2024: Issue 2 - June

Institute of Refractories Engineers

The Refractories Engineer

PRODUCTS
APPLICATIONS
TECHNOLOGY
NEWS ROUND-UP

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SAVE THE DATES

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- ❑ Decarbonisation

Don't miss the THE REFRACTORIES ENGINEER 2024: Issue 3 - September

Institute of Refractories Engineers

The Refractories Engineer

Lynn Postle, FICME

From the editor

With a heartfelt need to future proof the industry as our companies and those working in them adapt to an ever changing world, the Institute has placed sustainability at the centre of discussions at this year's UK IRE Annual Conference.

Taking place on 13 November in Derbyshire, the event will challenge existing concepts and highlight the importance of adapting materials, processes, products and consumables to be 'greener' as we strive for a low carbon way of living. The call for contributions is on, so interested parties should contact secretary@ireng.org now to discover how best to get involved – as a presenter, sponsor or delegate. This is your opportunity to engage with fellow IRE members and the wider industry at what is fast becoming a premier event for the refractories sector. Also, the *IRE Training Day* will continue the tradition of offering enhanced skills development on the day after the conference.

In addition, the *IRE- Australasia 2024 Conference* – to be held in Sydney, Australia on 8-10 December – will focus on refractory innovations in the Asia-Pacific area. It follows the success of the 2023 conference and offers a sounding board for delegates from the region and further afield.

In support of the need to highlight the professionalism and development of the global refractories sector, this issue of *The Refractories Engineer* is also full of news of innovations and sustainable engineering taking place in our sector. One such 'hot topic' is the growth of the use of hydrogen and in particular green hydrogen, which is why we place the spotlight on this matter in this issue. As the song goes: "the times, they are a-changing", let's not get left behind!

Whether you have a comment about the journal or want to get more involved at regional, national or international level, there is plenty the IRE can offer, so visit the website or give us a call to see how you can get even more out of your involvement with our fast growing organisation. Collectively, we will be more than capable of embracing the challenges our "new world" demands of us.

Happy reading.

Front cover image: Shutterstock

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Message from the PRESIDENT

I said in my last column that, due to the hard work of council, the IRE has managed to return to a financially sustainable position. I am delighted that due to the good diligence of Dominic Oates and Georgina Nicol this position is looking even healthier.

One of the main forces behind this has been improvements to how Council is being run, and one of the main players in that was Peter Rooney who, as a former President, was the go-to person for understanding the rules and what could and couldn't be achieved. He was the calm and wise counsel that we all relied upon. He has now decided it is time to step down as a member of Council. I would like to give my heartfelt appreciation for his contribution to the IRE over the past few years while I have been a Council member and the many years of great service before then.

It is also with sadness that I should report that Colin Hardy, another former President of the IRE in the 1980s, has sadly passed away. He was a long term manager of refractories research at British Steel. Our thoughts and condolences go to his family and friends.

It may still be over six months before the two IRE conferences taking place at the end of the year, but these are clearly not organised overnight, and we are fully ahead with planning. Mario Taddeo will give an update on the Australian conference in December, but I thought I should give some early news about the UK one. Following on from the successful conference last year we have decided that we need a larger venue with better parking facilities. As such, we have chosen to go to Van Dyk by Wildes Hotel near Barlborough, which is a convenient short distance from junction 30 of the M1 motorway. This is a four-star hotel with a modern building and facilities. It will be used for the conference, training day and dinner. Although there may be some changes, the current working title for the conference is *"Sustainability for a low carbon world"*, and the training is planning to be *"Beyond the Data Sheet"*. Although on a similar theme to the training day of a few years ago, it is there by request and will have a different emphasis on specification and validity of test data. More details will follow in due course, and I hope to welcome many of you to these events.

There have been suggestions to reintroduce *networking events* that used to be organised at branch level. We are working ahead with this and hope to have the first in the summer with one or two invited speakers.

Mike Lamkin, President
Institute of Refractories Engineers

Institute of Refractories Engineers

CORPORATE PARTNERS

The IRE thanks the following Corporate Partners for their support:

Bronze

Allied Mineral Products, American Ceramic Society, CHB South Africa, Dalmia GSB GmbH, 4D Delta, Elkem, Robert Lickley Refractories Ltd, Practical Refractories, Setic Refractories Ltd, Velco GmbH, Wilfrid Smith Ltd,

Silver

Almatis GmbH, Imerys Aluminates Ltd, LKAB Minerals Ltd, Mayerton Group, Mineral Technologies Inc, Siltherm Europe Ltd

Gold

Calderys NGJ Ltd, Capital Refractories Ltd, Stud Weld Pro-UK, Trent Refractories Ltd

A corporate partner package is a reflection of an organisation's commitment to the refractories industry and the professional institute that represents the industry. The IRE is appreciative of the support of our corporate partners and is delighted to be working with them for the benefit of the whole sector.

For more information on corporate partner packages refer to page 37.

Image Source: Shutterstock

Refractories in Ladles

Insulation/Covers/Lip Ring Construction

Wednesday 26 June
Alkegen offices, Alderly Edge, Cheshire (UK)

Join IRE for a technical evening offering a fascinating insight into an important aspect of refractories technology.

Participants will be given insight into the latest technology in terms of – insulation, covers and lip ring construction. Online registration is also available to ensure wherever you are in the world, you won't miss out.

For more information contact: secretary@ireng.org

Update from Australasia

Dear Members and Friends

The IRE-Australasia 2024 Conference will aim to be our best. We are taking it to the next level with our selection of one of Sydney's finest hotels. For this to be a success the management committee has worked extra hard and diligently and I want to extend my thanks. I am sure the delegates attending will share similar appreciation.

By the time of publishing, we will have issued the call for papers and registration forms.

I am also pleased to announced Professor Geoff Brooks (Swinburne University of Technology) and current *Bessemer Gold Medal* award winner will be the keynote speaker of our event.

