquid bath in the same condition as tapped for recovering the bath as well as metal without changing its phase from liquid to solid.

In the third stage, when ground solid bath is fed to the pot, there is consumption of electrical energy. There is a similar energy loss for melting the recovered metal collected in the bottom of the mould containing liquid bath.

Proposed Process: In all four stages the energy lost can be conserved by using electrical or thermal energy to keep the excess bath material in the liquid state by adding a holding furnace for the liquid bath moulds in the pot room, as indicated in Fig 2. This will lead to energy savings, reduced transport costs; less man power and will also make available pure bath with the required chemical additives to the pot room. There will be the additional capital cost of the holding furnace and for its operation in the pot room. This will reduce the burden of treating pure bath in the bath treatment plant as well as the rodding shop. The cost of needing two pure bath storage silos (feed as well as product) in the bath treatment plant will be reduced since the quantity is now less.

Streamline rod shop

The duties of a rodding shop are more than the name implies as in practice it handles recycled spent anodes and sizes pot bath, carbon butts and new carbon blocks for supplying to the anode casting machine. This operation results in a complex shop operation requiring greater manpower, costs and availability of the shop is low resulting in low productivity.

Proposed Process: The handling of solid bath, its treatment and handling of liquid bath and its reuse can be assigned to the pot room as it is originated from pots in liquid and in solid form and is going for reuse in the pot room.

The spent anodes after removal of bath at the pot room can be processed at the carbon recycling shop, which will be situated before the green anode plant.

Only the returned rods and the recycling of the cast iron used to seal the anodes into the anodes will take place in the rodding shop (Fig 4). This will streamline the operation, benefiting the whole carbon area. The present complexity of the rodding shop will end with no need for many silos and transportation of bath and dedicated plant to treat each.

The rodding shop building can be minimised. This will reduce handling costs, save manpower and decrease project costs. This will require an alternative layout for the pot room and carbon area.

Improved casting of rod assembly

The casting machine, which pours the cast iron into the anode holes to seal the yoke in place, currently takes cast iron from the melting furnace and transports it to the mating station. There it pours the molten cast iron into the gap between yoke and anode hole, one after the other. The machine has to retract back and forth for each cast. It takes about 20 seconds per hole to cast.

In the case of twin yokes the casting machine then waits for the whole assembly to be turned and come into position to pour the opposite three holes in the same sequence as before. The whole cycle takes about 150 seconds and this is the longest duration of any operation in the rodding shop stations (Fig 5).

Proposed Process: Rodding shop productivity can be improved and casting carried out in 20 seconds by using two
casting machines, one each side of the anode block. The two casting machines pour metal from a common launder which feeds a molten metal ladle with three pouring spouts. The spout gates can be controlled by auto gates and the volume of the metal poured can be controlled. This arrangement requires the cost for another set of transformers and casting line and a casting machine.

The availability of the rod shop will improve and the cycle time reduced to 1/6th of the present cycle time.

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Aluminium industry can learn from Deepwater oil rig disaster

The Deepwater Horizon oil rig disaster in the Gulf of Mexico in April 2010 resulted in the deaths of 11 workers. Aluminium plants, just as deepwater oil rigs, value training and safety measures to prevent accidents from occurring. Could the safety measures employed in a casthouse to prevent a molten metal steam explosion also fail?

By Alex W Lowery*, Terry Bateman**, Joe Roberts***

The aim of this paper is not to place blame and/or responsibly for the Horizon disaster and the loss of life. The desire of the authors is to hopefully illustrate that the root causes that may have led to the Deepwater Horizon explosion may be present in the aluminium industry today. In particular, the casthouses in the primary side of the industry.

The US Coast Guard, and the US Chemical Safety Board (CSB) investigated the accident. While the US Coast Guard is a well known federal agency the Chemical Safety Board is not. The CSB is an independent federal agency charged with investigating industrial chemical accidents. Its mission statement includes: “The CSB conducts root cause investigations of chemical accidents at fixed industrial facilities. Root causes are usually deficiencies in safety management systems, but can be any factor that would have prevented the accident if that factor had not occurred. Other accident causes often involve equipment failures, human errors, unforeseen chemical reactions or other hazards.”

Both agencies held public meetings and released transcripts of the meetings as well as reports on the causes of the accident.

**Safety Management Systems**

Safety Management Systems (SMS) is a systematic approach defining the activities by which safety management is undertaken by an organisation to achieve acceptable or tolerable safety.

The importance of SMS in the aluminium industry is well known. Many companies state safety is the most important goal. This is reinforced with the number of aluminium companies that have gone out of business following a severe molten metal steam explosion.

The industry has to be commended on its approach to open communication between organisations in the industry. It is not uncommon if an accident occurs at one company, that other companies will be made aware of the accident and the root cause of that accident.

For example, a number of years ago a casthouse had a fatality when a casting assistant fell into a high water pit unnoticed. That worker went unnoticed for a period of time. When their absence was noted, an investigation found that the worker slipped and fell into the pit. Instead of keeping that tragic accident within their own group the firm broached the subject at an industry meeting.

This opened a dialogue throughout the industry and resulted in companies worldwide addressing pit guarding.

It is unknown how many injuries and lives have been saved because that firm decided to speak out about its own accident to prevent similar incidents occurring. The aim of an SMS is to provide a structured management approach to control safety risks in all operations. Effective safety management must take into account the organisation’s specific structures and processes related to safety.

**Coastguard report**

The US Coast Guard’s report on the Horizon accident stated the following (note Transocean was the rig owner): “The investigation has shown that over a period of years and in the period immediately preceding the casualty, Transocean had a history of deficiencies in the area of safety. These weaknesses include a history of poor maintenance and failure to address it in a timely manner; a history of other casualties that were never properly investigated and addressed; a failure to establish a system to ensure that the Bridge was aware of the location of all personnel engaged in repair work to warn them of emergencies; a failure to provide sufficient training and knowledge to onboard management and crew regarding safety; a failure to require that systems and personnel emphasise maximum emergency preparedness; and a failure to employ risk assessment.”

A number of the deficiencies listed above could easily describe some casthouses in the aluminium industry. Poor maintenance has plagued the industry recently. The reason is threefold. The recession has forced companies to layoff personnel and not fill the positions of workers who retire. This leaves some facilities short handed in the maintenance department. Overtime is commonly not approved.

Second, the budgeting process for maintenance activities is not carried out properly by many companies. For instance, firms repair safety pit coatings as needed, sometimes extending the recoat time until funds can be allocated for the project. Studies have shown a bare area as small as 5cm x 5cm that has exposed the substrate under the safety coating can be an ignition source for a molten metal explosion. Other firms understand the advantage of budgeting for periodic recoating of tooling and casting pit walls allows them to follow its SMS.

The third reason for poor maintenance...
in casthouses is an attitude problem and the belief that production is more important than maintenance. Facilities are hesitant to have a scheduled maintenance shutdown. It is these facilities that suffer from repeated equipment breakdowns that ultimately effect production.

Poor maintenance practices in the long term cost more to rectify, and increase the likelihood of an injury.

The USCG report noted a history of other accidents that were never properly investigated and addressed aboard the drilling rig prior to the explosion.

Steam explosions
A precursor to severe molten aluminium steam explosions has almost always been smaller explosions. These small explosions were never properly investigated. The explosions occurred more often, and with greater force. All molten aluminium steam explosions no matter how small should be investigated for their root cause. Once the root cause has been determined, steps can be altered to eliminate the reoccurrence of an explosion.

The Deepwater Horizon explosion was noted ‘for a failure to establish a system to ensure that...of all personnel engaged in repair work in order to warn them of emergencies’. Most casthouses have flashing lights and/or horns to warn when a cast is occurring. But, unfortunately there are facilities that do not have a visual and audible safety indicator to warn of a cast occurring.

Many facilities do not limit non-essential personnel from being in the vicinity of a casting pit in the process of a cast. There have been several occurrences of molten aluminium steam explosions injuring non-essential personnel.

The aluminium industry has done a commendable job on safety training of all casthouse personnel. However, many seasoned casthouse personnel are retiring. Their replacements are trained as required, but the training cannot replace the years of experience their former coworkers had.

Since the very beginnings of continuous casting of aluminium alloys, water has played an important and sometimes destructive role in the process. Since the casting of aluminium alloys through water-cooled moulds suspended above a pit partially filled with water there have been metal spills that have resulted in molten metal falling into the pit and contacting concrete, steelwork and water.

While most of these occurrences probably passed without anyone noticing, some resulted in major explosions causing equipment damage and in some instances serious injury or death. Many other instances resulted in reactions situated between these two extremes. By far the most common causes of molten metal falling into the casting pit are bleed outs or yo-outs. A bleed-out is when metal escapes the mould: normally near the start of a cast when the shell ruptures.

Yo-out
Yo-out is metal spill that occurs at the start of the cast when severe butt curl allows molten metal to spill over the lip of the shell causing it to remelt and thus allowing molten metal to escape.

In the early days casters would try to stop bleed-outs and yo-outs by damming the holes in the shell with asbestos wool, ceramic fibre or pieces of aluminium scrap in an attempt to cause the leaking metal to freeze and seal the hole. Another popular technique, still used in some casthouses, is to plug the spout or feeder to the offending ingot.

While all of these have the ability to stem the metal flow there is an associated risk of failure, which then has the potential to cause a molten metal explosion often while the casting operator is standing over the pit trying to stem the flow.

These days the most popular, and perhaps the safest option, is to abandon the casting pit, and attempt to plug off the feeders or plug out. Depending on the root cause of the leak the operator may abort the cast in a safe and orderly manner.

Over the years casters have developed techniques to limit butt curl and this has largely eliminated the occurrence of the Yo-out. Bleed-outs continue to be the most common causes of molten metal explosions.

Computer controls have gone a long way towards understanding and addressing these problems. However, explosions can still occur.

A casting operator has two options for the operator, abort the cast and avoid the head of the ingot falling below the bottom of the mould. Or plug off the affected ingot/billet and to keep casting.

When a bleed out has occurred it is important to remove any metal adhering to the bottom block holder, platen, pit walls and guide rails if the platen has external guides.

Failure to do so increases the likelihood of an explosion if another bleed out occurs. Depending on the root cause of the bleed out several successive casts may be affected until the cause is corrected.

When individual ingots/billets are plugged out there is the potential for the plug to leak or fail completely. When this happens it should be treated the same as a bleed out and any metal that was removed before the next cast. Wise Chem safety coating is the last line of defence to reduce the likelihood of a molten metal...
An explosion on August 20, 2007 at Binzhou Weiqiao Aluminium Company, in China where nine workers were killed and 64 injured.

explosion.

If the coating is compromised by damage or an adherence of metal for example, its effectiveness in preventing an explosion will also be compromised. Following a bleed out the safety coating should be inspected and if necessary repaired prior to the next cast.

Conclusion

The investigations that followed the Hozizon accident focused on the root cause of the explosion. The government agencies report listed numerous reasons that contributed to the explosion.

Those contributing factors are present in a casthouse today. Constant vigilance is needed to prevent a molten metal explosion from occurring, preventing injuries and, in the worst case, loss of life.

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Automotive leads US recovery

The surprisingly strong recovery of the US automotive market has been a boon to aluminium suppliers to that market, but the future seems to be even more promising. By Myra Pinkham*

With increasingly stringent federal fuel economy standards coming down the pike, automakers are looking at ways to lighten the weight of their vehicles. This is expected to mean large gains as both vehicle volumes and aluminium intensity per vehicle grows.

"US automotive demand has been pretty spectacular during the last few months," said George Magliano, senior economist for IHS Automotive, New York. While the automotive market had been seeing steady increases at a greater rate than the general economy ever since Cash for Clunkers seemed to jumpstart the market, this year that rate of increase has accelerated.

"It really appears as if auto builds have turned the corner," said Doug Richman, vice president of engineering and technology for Kaiser Aluminum, Foothill Ranch, California.

"In 2009 North American auto production had fallen to 8.6 million cars and light trucks. Expectations are now that production could reach as high as 14.4 million vehicles this year" up from 13.1 million vehicles last year and 11.9 million vehicles in 2010.

Recovery

It seems the automotive industry, as well as the energy sector, has been leading the US economic recovery.

"Normally automotive trails GDP growth in an economic recovery," observed Bernard Swiecki, assistant director of the Automotive Communities Partnership at the Center for Automotive Research (CARS), Ann Arbor, Michigan. "Things get better and then people start buying cars. This time around it is backwards."

Mark Cornelius, president of Morgan & Co stated that: "While it will still be a while before the auto industry sees US sales reach 18 million cars and light trucks a year and North American production reach 16 million to 17 million units a year, the industry is much further ahead than we thought it would be at this time."

Alcoa CEO Klaus Kleinfeld agrees noting that for the first time since March 2008 the seasonally adjusted selling rate topped 50 million vehicles in February.