SAD NEWS

It is with a heavy heart that we say goodbye to Peter Carman – a long serving refractory member. He was widely known in the refractory industry, especially in WA Australia.

Peter's funeral service was held in Perth, WA, on Wednesday 14 February, the turnout from the refractory industry was overwhelming for the family. The IRE contributed a very fitting wreath and was represented by Dean Tredinnick (Secretary IRE-Aus), offering the following eulogy:

"Peter started in the refractory industry as a labourer in the 1980s, working his way up into supervision, and then various types of management roles. After leaving Andrecco Hurl with 27 years of service, he grew a family refractory business for seven years. In late 2018 Peter and his business partner Lee Button established Refractory Management Services (RMS). Still operating today, this business has made Peter and Lee very proud.

"Peter had quite the sense of humour, always up for countless laughs. He loved his favourite footy team Carlton and enjoyed his getaways in the caravan. Peter leaves behind his lovely wife Denise, his two children Lee and Lorinda and his two grandchildren (who were his world)"

INDUSTRY INSIGHT

In the previous issue of *The Refractories Engineer* we discussed the iron and steel industry in Australasia and, with thanks to Glyn Cox (formerly Metso and now Rotary Kiln Services), we offer the following insights into the nickel and lithium processing industry.

In general, there has been a pause in the activity around critical minerals production due to recent oversupply and associated low commodity prices. Much of the commentary in the media is that this is a temporary condition, but this is not an opinion shared by all. A prolonged reduction in mining would affect refractory demand due to postponement of downstream processing. A summary of the main issues is as follows:

- **Nickel:** The oversupply of nickel has largely been caused by new Chinese built Indonesian plants coming online. The CEO of BHP recently suggested that the price could remain low until the end of the decade and flagged the possible closure of its processing plant Nickel-West in Kalgoorlie. At least six other nickel projects in the planning stage have been postponed or mothballed. Glencore has exited its New Caledonia plant but is keeping open the Murrin mine in Western Australia for the time being.
- **Lithium:** The two processing plants recently commissioned in Western Australia, Tianqi and Albemarle, are both operating at around fifty per cent of their current capacity. This is due to both the reduced prices and technical issues. Albemarle currently has two production lines and a third line under construction. A planned fourth line has been shelved indefinitely. The lack of experienced personnel in Western Australia has been cited as a major difficulty in solving the technical problems. These plants are very pyro-metallurgical intensive, and any reduction in operation will reduce refractory demand. However, the long term demand for lithium is expected to remain high and exploration of Australia's abundant lithium pegmatite deposits continues at a high rate.

Looking forward to seeing you at our 2024 Conference, best always,

***Mario Taddeo** MI Ref Eng*
President, IRE Australasia

IRE AUS news this issue:

- **Latest update on IRE – Australasia 2024 conference**
- **Farewell to Peter Carman – a long supporting servant of the refractory industry**
- **Update on the lithium processing industry in Australasia**

Institute of Refractories Engineers

IRE AUS 2024

Refractory Innovations in the Asia Pacific

The Fullerton Hotel, Sydney, Australia
Sunday 8 to Tuesday 10 December 2024

Presented by the IRE Australasian Branch

ATTENDANCE FEES

Members/End Users: A$400.00
Non-Members: A$500.00
Retired/Students: A$300.00

Welcome Reception
Members/End Users: A$80.00
Non-Members: A$110.00
Retired/Students: A$50.00
Note: early bird discounts available before 1 July 2024, then above rates apply.

Conference Gala Dinner
A$195.00

Field Trip to BlueScope Steel
Members: A$100.00 Non-Members: A$150.00 Students: A$75.00

Fullerton Hotel special rate: book with discount code available from the IRE after registration. www.fullertonhotels.com/fullerton-hot

For more information, contact David Hollott (Secretary), email: australia@ireng.org

IRE Australasia Branch Organising Committee:
Mario Taddeo (President), Don Merritt (Asst. VP), David Hollott (Secretary), Dean Treddinick (Asst. Secretary), Mike Walton (Treasurer), Greg Connor (Public Officer) and Alan Blanch

- **Sunday 8 December –** Evening Welcome Function
- **Monday 9 December –** Conference/Training Day
- **Monday 9 December Evening –** Conference Dinner
- **Tuesday 10 December –** Field Trip – BlueScope Steel

IRE AUS 2024 SPONSORSHIPS

PLATINUM – A$4,000.00
Major exposure, choice of exhibition space, literature in satchel, plus three complimentary attendee places

GOLD – A$3,000.00
Second choice of exhibition space, literature in satchel, plus two complimentary attendee places

SILVER – A$2,000.00
Table space, literature in satchel, plus one complimentary attendee place

MINI-SPONSOR – A$1,000.00
Literature in satchel

Dinner and tour not included

www.ireng.org

In the thick of it for new measurement device

Full solution provider of refractory installation equipment, Bricking Solutions, has introduced a new product to the market.

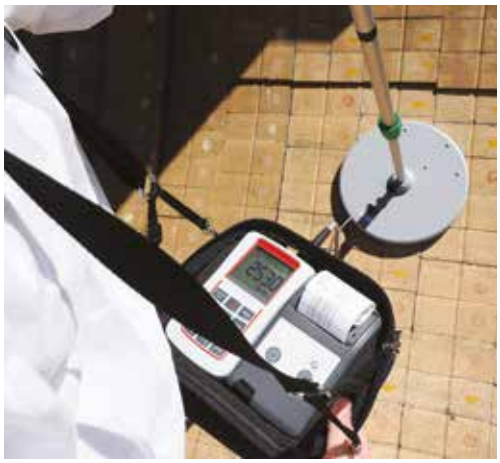
BrickCheck measures the thickness of refractory lining inside industrial furnaces, ovens and kilns quickly and easily in a non destructive way after calibration. The readings can be used to ensure smooth operation of a vessel and help plan future maintenance in any facility that uses refractory, including cement, pulp and paper, lime and metal processing facilities. BrickCheck replaces the popular, discontinued Linometer system in the Bricking Solutions line.