"In fact, North American automotive output actually reached a 15 million annualised rate during February, which was an astounding 22% improvement year on year. "But a big chunk of that is pent up demand," Magliano says, noting during the economic downturn many people held off buying cars and now the average vehicle on the road is 10-11 years old. "Because of that, it is cheaper to buy a new car than to keep the one they have."

Consumer confidence is also improving, Kaiser's Richman observes, and that could encourage consumers who had been holding off making purchases.

"Confidence is critical," said Ellen Hughes-Cromwick, chief economist at Ford Motor Co, Dearborn, Michigan, and the Bloomberg Consumer Comfort Index had its highest reading since March 2008 for the period ending April 1. At the same time, Cornelius stated that

" automakers – particularly the New Domestic, or transplant, automakers – have been cranking up their production output to make up for the volumes lost a year ago due to the after effects of the Japanese earthquake and tsunami.

Output boost

Because of this, while it is unlikely production of 15 million vehicles will be sustained, auto market observers say output of between 13.9 million and 14.5 million units is likely this year and 15 million vehicles next year.

"We are forecasting for it to rise from there to about 16 million vehicles by 2016," Magliano stated. "It will be a slow climb but a climb."

The increase of aluminium shipments to the US automotive market, however, might not be so slow. "Given that automakers have a Herculean task to meet new federal corporate average fuel economy (CAFE) standards, we expect aluminium to displace steel and make up a larger portion of each vehicle," Lloyd T O’Carroll, senior vice president of research for Davenport & Co, writes in the Davenport Quarterly Aluminum Outlook for the first quarter.

CAFE standards for passenger cars jumped to 29.5 miles per gallon this year from 27mpg in 2008 and, according to Christopher Plummer, managing director of Metal Strategies Inc, low-end projections call for a further step up to 38mpg in 2017, 40mpg in 2020 and 46mpg (and possibly as high as 54.5mpg) by 2025.
Energy costs
The current trend in energy costs is also a contributing factor. Currently US gasoline prices are averaging just under $4 a gallon with prices as high as $4.50 in certain regions, such as Chicago and Los Angeles. Why the rise of growth has been slow recently, given political unrest in the Middle East, including threats by Iran that they will block oil deliveries from the Strait of Hormuz, there is fear prices could rise to $5-$6/g over the summer.

While it has been questioned whether gasoline prices will have much of an impact on consumers' automobile choices or materials used in autos, Siewiec stated high gasoline prices will continue to be a fact of life and could be higher than they are now. “Imagine if Europe was humming right now and buying a lot of gasoline in competition with us. Prices would be higher still,” he said.

There is a strong bias for more fuel efficient vehicles, Richman declared. “Consumers are demanding more fuel economy and are buying vehicles with fuel economy ratings that are two to three miles per gallon higher than the current federal requirements,” he said.

With the expected continuation of increasingly stringent fuel economy regulations the OEMs are responding and designing more fuel efficient vehicles. Because of this O’Carroll forecast US aluminium shipments to the automotive market are likely to increase 13.7% in 2012 and another 10.4% next year.

“Aluminium is a practical and cost effective way to achieve weight reduction,” Richman maintains. “We are already seeing use of aluminium in bumpers and crash boxes and we are also seeing other applications being evaluated by the OEMs;” Dale F Ewing, manager for automotive structures North America for Constellium, declared.

“Consumers want cars to perform well even with all the electronic gadgets in their vehicles which add weight,” observed Kevin Lowrey, Alcoa spokesman, who says this, the desire for increased fuel efficiency, and safety advantages because of its durability is why aluminium use by the US automotive sector has grown every year for the past 40 years. “There has never been a better time for aluminium companies serving the automotive industry.”

Content shift
Going forward the aluminium content shift in the average North American passenger car ‘will be unprecedented,’ according to Dick Schultz, managing director of Ducker Worldwide, Troy, Michigan. He predicts aluminium content per vehicle will grow from 343lbs/vehicle now to 400lbs by 2015 and to 550lbs by 2025, mostly through gains in sheet and extrusion use in the body structure and closures.

“Traditionally 80% of aluminium in automobiles has been in castings, but the time has come for more aluminium sheet and extrusions.”

While aluminium is already the leading material in powertrain and wheel applications, the latest Ducker survey, released last September, indicates it is quickly gaining market share in hoods, trunks, doors and bumpers.

Body, bumper and closure content grew by 58% from 2009 to 2012, with 30% of all hoods in 2012 vehicles being aluminium, saving a total of about 100 million lbs of vehicle weight across the entire fleet.

“That should double by 2025,” Richman stated, noting the automotive body in white – the body of the car not including closure panels – which accounts for 20 to 25% of the vehicle is the next frontier. “We expect to add over 2bn lbs of aluminium use in the automotive sector by 2025.”

Meanwhile the amount of steel used per vehicle is also changing, shifting from mild steels to high strength low alloys steels and advanced high strength steels. The end result is overall steel content of the average North American passenger car will go from 58% to 46% between now and 2025 with mild steels, and to a lesser degree high strength low alloy steels, declining and advanced high strength steels seeing good growth.

Aluminium content will increase from 9% to 16% and there will also be increases for magnesium and other lightweight materials. This should enable the overall vehicle to be about 400 lbs lighter than a comparable car.

Lowrey admits this could come at a price premium, as it is its higher cost that has...
limited aluminium’s growth in autos in the past. But he maintains it will not be as drastic as it might seem. “Lightweighting is actually a cost savings enabler,” he explained. “You can use a V-6 engine instead of a V-8 engine while achieving the same performance.”

Steel
However the steel industry, which has engaged in both joint efforts and certain individual company initiatives, sees a different scenario. It believes steel will hold on to much of its share by using advanced high strength steels without a significant cost penalty and, in many cases, a cost benefit, according to Robert Dicianni, marketing manager for ArcelorMittal USA. He maintains even though AHSS is more expensive than mild steel on a per tonne basis, automakers could use less of it. “We don’t necessarily look at advanced high strength steels as competition,” Kaiser’s Richman asserted. “The vehicle of the future is not going to be a monolithic vehicle. The body in white will have aluminium, steel, magnesium and other materials in it as well.”

“Lightweighting is actually a cost savings enabler,” he explained. “You can use a V-6 engine instead of a V-8 engine while achieving the same performance.”

Ramp up
“Also the OEMs need to implement all of these new technologies in a timely fashion.”

As automakers consume more aluminium, it could result in a tightening of supply of automotive grade aluminium sheet and extrusions, Ducker’s Schultz said. “We are working to dramatically ramp up,” Lowrey stated, noting that prompted by current and expectations for future customer demand, Alcoa is investing about $300M to expand its Davenport, Iowa, rolled products plant, upping its production of automotive grade plate and sheet by the end 2013.

Much of the expansion will be geared to already secured business, although the company also sees huge opportunities beyond that for some of its automotive technology solutions, including for its patented Alcoa 951 adhesive bonding technology which it expects to license throughout the industry.

Alcoa is not alone in making these kinds of investments. Also in response to escalating demand for automotive aluminium sheet, Novelis is investing $200M at its rolling mill in Oswego, NY, to increase its capacity by 200kt, which is five times its current North American capacity for producing sheet for the automotive industry. That expansion is also expected to be completed next year.

Other aluminium and steel mills have also announced plans to either add new lines or upgrading existing ones to add auto-related production capacity.

Richman believes 2012 will be a great year for N American automakers and their suppliers. “It has already been a wonderful year and I see nothing changing that.”
Automotive provides US cheer

Generally the mood at the conference was one of optimism. The US is slowly emerging from recession and although growth is still slow there are reasons to be cheerful. The automotive sector looks to be a real positive point with aluminium use in vehicles set to grow. Shale gas is proving to be a game changer, keeping gas prices low and creating plenty of jobs. Meanwhile global supply should remain adequate as China and the Middle East continue to increase. The downside is that cost pressures in both areas are rising as energy costs increase.

The 96 delegates were made up of people from downstream companies such as Rexam Beverage Can Co and MillerCoors, metal traders and financiers from banks such as Barclays Capital, as well as primary companies such as Ormet Corporation, Norsk Hydro and Rio Tinto Alcan.

Road to nowhere

Several papers investigated China’s role.

Huw Roberts, Director of CHR Metals said the next phase of China’s development will not be as intensive as the past 10 years. While it has dominated developments in global growth and the base metals market Mr Roberts felt the structure of the growth was not sustainable and had not been recognised by the authorities.

He described China’s infrastructure plan, announced at the height of the recent recession as a way of boosting China’s economy, as a ‘road to nowhere.’

The government spent billions on roads, railway projects, public buildings and other ambitious infrastructure projects which have nearly all been completed. However, they are not being used (Pic 1).

While roads and trains are unused. It has been a waste of money, said Mr Roberts, and the money would be better used on building hospitals or training the next generation of doctors or teachers.

China’s economic model must move from dependence on exports and investment to domestic consumption and greater social development, such as environment, health and education.

Swing producer?

CRU’s Head of Aluminium Marco Georgiou looked at smelting cost trends and asked if China was the swing producer and how has their make versus buy decision changed.

China represents more than 40% of world demand for base metals. But for a Chinese smelter, its average cash costs are some of the most expensive in the world. Alumina, power and the costs of carbon products are extremely expensive. Up to February 2012 about 387kt/y of output had been cutback in China, a relatively small amount, mainly due to the low Shanghai metal price. Production will continue to rise because many smelters are government owned and receive subsidies. They are also able to curtail and restart pot lines much quicker than the rest of the world. The migration of smelters from the east of the country to the west will continue due to the lower power price and coal availability. Costs will be lowered as outdated technology is phased out and improved technology introduced. In 2010 34% of capacity was below 200kA, while in 2011 21% of capacity was below 200kA. About 48% of capacity is captive powered in China making smelters more efficient (Fig 1).

In its 12th non-ferrous metals five year plan companies will be encouraged to be self sufficient, to import, and for mining, refining and smelting groups to start overseas projects.

But exports in the areas of mining, refining, smelting, rolling and extruding, and recycling will not be encouraged.

Currently the top ten producers in China hold 51% of capacity, the government aims to increase this to 90%. This will see some large producers and will also make companies more efficient.

Citigroup’s Director of Metals Research and Strategy, David Wilson, said Chinese primary consumption increased from 2.8Mt in 2000, to 19.3Mt in 2011.

In 2011, China accounted for 43% of total global primary aluminium consumption and was the key major demand story, pushing 2011 total global aluminium consumption to around 45Mt. Much of this demand was driven by fixed asset growth, such as roads, apartments and rail links. Retail demand was also strong.

Fig 1 Empty Chinese railway station at morning rush hour

Fig 1 Xinjiang’s infrastructure growth is paramount to its production increase.

Black arrow - inflow of raw materials, blue arrow outflow of primary metals

Source CRU

China, trade issues and the situation in the USA were among the subjects under discussion at CRU’s 19th North American Aluminium Trends conference. Just under 100 delegates attended the two-day event held in Miami, Florida at the Marriott Doral Resort.

By Greg Morris, Editor, Aluminium International Today
Automotive production grew by 45% in 2009 and 32% in 2010, and reached over 19 million units in 2011. In 2011, China produced 124 million TVs, 146 million air conditioners, 86 million household refrigerators, 67 million washing machines and 19 million freezers.

It is now looking at resource security. It is investing in alumina refining capacity, while alumina producers try to break out of LME. It is investing to move away from alumina import dependence and buying bauxite deposits overseas both as a way of helping manage costs and for resource security, especially as aluminium smelting capacity is set to increase.

As indicated above, the next stage of growth will be in the west. For example aluminium production in Xingjiang is forecast to grow from 380kt/y in 2011 to 4.4Mt/y by 2018. China's total capacity is set to rise to 40Mt by 2018.

However, Mr Wilson believes demand is normalising. Property prices have dropped in the past five months. With much of the East Coast already highly developed, the next stage of development is the West. However, the Western provinces are significantly less populated that the East, thus have lower infrastructure and property construction needs.

In automotive, January and February 2012 saw the worst start for sales in China since 2005 with a 3% pull back in sales and is expected to remain low this year.

The investment in increased capacity, coupled with the normalising in demand could see a sharp fall in use of aluminium. China will remain in a surplus for the next few years which will also have an impact on the rest of the world in terms of their export opportunities.

CRU’s Aluminium Research manager, Paul Williams suggested the end of China’s boom years were in sight with economic growth slowing and a policy focus on improving environmental protection and living conditions.

However, its GDP is still behind that of Russia and Brazil so there is still room for growth. Ownership of vehicles outside the mega cities is low, presenting aluminium opportunities. Urbanisation is still continuing, also presenting construction opportunities (Fig 2).

Although the pace of growth may ease off asemis growth will continue to drive primary demand, with transport and construction the key sectors.

Its alumina capacity will rise to meet smelter requirements. With Shanxi, Shandong and Henan provinces increasing alumina capacity. Key projects include Shanxi Jiaokou at 2.4Mt/y and Shanxi Xingxian at 800kt/y capacity. While 2011 saw an increase in domestic alumina production alumina imports dropped from 4.3Mt in 2010 to 1.9Mt in 2011.