"Customers need to minimise the risk of refractory failure. The ability to monitor the thickness of the refractory in their vessels gives them the knowledge they need to identify wear trends before kiln failure," said Jeff Mirisola, Bricking Solutions vice president of global sales and service. "Using BrickCheck allows operations to plan for maintenance and downtime, limiting the impact on productivity and profitability. It's easy to use and doesn't damage the brick layers as much as drill core methods."

BrickCheck includes a control unit, measuring probe, connecting cable, anti-dust cover, carrying case, plastic case and instruction manual. Three AA (LR05) batteries power the unit for up to 150 hours. The probe can also feature an optional protective coating for measurements on brick up to 100°C. The handheld instrument measures and displays the thickness of refractory brick and concrete for industrial ovens, kilns and furnaces as well as unreinforced refractory concrete. It can be used on cement, dolomite, magnesite or fireclay bricks and measure a range up to 300mm.

The device uses electromagnetic measuring through the eddy currents principle to determine brick thickness. The magnetic probe is placed against the brick, and the 4-digit display shows the measurement in centimetres. The probe is accurate within 5mm. The probe and telescoping extension arm give operators a full range of motion, allowing them to measure the full circumference of the vessel without bending, stretching or stooping.

The handheld instrument measures and displays the thickness of refractory brick and concrete for industrial ovens, kilns and furnaces as well as unreinforced refractory concrete



The device uses electromagnetic measuring through the eddy currents principle to determine brick thickness. The magnetic probe is placed against the brick, and the 4-digit display shows the measurement in centimetres

The operator calibrates BrickCheck by drilling a single trial hole. This virtually eliminates the extensive, repeated damage to the shell that the drill core method can cause where up to two hundred holes may be required. Bricking Solutions reports that the BrickCheck process is also ten times faster.

Operators can transfer data from the device via USB or Bluetooth connection, making transfers easy. It works like a USB mass storage device and stores as many as one million individual readings and 9,801 separate measurement series as CSV files that can be read in programs like Microsoft Excel. This information can be analysed to see what the normal wear rate is for the vessel as well as how it varies over time, giving operators the information needed to notice hotspots or abnormal brick wear.

Bricking Solutions manufactures a wide breadth of refractory installation equipment, including bricking machines, ramps and conveyors.

www.brickingsolutions.com

Copper smelter refractory maintenance

Moreki Development has launched a fully fledged training centre in the Copperbelt in South Africa. The centre will focus on developing both Zambian and DRC refractory maintenance staff.

IRE member François Els of Moreki Development explained: "Refractories are a critical part of the operation of most high temperature industrial processes and they also play an essential role in many other industries. They are frequently a major cost item both in general maintenance and the unscheduled downtime of production units arising from premature refractory failure.

"The depth of the subject is demonstrated by the six months certified course in refractory technology. The majority of refractory purchasers have had little, if any, formal training in refractory maintenance. Numerous books and technical papers are available, but none have been written specifically for copper smelter maintenance."

The program will focus on:

- Furnaces construction.
- Refractory maintenance.
- Material planning.
- Brokk machine operating.
- Brokk machine maintenance.
- Refractory safety and hot repairs.

For more information, contact François Els, email: francois@morekidevelopments.co.za

Extended portfolio of high temperature solutions for global customers

In February 2023, Calderys and HWI joined forces to create a single, market leading, high temperature solutions provider. Twelve months later, the two have become a unified group, and are sharing technologies from one region to another to offer an expanded portfolio of world-class refractory products for high temperature industries around the globe.

The new group offers an exciting program to share technologies, transferring a selection of Calderys solutions in the Americas to HWI – a member of Calderys, and bringing a selection of HWI products to Europe, the Middle East and Africa (EMEA) and the Asia-Pacific (APAC), available through Calderys.

The company says the first stages of this technology sharing program are already bearing fruit, as customers in EMEA and APAC have access to several carefully selected, high value HWI refractory products, and customers in the Americas can benefit from Calderys' tried and tested products, including steel casting fluxes.

"The past twelve months have been exciting, demanding, and very productive for our newly formed group," said president and CEO, Michel Cornelissen. "The combination brought together two dynamic businesses with complimentary product ranges and created the opportunity for technology sharing and co-operation for the benefit of the world's high temperature manufacturing sectors. I am delighted that we are already seeing great results."

By manufacturing a carefully selected range of HWI's products in Europe, Calderys is able to provide EMEA customers with short lead times, small stock holdings at customer sites, and high levels of local, technical support. Product evolution will also be undertaken locally, meaning products can be developed and fine-tuned to meet the specific needs of EMEA customers' process developments, including, for example, 'green steel' applications. Thus, bringing to the EMEA market a combined portfolio of refractory bricks and monolithics for various high temperature segments. These products will complement those the company already produces in the EMEA region, providing customers with an expanded and improved array of solutions for a wide range of applications, including steel, direct reduced iron (DRI), glass, copper and petrochemical.

Over the past few months, Calderys has already transferred dozens of HWI products for production to the Calderys Bekasi (Indonesia) site, with many more to be transferred in the coming months.

The products to be manufactured locally are those in highest demand, as well as products complementary to the full Calderys portfolio, including dense castables and, due later in 2024, a combination of lightweight castables, additional dense castable, wet mortars, and patching materials, for power generation, petrochemical, nickel production, cement and glass.

Demand for HWI products in Indonesia is particularly high, but work is also ongoing to make available key HWI products around the APAC region, particularly products for the petrochemical sector.

In the Americas, HWI customers now benefit from an overall broadened portfolio, including Calderys' monolithics and pre-shaped technologies, and the company's proven steel casting fluxes, insulating fire bricks, tundish monolithics, and purging plugs. Some more work is expected in the coming months to transfer the production of additional Calderys items to HWI facilities.