It will have to import bauxite however. Its bauxite need will rise and despite domestic production increasing to 93Mt in 2016 it will still have to import 48Mt by then. This is likely to come from Australia, Indonesia and Fiji but with ‘resource nationalism’ beginning to appear in other countries there could be rising risks to supply.

**Automotive ‘golden age’**

Aluminium is entering a golden age in automotive use, delegates were told.

Alcoa’s automotive marketing director Randall Scheps said aluminium use in auto body sheet would be the new growth area. He told delegates aluminium was the ideal solution for automotive use because of its light weight (Fig 3).

Mr Scheps, who is also chairman of the Aluminium Association’s Transportation Group, said the amount of aluminium in automotive will grow from 7Mt today to 18Mt by 2020.

It improves fuel economy, has lower CO₂ emissions over its lifecycle, is as safe as steel, brings better driving dynamics and is capital friendly for automakers.

Automotive is the best growth story the aluminium industry has going, he stated, as it replaces steel in vehicles.

The auto body area was traditionally a steel strong point but because of aluminium’s light weight it is taking over, particularly in the body structure area. The body is the heart of the car and represents 35% of a car’s weight. Today it is almost 99% steel but aluminium castings are beginning to displace it.

In 2011 215kt of body sheet was sold as a result of this growth but this is expected to jump to 1.5Mt by 2020.

“Three in a row in the history of aluminium,” Mr Scheps said. “A 1.3Mt rise in sheet demand in nine years is quite something.”

The industry is meeting this challenge with new capacity being added to meet the number.

Aluminium is gaining the share at the expense of steel. While steel does have High Strength Steel it cannot replace the same amount of weight as aluminium.

CRU Senior consultant, Aluminium, Mike Southwood, also discussed the automotive story, stating shipments of custom aluminium die castings had risen 13% in 2011 from 2010 and are estimated to rise a further 8% this year. Quarterly expectations for car and truck production in North America are strong estimated at about 13.80 million units for 2012 and by 2016 up to 16.49 units.

The amount of aluminium in vehicles is also forecast to increase, currently at about 343lbs/vehicle which could rise to 400lbs/vehicle by 2016.

Mr Southwood was quoting from an automotive report by Ducker Worldwide, which states 60% of the growth from 2009 will be for structural components made from primary aluminium.

In the previous decade the majority of aluminium content was from non-structural components made from secondary aluminium.

Growth in structural aluminium castings is set to increase by a third in the next three years to 408.88Mlbs in 2015 and grows to 1.020Mlbs in 2025 as structural castings grows to 60lbs/vehicle.

By 2025 the Al product mix will be 39%...
mill products, which will require more secondary alloy production, but a lot of capacity is defunct or idle. Demand growth will also require plenty of scrap, but a lot of US scrap goes to China.

Chinese auto production is forecast to rise to 28.5M units in 2016 from 18M units this year so its thirst for secondary scrap imports will continue.

Shale gas
Brian Habacivch, Senior Vice President at Fellon-McCord, discussed The Shale Gas Revolution in the USA.

He said shale gas was causing a massive jobs boost, lowering gas prices and having a profound effect on the US economy. Natural gas production has increased and this has lowered prices as well as reduced volatility. From being in a position where it was running out of gas between 2001-06, gas prices dropped from $13/unit in 2008 to $2/unit today caused by the discovery of shale gas.

It has the potential to make the US the most energy-rich country in the world. In 2010 the shale gas industry employed 600k people, with an extra 87k expected to be added by 2015.

Between 2011 and 2020 there are many coal plant capacity retirements due in the USA, particularly in the east. Mr Habacivch said the newly discovered natural gas can bridge this gap. A number of LNG import terminals have requested approval to export, where the price of gas in Asia makes it a very favourable proposition.

Now hydraulic fracking is unleashing previously undiscovered oil. It has been discovered in east Ohio and now in North Dakota, which currently produces 540k barrels a day compared to less than 100k five years ago.

Beverages
Drinks giant Coca Cola plans to double business by 2020 – and aluminium will be vital to this.

Coca Cola’s Chief Procurement Officer – Bottling Investment Group William Hovis said the beverage group was one of the world’s largest users of aluminium with 150 million aluminium cans and bottles sold every day. Coca Cola currently has 1.8bn consumers a day and plans to double this by 2020.

Aluminium is a key material for this success but it needs to remain affordable, sustainable and innovative, Mr Hovis told delegates.

It has launched an aluminium bottle built in the same design as its glass bottle, and he believes this is the next big package for the drinks industry.

He warned that current confidence in institutions, such as Wall Street, has been low since the global recession and that aluminium is included in this.

While aluminium is a $110bn market consumers often have little say in who makes the rules of this market.

“Who makes the rules of this market that 7 billion people buy worldwide?” he asked.

Coca Cola is increasing its recycling targets. It has launched Coca Cola Recycling, which will increase recovery through innovation and partnering, and will integrate it into sourcing. The aim is for 80-90% recovery rates and to do away with non-returnable packaging.
A fused magnesium chloride containing refining flux

The performance of a fused magnesium chloride-potassium chloride refining flux, in a paper presented to the 2012 TMS Conference by John Courtenay*, Michael Bryant**, MQP, reviews.

Fused magnesium chloride-potassium chloride refining fluxes are used as an environmentally acceptable means for removing alkali metals and oxides from molten aluminium than injection of chlorine gas.

These refining fluxes were initially based on the classic binary system magnesium chloride-potassium chloride, which exhibits two low melting point eutectics, one at about 55.5% mole magnesium chloride and another at 36.5% mole magnesium chloride. Later a revised binary diagram was accepted that showed three eutectics with the two ‘classic’ eutectics and a third eutectic occurring at 31% mole.

Today, commercial products are supplied based on all three eutectics with magnesium chloride contents ranging from the slightly hypo eutectic 25% by weight up to the hyper eutectic 75% by weight. In addition, a product with 25% weight up to the hyper eutectic 75% by weight is also available.

Economics

The major cost factor in the production of fused refining fluxes is raw materials and in particular the cost of potassium chloride. This first became an issue in 2008/2009 as demand for potash for world food production and bio-fuels increased. Prices are starting once again to move upwards (Fig 1).

The rising price of potassium chloride and the likelihood of further increases has given impetus to a programme aimed at developing an alternative flux where the potassium chloride is partially replaced with sodium chloride. This paper summarises the results of a thermodynamic study together with laboratory measurement of viscosity, and differential thermal analysis and sodium removal casthouse trials of a flux product where 25% of sodium chloride is introduced to replace potassium chloride.

Developing a new flux

In constituting a new flux it was important to understand some of the thinking that originally went into devising a refining flux. Two conventional wisdoms were in place. The first held that performance in terms of sodium removal would be higher as the percentage of magnesium chloride increased. Second, that the amount of sodium chloride permitted in the product must be below 1%. In reality neither of these beliefs is correct as demonstrated by the theoretical arguments and evidence from the series of results and investigations presented below.

Influence of % magnesium chloride on efficiency

Test data was collected under controlled conditions at a number of casthouses. Comparisons were made between a 40%MgCl₂ and a 60-65% MgCl₂ containing product applied manually in two identical 50t furnaces at a smelter casting 5xxx alloy.

Results showed the 40%MgCl₂ product performed slightly better than the 60-65% product. In a separate series of tests, results were obtained from production use for a 40%MgCl₂ product and a 25%MgCl₂ product at a smelter casthouse. The average % sodium removal for the 40%MgCl₂ product was 76% while the result for the 25%MgCl₂ product was 77% sodium removal.

More recently a study of MgCl₂ fused salt reagents applied in the salt flux ACD, showed there was no significant difference in alkali removal efficiency with a 60%MgCl₂ or a 75% containing composition. Further confirmation came from results of an investigation carried out at the Alcoa Technical Centre showing that varying the % MgCl₂ between 10% and 90% had no influence on the rate of sodium removal (Fig 2).

All the evidence from practical evaluations and published research from different sources shows alkali removal efficiency is not influenced by the % of MgCl₂ in the fused salt, contrary to some widely held views.

In an explanation of this Dietze has proposed the concentration of MgCl₂ in the molten salt droplet has little influence on the kinetics because the rate of salt addition applied in practise is ten times that needed to satisfy the requirement for stoichiometric reaction and therefore there is always an excess present.

*Managing Director, MQP
**Marketing Manager, MQP
Influence of sodium chloride on sodium removal

In terms of cost NaCl would be welcome as a substitute or partial substitute for KCl in fused salts.

The reaction \( \text{MgCl}_2 + 2 \text{Na} = 2\text{NaCl} + \text{Mg} \) can be considered to move strongly to the right. If this was not the case then the sodium removal process by \( \text{MgCl}_2 \) would not be practically effective. Ellingham diagrams show the high stability of NaCl with respect to \( \text{MgCl}_2 \). Therefore it was anticipated there would be no increase in sodium in the aluminium if quantities of NaCl were introduced into the flux composition.

The above hypothesis was tested by thermodynamic modelling at IME Aachen, under Prof Friedrich. FactSage databases were used to investigate the effect of NaCl content in Refinal on the reaction between \( \text{MgCl}_2 \) in Refinal and Na from the aluminium melt.

In terms of selecting the product, composition consideration was given to selecting a ternary composition, with an appropriate addition of NaCl to an existing proven formulation (Fig 3).

The eutectic low melting point area of the system can be seen on the diagram and the composition selected was:

- Magnesium Chloride 37-42%
- Potassium Chloride 21-26%
- Sodium Chloride 27-32%

The thermodynamic study was based on the following conditions:

A standard salt flux composition with 35% \( \text{MgCl}_2 \) + 65% KCl.

Additions of 1%; 5%; 10% or 25% NaCl into the flux.

Starting with an initial Na content of 30ppm or 10ppm in the melt and targeting a final Na content of 10ppm or 2ppm respectively.

Application of 0.05 – 0.1 % Refinal based on melt weight.

Melt temperatures of 700 and 750°C.

The modelling results showed that after completion there was no sodium remaining in the melt. Therefore it can be concluded that up to 25% NaCl can be substituted for KCl in Refinal 350 and Refinal 352XF without effect on the residual Na content after treatment.

Given that KCl plays no active part in the alkali removal reaction, substitution or partial substitution with an alternative stable alkali metal chloride should not influence the alkali removal kinetic.

Viscosity measurements

The objective of the work was to get a better understanding of the variation in viscosity with temperature and composition of the flux with a view to connecting this with performance in molten aluminium.

In the context of performance it has been proposed that the beneficial influence of fluoride additions to the flux, as in Refinal 352XF, is due to its propensity to reduce interfacial surface tension.

This leads to the formation of smaller diameter liquid salt flux droplets giving rise to an increase in the surface area for reaction. Prof Friedrich believes the presence of F ions in Refinal 352 is the reason for the better performance due to F ions reacting with Na better than Cl ions.

The following compositions were studied in (Table 1):

<table>
<thead>
<tr>
<th>Product</th>
<th>( \text{MgCl}_2 ) %</th>
<th>( \text{KCl} ) %</th>
<th>( \text{NaCl} ) %</th>
<th>( \text{CaF}_2 ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refinal 350</td>
<td>30-35</td>
<td>60-65</td>
<td>1-3</td>
<td></td>
</tr>
<tr>
<td>Refinal 352XF</td>
<td>30-35</td>
<td>60-65</td>
<td>1-3</td>
<td>1-3</td>
</tr>
<tr>
<td>Refinal 555XF</td>
<td>36-41</td>
<td>21-26</td>
<td>26-31</td>
<td>1-3</td>
</tr>
<tr>
<td>Refinal 750</td>
<td>40-45</td>
<td>55-60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Viscosity was measured by oscillographic viscometer in conjunction with density measurement, and confirmed with a high degree of probability the following initial conclusions:

Refinal 352XF has a higher viscosity than Refinal 350 or 555XF.

Refinal 352XF has a higher change-rate of the viscosity than Refinal 350 or 555XF.

The viscosity of all fluxes becomes equal > 600°C. The precision of the absolute values is difficult to estimate.

Since the viscosities, although quite different at low temperatures, become equal at >600°C it can be determined there is no negative effect from the addition of NaCl as a ternary addition to the standard binary product in terms of viscosity.

Differential thermal analysis

DTA measurement was carried out on the ternary composition, Refinal 555XF and the result showed a sharp peak at 402.7°C in the heating up cycle and 405.6°C when cooling down. The sharpness of the peak indicates eutectic melting (Fig 4).

This data was then compared with the DTA curve for a typical binary composition, Refinal 350 which showed a similar sharp peak at 438.8°C.

The conclusion was that both products exhibited sharp eutectic melting points with the ternary composition having a lower melting point by 30°C and that there was no negative effect from the addition of NaCl as a ternary addition in terms of melting characteristics.

Trials in a casthouse

With the favourable outcome of thermodynamic calculations and
laboratory tests it was decided to proceed with full-scale casthouse trials at a major casthouse in Europe.