Cornelissen concludes: "Throughout 2024 we will continue to add to, and update, our product portfolios, as HWI solutions are tested and made available in all geographic regions via Calderys' global network, and Calderys products are made available in the Americas through HWI, now a member of Calderys."

Events Diary

Upcoming events to be added as dates in your diary

9-11 May 2024
ACTSEA 2024
8th International Symposium on Advanced Ceramics and Technology for Sustainable Engineering Applications
Venue: GIS Taipei Tech Convention Center (Taiwan)
Contact: www.actsea-symposium.com

15-16 May 2024
The Advanced Ceramics Show
Venue: the NEC, Birmingham (UK)
Contact: www.advancedceramicsshow.com

5-6 June 2024
Subcon
Venue: the NEC, Birmingham (UK)
Contact: www.subconshow.co.uk

5-6 June 2024
18th Furnace Solutions
Venue: Totally Wicked Stadium, St Helens (UK)
Contact: Society of Glass Technology, www.sgt.org

14-19 July 2024
International Congress on Ceramics
Venue: Hotel Bonaventure, Montreal (Canada)
Contact: www.ceramics.org/event

15-19 July 2024
Society of Glass Annual and Technology Conference
Venue: Churchill College, Cambridge (UK)
Contact: www.sgt.org

11-12 September 2024
UK Metals Expo
Venue: NEC, Birmingham (UK)
Contact: www.ukmetalsexpo.com

18-19 September 2024
The International Colloquium on Refractories 2024
Venue: Aachen (Germany)
Contact: www.ic-refractories.eu

8-10 October 2024
Aluminium 2024
Venue: Exhibition Centre, Dusseldorf (Germany)
Contact: www.aluminium-exhibition.com

25-30 October 2024
75th World Foundry Congress
Venue: Deyang (China)
Contact: www.75wfc.com

28-30 October 2024
Industrial Heating Decarbonisation Summit
Venue: Conrad Indianapolis (USA)
Contact: www.ihea.org

8-10 December 2024
IRE Australasia 12th Biennial Conference
Venue: Sydney (Australia)
Contact: email: australia@ireng.org

Partnership to improve kiln solutions to North America

Evergreen Kiln Technologies, LLC, of Niagara Falls, USA and Suzhou Kilnpartner Mechanical Technology Co Ltd, located in China, have announced the strategic partnership between both parties.

This partnership was developed to service and support the growing demands of the North American lithium-ion battery market. This partnership will provide the market's battery material producers with access to the most modern and innovative kiln system solutions for producing cathode (LFP, NMC), and anode active materials.

Evergreen Kiln Technologies LLC will operate as a subsidiary of Can-Eng Furnaces International Ltd, where Can-Eng will share over sixty years of experience designing and developing customised thermal processing solutions.

This partnership between the two companies encompasses various areas including marketing, brand collaboration, technological development, production, and engineering, as well as aftersales services. The goal is to create innovative methods for the thermal processing of battery powder.

A statement issued on behalf of both parties said: "Together, we are committed to forming a collaborative alliance to provide the best kiln solutions to our customers in North America." *www.can-eng.com*

Source: Evergreen Kiln Technologies

Innovative circular economy solutions

Imerys and Seitiss have created a joint venture to develop mineral solutions from the circular economy. The joint venture, Seitiss Imerys Minéraux Circulaires, will allow the utilisation of waste minerals from various industrial activities.

It illustrates the growing need for manufacturers to better recover waste produced through industrial activities. Olivier de Mougins, group strategy vice president at Imerys said: "Thanks to this partnership with Seitiss, Imerys wishes to enrich its offering of circular solutions to meet the growing expectations of its customers in terms of recycled minerals. This is a new step taken by Imerys towards a greater circularity of its resources." The joint venture will use innovative tools developed by Seitiss, making it possible to source unexploited waste deposits and promote them to various industrial users, including Imerys.

Seitiss uses digital tools to find industrial synergies and set up recovery channels for industrial waste.

In addition to financial investment, Imerys will provide Seitiss Imerys Minéraux Circulaires with industrial and commercial know-how as well as its international presence to accelerate the development of the first identified opportunity relating to the valorisation of recycled calcium carbonate from industry.

"This joint venture will benefit from Imerys' technical expertise and capacity for innovation in order to offer customers high performance mineral products with minimal impact on the planet," said Frédéric Jouffret, vice president science & technology, performance minerals.

Personnel change at advanced materials company

Elkem has appointed a new acting senior vice president for its silicones division.

Larry Zhang has accepted a new position in Sinochem and Sandy Chen has been appointed acting senior vice president for Elkem's silicones division, a leading global player in fully integrated silicone manufacturing. Both will step into their new roles with immediate effect.

Sandy Chen comes from the position as the vice president Asia Pacific region in the Elkem silicones division. Chen has long and extensive experience both within leadership and the silicones global business. She holds a polymer master's degree from Beijing Technology and Business University.

"Elkem is one of the world's leading suppliers of silicon based advanced material solutions shaping a better and more sustainable future, and we are proud to be a global leader in fully integrated silicone manufacturing. Elkem pursues a strategy of dual play growth and green leadership, and this will continue in the silicones division under Sandy's temporary leadership. I know Sandy as a committed business leader and I very much look forward to having her as a temporary member of Elkem's corporate management team, until a permanent solution is in place," says Elkem's CEO Helge Aasen.

Chen (pictured below) said: "I am honoured to be appointed as the Acting SVP for Elkem's silicones division and will do my utmost to lead the global team delivering on our ambitious targets in 2024."

Elkem's silicones division is a fully integrated producer from silicon metal to upstream siloxanes and downstream silicone specialties. The division has two large expansion projects in France and China which will be finalised in 2024. These projects will improve the plants' cost positions, mainly through lower energy and raw material consumption. The new production line in China is expected to be on level with the current lowest cost producers.

Investing in grinding capacity in France and Korea

Alteo, world leader in the production of specialty alumina, announces the completion of its fourth expansion project of grinding capacity in Korea, as well as a second expansion in France at the end of September 2024.