Trials were carried out by substituting the trial product, Refinal 555XF into standard practice and comparing results to those obtained with standard practice using a 35% MgCl2 – 65% KCl salt flux.

During 87 furnace preparations an average Na-level of 6.5ppm at first time of batching was achieved.

The conclusion was the results were comparable to their standard practice of applying Refinal 350.

Subsequently Refinal 555XF has been adopted into regular production with over 100kt of aluminium having been successfully produced.

Summing up
Not for the first time widely held beliefs have been challenged by technical investigation.

In the case of the effect of MgCl2 content reaction kinetics are of overriding importance and simply matching the stoichiometrically required amount does not ensure that the reaction goes to completion.

In the case of the effect of NaCl additions, here the thermodynamics confirm that, irrespective of reaction kinetic considerations, NaCl cannot be reduced again to Na. Furthermore laboratory characterisation of the ternary composition has confirmed that there is no adverse effect from the NaCl addition in terms of both the viscosity and melting characteristics of the product.

Conclusions
– A fundamental study involving thermodynamic modelling databases has demonstrated it should be possible to add up to 25% of NaCl to a MgCl2 – KCl salt flux by substituting KCl without any effect on the residual Na content in the treated aluminium melt.
– A composition, corresponding to the ternary eutectic in the MgCl2, KCl,NaCl system has been produced, characterised in laboratory testing and trialled on a production scale in a large casthouse in Europe.

– The results of the laboratory characterisation confirmed there were no adverse effects from the ternary addition of up to 25% NaCl to a MgCl2 – KCl binary composition in terms of viscosity and melting characteristics.
– The casthouse results confirmed the thermodynamic prediction and showed a satisfactory performance in terms of sodium removal, compared with standard practice, over a monitored series of 87 production casts.

Acknowledgement
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Evolution of a pot ramming machine

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.

These include AP and Rio Tinto Alcan technology, Alcoa technology, Rusal, Hydro, Alcoa, Dubal, and others, including VAW Technology, VAMI technology, Nat’l Southwire, ASV, Alusuisse-Lonza, HA 230, MCS technology, Harvey Technology, Elektrokemisk Pechiney Sumitomo, Montecatini, Reynolds and Kaiser.

Recent contracts include two pot ramming machines for Emal, at Abu Dhabi, and for Kitimat, Rio Tinto Alcan, also for two pot ramming machines both at the start of this year. It also installed four pot ramming machines at Ma’aden in Saudi Arabia in 2011.

Brochot is working developing the machine: the pot’s size adaptation, reducing the noise, and being able to work with important magnetic fields.

Modernisation

It continues to modernise its machine. After the all-electric ramming, the remote control and the data box, Brochot will reorganise the machine’s components to answer new smelters needs and to keep the machine efficient.

Brochot also works on delining, which is the fact of removing all materials within the pot, and using potshells for a new lining.

The pot ramming machine can achieve high density paste and can reach a high homogenous density with hot, tepid, or cold paste.

Brochot pot ramming machines can comply to a specific procedure, the repeatability from one pot to the other. This expertise and certification (to AP technology) can increase a pot’s life.

The data box is incorporated in the machines. This allows recording automatically each step in the ramming operation of each layer and storing the information in the main computer database. This provides a clear picture of the entire pot lining operation.

As regards the paste feeding machine, it improves workshop cleanliness, and saves ramming operating costs, thanks to less handling operations, and also saves paste quantity avoiding paste waste.

The paste-feeding machine improves working conditions, preventing handling operations and avoiding tar fumes. Working conditions is a Brochot priority, and noise is an aspect it is working on.

Noise level

Vibration is part of the process. Thanks to the remote control, the operator does not feel vibrations.

All the functionalities are scheduled within the remote control, which is a massive overhang for working conditions. Brochot is re-configuring the vibration’s components to isolate the noise in the best way and obtain an acceptable noise level.

Brochot has years of experience and possesses machine ranges from 180kA to more than 400kA.

The machine has had to adapt to different configurations: so the machine needs to have an overall dimension and weight to fit customer’s constraints.

The machine is always tailor-made. For example, Brochot has solutions to use the machine beyond 200 gauss. For this, it isolate the switchgear cubicle. It is working on a permanent solution to answer smelter needs.

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Cash solution helps provide Dubal growth

Dubal is one of the largest non-oil contributors to Dubai’s economy, however its operational success was not matched by its cash management and treasury systems. As emerging markets develop and appetite for aluminium grows, the need for sophisticated cash management solutions becomes more imperative.

Opportunities abound for aluminium companies, as the global trading landscape changes and emerging markets become prominent as trading powers, as well as key consumer markets.

Challenging conditions in many OECD countries has led to a focus on the emerging markets as they become important to global trade flows and world economic growth. Research shows that by 2030, emerging markets will represent 70% of the world’s $180trillion GDP compared to 52% of $73tri in 2010.

The advancement that comes with this increased global significance requires commodities and metals.

Demand for aluminium is fuelled by the booming Chinese economy, for instance, which consumes a quarter of the world’s aluminium. This provides aluminium companies the chance to thrive.

One such company is Dubai Aluminium (Dubal). Built on a major site in Jebel Ali, it has the capacity to produce more than 1Mt/y of finished products. It serves more than 300 clients in at least 50 countries – predominantly in the Far East, Europe, the ASEAN region and the Middle East.

Yet while huge demand, a diversified, well established and loyal customer base and evident profitability provide prime growth opportunities for companies such as Dubal, it is not quite that simple.

Growing pains
Its journey to success has not been without its challenges.

Its recent growth presented it with cash management challenges that hampered the efficiency of its treasury operations and corporate financing strategies.

The importance of effective cash management should not be underestimated. With rating agencies and equity analysts focused on companies with strong liquidity as the driver of performance, better visibility and control of cash has become important.

Companies need global visibility of cash balances and real-time balance sheet management. They also need a complete end-to-end process, from collections to investments, to increase the velocity of cash flow and the ability to net surpluses and deficits across regions – especially in emerging markets where cash management regulations are challenging.

Dubal was running on an outdated and manual cash management model. Its first challenge was the absence of a centralised electronic payments system. Operating on a manual system, supplier payments required physical signing and delivery of bank letters.

Its growth meant it had formed relationships with foreign parties. This created the second cash management challenge as they had to monitor more than 50 multicurrency bank accounts across eight banks.

This made it difficult to consolidate the company’s opening daily cash balance, as details had to be manually collated from paper-based statements received from several banks every morning.

The system hindered timely and efficient reconciliation, as the Treasury Team would often have to wait for the accounts to be delivered to compare them for accuracy.