These significant developments will considerably strengthen the company's position in the global alumina market, particularly in the semiconductor (HYCal range) and battery (SEPal range) sectors.

In Korea, the completion of a fourth grinding capacity extension confirms a leading position in super grinding in Asia.

At the same time, the company is responding to growing demand from battery customers in Europe with a new phase of expansion at its Gardanne site. Specialising in the calcination of specialty alumina, this site will see an additional fifty per cent increase in its super grinding capacity, operational by the end of September 2024. This comes on top of a successful initial fifty per cent expansion in 2022.

These investments are not limited to increasing super grinding capacity. Alteo is also strengthening its alumina sifting and alumina iron removal capabilities, while introducing a robotised packaging workshop.

Research and innovation project aims to eliminate GREENHOUSE GAS EMISSIONS in materials

SKF has decided to join and co-fund Mission 0 to contribute to the development of groundbreaking technologies and deliver solutions to eliminate greenhouse gas (GHG) emissions in materials, production and end of life of passenger cars. In an initial pilot project, SKF will collaborate with academia and industry experts in a research arena to solve GHG emissions in materials and processes that require new knowledge or disruptive technologies.

"In this deciding decade, we need to take the right decisive actions," says Annika Ölme, CTO and senior vice president, technology development, SKF. "At SKF, we are committed to sustainability, and we know that innovation is key to succeed. By innovating and collaborating with leading companies and partners, we can achieve more. This is made possible in Mission 0 where we expect new ideas to emerge, new connections to be made, and that we together can create results that might remain unattainable if we act alone. SKF can contribute in many ways, for example in the areas of sustainable materials and lubrication."

As part of this research and innovation project, a Mission 0 House has been established in Gothenburg, Sweden. This collaborative space brings together researchers and engineers from product companies, material suppliers, and academia to work on concrete projects, exchange knowledge, and jointly develop groundbreaking technologies and solutions.

"The transport sector is the fastest growing GHG emitting sector worldwide. Together, with the Mission 0 partners, we are envisioning the possibilities of discovering new ways to eliminate GHG emission in modern materials in industrial manufacturing. Decarbonisation and accelerating sustainable transformation within industries are our core priorities. We are excited to be part of this important project to make a difference", says Kerstin Enochsson, president automotive, SKF.

Other collaborators in Mission 0 are Boliden, Borgstena, Lindholmen Science Park, Polestar, Sekab, SSAB, Stora Enso, Volvo Cars, and several universities.

Leading Indian steel producer partners with supplier for GREEN STEEL TRANSITION

Primetals Technologies and leading Indian steel producer Steel Authority of India Limited (SAIL) have signed a memorandum of understanding (MOU) to closely collaborate on projects and technologies related to decarbonisation at the plant located in Rourkela, Odisha, India. The signing ceremony took place at the executive director's office of SAIL's Rourkela Steel Plant in February.

SAIL's Rourkela steel plant has a strong focus on decarbonisation as one of its priorities to future proof the production processes and is therefore currently looking for solutions to lower its carbon footprint. The partnership with Primetals Technologies is a key strategic move in this endeavour.

A fully fledged provider of green production solutions

Primetals Technologies is the market leader in environmental and energy efficiency solutions for the metals industry and has established an organisation dedicated to green steel technologies and the transformation into a greener steel industry. Primetals Technologies will work closely with SAIL's Rourkela location, providing expertise across the green ironmaking and steelmaking value chain, including but not limited to carbon capture and utilisation (CCU), digitalisation, hydrogen based steel production, electric steelmaking, and advanced gas cleaning solutions.

Leading plant building expertise

"We are very happy to partner with SAIL and the Rourkela steel plant for its transition into green steel production," said Norbert Petermaier, executive vice president of sales at Primetals Technologies. "The metals industry is currently moving quickly in terms of efforts to decarbonise. As the global front runner, Primetals Technologies will support and assist the SAIL Rourkela steel plant in the best possible way based on our proven expertise in green ironmaking and steelmaking solutions. And, as part of the larger Mitsubishi Heavy Industries Group, we also have at our disposal profound knowledge in technologies related to carbon capture and utilisation."

Biswadeep Bhattacharjee, vice president of sales and head of Green Steel India at Primetals Technologies, and Sharad Raghunath Suryawanshi, executive director (works) at SAIL's Rourkela steel plant, during the contract signing ceremony

"The SAIL Rourkela steel plant is happy to get associated with Primetals Technologies on our endeavour to cut down the carbon emissions in order to meet our overall target of becoming net carbon neutral," said Sharad Raghunath Suryawanshi, executive director (works) of SAIL's Rourkela steel plant.

The SAIL Rourkela location is a leading steel plant in India and the world. The Rourkela facility alone has an annual crude steel capacity of 4.2 million tons. The plant's product portfolio is wide ranging and comprises prime plates, hot rolled coils, cold rolled coils and sheets, galvanised sheets, cold rolled non-oriented (CRNO) electrical steel, electric resistance welded (ERW) pipes, spiral welded pipes, and special plates to serve the defence sector.

Key developments for the UK ceramics industry

The Applied Materials Research, Innovation & Commercialisation Company Centre (AMRICC) has officially launched.

Jo Gideon MP, chair of the All-Party Parliamentary Group for the UK ceramics industry, cut the ribbon, opening the doors to industry leaders, academics, and the public sector. The AMRICC Centre, a world first, operates on an open access format, translating materials, processes, and technologies into real world solutions.

According to Jo Gideon, MP for Stoke-on-Trent Central: "The AMRICC Centre is a fantastic facility, which will drive innovation in ceramics and advanced ceramics up to the next level.

"Advanced ceramics offer many opportunities for UK plc, and The AMRICC Centre is a brilliant addition for the sector."

The facility includes an equipment suite with over 350 high value technologies, unique capabilities, and a team of experts to turn innovative ideas into market ready technologies.

The centre is the result of the Midlands Industrial Ceramics Group's £18.27 million, four year research program, funded by the UK government under UK Research and Innovation's flagship Strength in Places Fund in 2021.

Commenting on the move, Dr Cathryn Hickey, CEO of The AMRICC Centre, said: "Forecasts for the advanced ceramics industry value in 2023 were £143 billion, and The AMRICC Centre places the Midlands in a strong position to play a key role in this highly valued sector."

An essential aspect of The AMRICC Centre's mission is to partner with universities, providing an educational facility to train and support material scientists for the future. Staffordshire University's vice chancellor, Professor Martin Jones, emphasised their commitment to developing the ceramic and advanced materials' economy.

Meanwhile, Ceramics UK CEO Rob Flello said: "Ceramics are absolutely fundamental to every part of our lives and a facility like this enables further development, new ideas and creations, as well as testing existing ideas and perhaps finding new applications for them. It's amazing." *www.ceramics-uk.org*

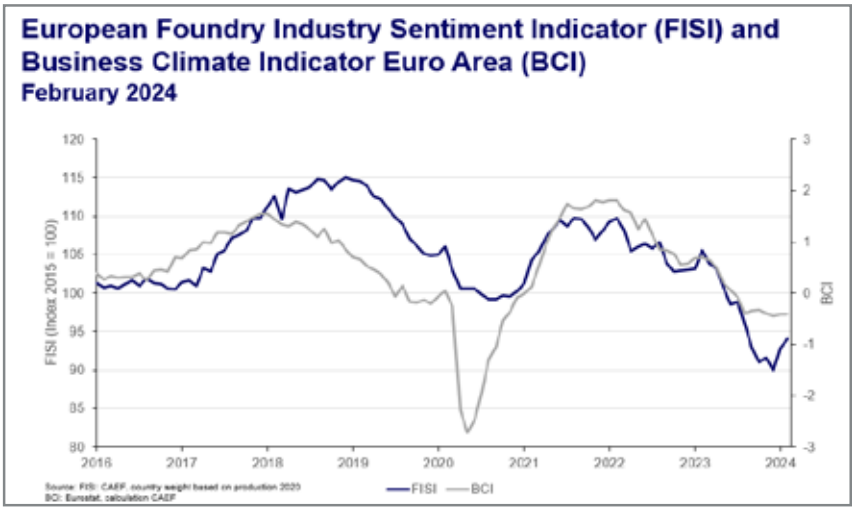
European Foundry Industry Sentiment

In February 2024, the European Foundry Industry Sentiment Indicator (FISI) experienced a pleasing surge, with an increase to 94.0 index points, says the European Foundry Federation (EFF). This development reflects the second consecutive increase for the FISI, the index experiences an increase of 1.1 points, settling at 94.0 compared to 92.9 in the previous month.

The current upsurge in sentiment may partly be attributed to a moderation in the situation across procurement markets, contributing to a mild easing of pressures. The pricing dynamics of raw materials have settled into a new normal, persisting at levels that exceed those observed prior to the onset of the pandemic. However, EFF reports: "it is essential to highlight that the overall situation remains tense, with considerable obstacles still to overcome."

The industry faces ongoing challenges like fluctuating demand and global economic uncertainties. These factors underscore the fragility of the current improvement and emphasise the need for sustained efforts to stabilise and strengthen the sector. EFF says: "While the small improvement in February is a positive sign, it's important to remember that the European foundry industry still has a tough road ahead. Staying alert and taking proactive steps will be vital to deal with the ongoing challenges and ensure that the industry stays strong in the face of adversity."

Meanwhile the *Business Climate Indicator (BCI)* remains unchanged at -0.42 index points, mirroring its value from January. This marks the eighth consecutive month that the BCI has lingered below the critical threshold of 0 index points. Once again, the negative trend in the BCI primarily stems from the assessment of export order-book levels, a reflection of persistent challenges in this aspect. The ongoing geopolitical tensions in regions such as the Middle East and Ukraine continue to exert significant influence on this trajectory, contributing to the sustained stagnation in the BCI. *www.caef.eu*



Concrete distribution partnership in North America

Blastcrete Equipment LLC, an industry leading manufacturer of concrete pumps, shotcrete and gunite equipment and accessories, has formed a distribution and service partnership with Italian concrete equipment manufacturer Mecbo Srl. The alliance forms 'Mecbo America: a Division of Blastcrete.'

The partnership will provide customers in North, Central and South America with access to cutting edge Mecbo products, enhance the Blastcrete offering with new models designed around Mecbo pump technology and ensures a solid parts and service support network throughout North America.

Blastcrete will leverage the quality and innovative products designed by Mecbo, with an internal capability to modify and customise the equipment design to customer specifications. Additionally, Blastcrete will incorporate Mecbo pump technology into their trailer mounted pump designs to meet customers' unique needs in pool installation, deep foundation installation and other high volume applications.

Mecbo America will offer multiple Mecbo products, including their Benton Cap concrete mixer and CARTRACK P6. The Benton Cap is a mixer pump installed on an axle with a crawler undercarriage. The CARTRACK P6 pumping unit is highly versatile, capable of being installed on crawlers, wheels, trucks or tracks. *www.blastcrete.com*

Lean and efficient business project at steel giant

Preparations are well underway for a new tube mill to be installed at Tata Steel UK's Corby site later this year as part of its regeneration and renewal programme, 'Project Aurora'.

Works manager Corby, Gary Blackman said: "Despite all the uncertainty in the wider business, the downstream businesses are continuing to invest and we're making great progress with our own site's £30million Aurora Project.

"Our new warehouse was completed last year, and the civils work is coming along well in preparation for a new combination tube mill, which will be making tubes later this year.

"Along with that, the land sale of the old part of the site is progressing quickly and we hope to be able to soon use the funds from that for other parts of the project such as new offices and engineering workshops."