Dubal’s lack of visibility across its balances meant the management of its cash assets was sub-optimal and its foreign currency payments delayed, resulting in loss of value and potentially dissatisfied suppliers.

Upgrading the system
Continuing to function with such a cash management system threatened business sustainability and was hindering its financial efficiencies. The clearest way to protect itself was to eliminate the inefficiencies that stemmed from running on a manual system and to upgrade to a centralised electronic payments platform.

An electronic payments system allows mobility, enabling access from anywhere worldwide – invaluable to a company with a global presence. It also allows around-the-clock access to and control of trade transactions – meaning improved visibility and rapid reconciliation.

One major advantage offered by electronic payments systems is security, as it removes several hazards attributed to human error.

Advanced systems can also host data and software in a central location, providing companies added assurance that all authorised users are working with the same information and software.

Whereas manual operations are generic and simple, advanced electronic payments systems are bespoke and sophisticated – adapting to the specific needs of the company. Dubal found what it needed in Citibank’s CitiDirect Online Banking and implemented a two-part solution. The first step was to move cumbersome payments system to the online platform.

This removed the need to manually handle and deliver payments and facilitated cross-currency payments to foreign groups.

The second step focused on improving Dubal’s method of aggregation of information. Instead of relying on manual processes, it integrated CitiDirect with its SAP enterprise software. This improved Dubal’s visibility of its cash and aided in the electronic automated bank reconciliation process – enabling the company to quickly and efficiently receive, reconcile and match customer payments.

A stronger business
The company now has online access and real-time visibility and control over its accounts, reports and payments – including cross-currency payments.

The changes have shortened bank reconciliation time and increased straight-through processing. Now 99% of payments to suppliers are made electronically through CitiDirect. Refining cash management practices strengthens the core of a company. Upgrading payment systems facilitates transactions – improving counterparty relationships.

More information
http://www.citibank.com/
transactionservices/home/
Solios Environnement has supplied four Fume Treatment Plants within the Qatalum smelter to treat fumes. These plants also include seawater scrubbers, which have been implemented downstream, to reduce sulphur dioxide emissions.

By Alix Courau and El-Hani Bouhabila

SO₂ treatment is important in aluminium smelters due to current environmental trends. Producers must now rise to the challenge of producing aluminium with anodes containing higher levels of sulphur.

As a result of the reinforcement of fuel quality standards, petroleum coke has seen its sulphurous fraction creep up. Anode baking furnaces (mainly because of the pitch used for their production) and electrolysis pots emissions are strictly concerned, as these compounds finally end their way in the fumes.

National and international standards about air pollution control are also becoming more restrictive on emission levels. To cope with increasing SO₂ concentrations in incoming fumes without affecting stack emissions, Solios Environnement has developed its own scrubbers, which are achieving emission levels well below the most stringent environmental regulations.

The desulphurisation principle

Desulphurisation by seawater wet-scrubber results from absorption of SO₂ from gaseous phase to liquid phase and reaction of soluble SO₂ with basic ions.

The absorption phenomenon is enhanced by a large contact area between gas and liquid phases. SO₂ is not easily soluble in water. Only the use of basic solutions allows SO₂ capture. In wet-scrubbers located in regions bordering coastlines, seawater can be used as a basic solution due to its hydrogencarbonate ions. These ions react with dissolved SO₂, also called H₂SO₃ (sulphurous acid) according to the following reactions:

HCO₃⁻ + H₂SO₃ (SO₂+H₂O) ⇌⇌ HSO₃⁻ + H₂CO₃ (CO₂+H₂O) HCO₃⁻ + HSO₃⁻ ⇌⇌ SO₃²⁻ + H₂CO₃ (CO₂+H₂O)

These two reactions occur inside the wet-scrubber. In the seawater outlet network, remaining bisulphite (HSO₃⁻) and sulphite ions (SO₃²⁻) are then naturally transformed into SO₄²⁻ (sulphate ion) by oxidation reaction. This process is facilitated by aeration through air or in some cases by an oxygen injection tank dedicated to this purpose.

The amount of sulphate ions added in seawater (after oxidation) does not influence the residual seawater quality because sulphate concentration in fresh seawater is naturally high (>2.5g/l). The residual seawater is also neutralised by mixing fresh seawater before being rejected back in its natural environment.

Nevertheless seawater pH variation between inlet and outlet wet-scrubber, which is measured before dilution of used seawater in the sea, can be used as an indicator of wet-scrubber efficiency. It has been observed that pH decreases from approximately 8.2 to 3.5 before and after SO₂ treatment.

The three steps

Fig 1 highlights the desulphurisation process, which includes the following steps:

1. Gas cooling at wet-scrubber inlet
2. SO₂ removal by seawater
3. Mechanical elimination of droplets through demister (containing sulphite and bisulphite)

The purpose of gas cooling(1) is to prevent sprayed seawater from being evaporated in the fumes and to improve SO₂ removal. Such cooling is realised at the bottom of the wet-scrubber or in an inlet quench section (cooling by water evaporation).

Then, the gas rising will have to make its way through column sections filled with packing. Seawater is sprayed above this column counter-current from the gas. It is step 2 that SO₂ removal is achieved. A packing column composed of complex shapes offers high contact area.

At the packing outlet, gas is not yet ready to be rejected in the atmosphere.

Seawater residual droplets, or ‘mist’, need to be eliminated because droplets contain polluting ions such as sulphite and bisulphite. Removing water droplets is also necessary to prevent dispersion and fallout in the vicinity of the stack.

Step 3 is achieved via a demister located at the top of the scrubber section, prior to entering the stack. The demister principle consists of separating droplets from fumes by their inertial mass.

Modifications in flow direction are generated by demister baffles. These baffles make a ‘primary collection’ that separates droplets from fumes.

Once droplets are stopped, they have to accumulate to be drained. A demister is designed to offer dead areas where droplets are sheltered from the fume flow. Droplets coalesce in these areas and grow until forming a seawater film heavy enough to oppose re-entrainment by the fumes, which can thus be collected. This is called ‘secondary collection’.

Solios Environment’s guaranteed value is 35mg/Nm³ of SO₂ at each wet-scrubber outlet. As an example, the SO₂ concentration measured at the outlet of GTC 1 and 2 is inferior to 20mg/Nm³ for each of the four wet-scrubbers.

For an average inlet concentration of 300mg/Nm³, it means each GTC prevents the discharge of more than 400kg/h of sulfur dioxide in the atmosphere, which represents an excess of 1.6t/h for the whole plant – nearly 39t/day.