And talking about the work to prepare for the arrival of the new combination tube mill, project manager Nigel Chudley said: "This mill will be making many of our premium branded products such as Celsius, HyBox and StrongBox, so it's going to be a real showstopper for our site. But it's only going to be as good as the foundations it's built on, so this is a critical phase of the project.

"The mill will weigh about 650 tonnes and stretches about 200m. It's critical that the foundations are not only solid but completely flat and level. The teams are currently working incredibly hard to complete all the channels for water, electrics and hydraulic systems.

"We're expecting the mill to arrive in the next few months and plan to be making tubes in the summer."

Blackman added: "We've also got a £20million green steel journey, the first phase of which has been the installation of electric induction furnaces on the stretch reduction tube mill to replace the old inefficient gas powered ones. Not only will it bring environmental benefits but also speed of work and quality improvements."

"A lot of the work has been behind the scenes, but now the workforce can see the work being done, infrastructure going in – that will give them, and our customers, huge confidence in the future of the site.

"It's all part of getting Corby fit for the future so we're a lean, efficient, quality tube maker that's part of a streamlined efficient UK business."

www.tatasteeleurope.com

Expansion of collaboration for electrification of emission intensive industries

ABB and Sweden based greentech company Salt X have signed an agreement to enable the further development of technologies in the electric arc calcination (EAC) process. ABB will also become a minority shareholder in Salt X.

The two companies are known for their expertise in electrifying emission intensive industries, including in the production of cement and quicklime, highly sought after materials in modern construction and process industries. Today, manufacturers are dependent on fossil fuels for high temperature heating, up to 900ºC, and have no realistic alternative.

Under the new agreement, Salt X will further develop its innovative electric arc calciner (EAC), a technology that makes it possible to reach several thousand degrees Celsius. The electric plasma solution reinvents industrial calcination – the process used to heat materials to high temperatures – and replaces fossil driven heating with renewable electricity while capturing the CO_2 emissions released. ABB will contribute with control and electrical systems for the EAC, creating a strong joint offering to the market. The collaboration aims to accelerate the commercialisation of Salt X's electrification and carbon separation technology.

"Salt X gains an optimal industrial partner with extensive experience in scaling up and implementing new industrial technologies on a global scale, together with a substantial capital injection," said Carl-Johan Linér, CEO of Salt X. "This strengthens us as a company and enables us to progress with our growth plans. With ABB and our other partners, we can significantly improve our capability to take a leading role in the electrification wave sweeping through the industrial sector."

"At ABB, we are at the core of accelerating decarbonisation in the cement and other emission intensive industries whilst providing world-class solutions to our customers," said Michael Marti, global growth industries business line manager, ABB Process Industries. "Our collaboration with Salt X marks a significant milestone in this journey. The technology benefits are two-fold – replacing the use of fossil fuels through renewable electricity in the calcination process and enabling cost efficient capture of the carbon emissions at the same time. It will be a highly effective way of curbing lime production emissions."

The companies first initiated a collaboration for electrifying the industrial process of calcination in 2022. This intensified in 2023 with the construction of Salt X's research and test facility (ECRC).

ABB's Process Automation business automates, electrifies and digitalises industrial operations that address a wide range of essential needs – from supplying energy, water and materials, to producing goods and transporting them to market.

ABB is a technology leader in electrification and automation, enabling a more sustainable and resource efficient future. The company's solutions connect engineering know-how and software to optimise how things are manufactured, moved, powered and operated. Building on more than 140 years of excellence, ABB's more than 105,000 employees are committed to driving innovations that accelerate industrial transformation. *www.abb.com*

UK manufacturing outlook – Q1 2024

Britain's manufacturers are facing the prospect of two years of low growth, with latest forecasts suggesting the rate for the sector will remain flat this year at 0.1 per cent, before increasing by 0.8 per cent in 2025 – just half the forecasted GDP rate for the economy overall, warns Make UK.

The findings come from Make UK's *Manufacturing Outlook 2024 Q1 survey*, in partnership with business advisory firm BDO. It also reveals that, despite the above forecasts, confidence levels among companies in the sector remain robust, with investment and recruitment intentions increasing on those in Q4 2023.

According to the survey, the balance on output fell significantly at the end of last year but is expected to rebound in the next three months. Total orders remained at similar levels but, likewise, are also forecast to improve over the same period.

Similarly, in the previous quarter, both UK and export orders were flat but are both predicted to improve, while the post pandemic pattern of UK orders consistently exceeding export orders looks likely to continue after a brief reversal in Q4 2023.

Underlying sectoral and regional imbalances also look set to persist, with electronics, aerospace and food and drink powering ahead, whilst the South East and Wales are performing substantially better than other regions and devolved nations. *www.makeuk.org*

Contributing in a meaningful way towards the circular economy

Reconomy, a leading international circular economy specialist, has acquired Sudamin Rohstoff (Sudamin), Europe's foremost independent recycling broker and logistics expert specialising in the recovery of valuable metals from the iron and steel industry.

Based in Duisburg, Germany, Sudamin has established itself as a powerhouse in the recovery of zinc and other finite metals from the by-products of electric arc furnaces.

Sudamin's core business is the collection of valuable metal containing residues from electro-steel plants across Europe and delivering them to specialist recycling facilities, ensuring the environmentally sound and economically efficient transportation of materials, and fulfilling all necessary national and international documentation requirements to certify full regulatory compliance.

Alongside this core proposition, Sudamin also owns approvals and licences for brokering waste disposal and battery and black mass recovery services. The acquisition of Sudamin, therefore, enriches Reconomy's capabilities and complements the services provided by its brands such as Combineering and RLG to increase its importance to international customers.

For example, by leveraging Sudamin's extensive market presence in the steel industry, Combineering – Reconomy's Denmark based greentech development business – will combine its expertise in other inorganic industries to develop innovative solutions for steel industry by-products.

This acquisition reinforces Reconomy's position as a leader in the circular economy and marks another step in its international expansion strategy, ultimately pursuing the vision of a waste free world.

Guy Wakeley, chief executive at Reconomy, said: "Reconomy is delighted to partner with Sudamin, Europe's leading specialist in the recovery of zinc and other valuable metals from the by-products of electric arc furnaces. We see real potential to develop new recycling and recovery streams across our client base as the steel industry adapts to the opportunities of the circular economy."

Lars Vedel Jørgensen, founding director of Reconomy brand Combineering, said: "Combineering has known and worked with Sudamin for many years and we are looking forward to developing new solutions together with them. We see a big potential for delivering alternative raw materials from all the steel industries Sudamin works with and Combineering's end users."

Forging a sustainable path for the INDUSTRIAL HEATING industry

The Industrial Heating Equipment Association (IHEA) will host the Industrial Heating Decarbonization Summit (28-30 October 2024) at the Conrad Indianapolis, USA. With the theme, 'forging a sustainable path for the industrial heating industry,' the summit is being developed to provide a platform for those needing to explore all facets of decarbonisation as they relate to the industrial process heating industry.

IHEA president Brian Kelly explains: "With all the emphasis to reduce or eliminate carbon in our processes and the challenges that come along with this, there has never been a more opportune time to hold this summit. It will provide attendees with the opportunity to learn more about the different pathways that are possible to decarbonise their processes, along with tools and programs to assist in these endeavours. This is an event not to be missed and is unique in its offerings as we look to forge a sustainable path for the industrial heating industry."

Manufacturers face increasing pressures to become more environmentally responsible and the challenge to implement sustainable energy alternatives looms large for many companies. Rapid advancements in technologies and industry energy infrastructure make planning for sustainable industrial manufacturing a daunting task.

"At IHEA's 2024 *Industrial Heating Decarbonization Summit*, attendees will benefit from expert advice and practical experiences delivered by industry leaders implementing a wide variety of solutions for sustainable industrial process heating," notes IHEA's sustainability summit program chairman, Jeff Rafter. "Presentations will include a wide range of alternatives to reduce your carbon footprint. Panel discussions will explore best practices and real world experiences of major manufacturers leading sustainability trends. In total, the summit will provide an invaluable suite of information and networking for any company seeking to address advancements in more sustainable manufacturing."

A tabletop exhibition will be offered as part of the summit and registration is open. *For more information visit: www.ihea.org*

Acquisition strengthens process automation offering

Valmet has completed the acquisition of the Process Gas Chromatography & Integration business from Siemens AG. The closing of the transaction follows the agreement that was announced on 17 July 2023.

The Process Gas Chromatography & Integration business of Siemens AG is a market leader with its MAXUM II gas chromatograph platform, systems integration, and customer services offering. Gas chromatographs are used to measure the chemical composition in gases and evaporable liquids in all stages of production. With deep customer process knowledge in chemicals, liquefied natural gas (LNG), refining and biofuels, the business provides critical process insights to support its customers in ensuring and improving quality, sustainability and safety worldwide. The business employs around three hundred people, and its main locations are in the USA, Germany, and Singapore.

The acquisition is in line with Valmet's strategy and will further strengthen Valmet's automation segment and process automation offering with process industry gas chromatograph and process analyser systems offering. It also strengthens Valmet's automation systems business footprint in North America, Asia-Pacific, and Europe. The acquired business is integrated into Valmet's automation systems business line as a business unit called analyzer products and integration.

In FY2022, net sales of the business amounted to approximately €120 million. The value of the acquisition is €102.5 million on a cash and debt-free basis, subject to ordinary post-closing adjustments. The acquired business will be included in Valmet's financial reporting for the first time in Valmet's second quarter 2024 financial reporting.

Growth glimmers from SMES as they adapt recruitment approach

A new UK report into the skills and recruitment challenges of small and medium sized enterprises (SMEs) reveals that businesses plan to invest in their workforces by upskilling and recruiting through technical education, to plug skills gaps and meet ambitious growth plans in light of the cost of living pressures.

Now in its second year, *The Skills Horizon 2024 Barometer*, launched by the Skills for Life campaign in partnership with the British Chambers of Commerce, found that SMEs are adapting to continue investing in talent amidst a challenging economic climate.

Over half of UK SMEs agree that the top concern for the year ahead is increased running costs (51 per cent), with many also concerned about staff wellbeing linked to the cost of living (41 per cent). This has prompted two thirds of businesses to consider investing in low cost but longer term workforce recruitment tactics such as school leaver employment schemes (e.g. apprenticeships) (53 per cent in 2024 versus 50.9 per cent in 2023) and offering work placements (e.g. T Levels) (60 per cent in 2024 versus 55.2 per cent in 2023). SMEs consider the top benefits of these technical education options to be the opportunity to shape young talent (55 per cent), the ability to upskill existing team members (52 per cent), and to address skills gaps in the business (50 per cent).

Seven in ten SMEs (71 per cent) are looking to take an introspective approach by investing in their current workforce – a four per cent increase on last year – with three in five (60 per cent) considering offering training and employment schemes for existing employees to help plug skills gaps they foresee in the year ahead.

Reflective of the change in approach, are the current top skills SME employers are looking for in job candidates. "A particular level of qualification" might have once been a non negotiable on most job descriptions, but it is now at the bottom of the agenda (14 per cent). Instead, employers are open to more routes and seeking attributes that enable employees to thrive in a fast paced environment. The top traits employers will look for in 2024 are "a good work ethic" (38 per cent of employers agree), "a team player" (37 per cent) and "a quick learner" (31 per cent).

Reassuringly, diversity, equity and inclusion also remain crucial for employers, with two in five (40 per cent) hoping new talent recruited in 2024 will help diversify the workforce ahead of 2025 – this is up from 30 per cent in 2023.

Despite the financial challenges highlighted by SMEs, there is optimism for the year ahead as a high majority (86 per cent) of businesses plan to grow revenue in 2024, a three per cent increase from last year. On average, SMEs expect to grow 26.43 per cent in the next year and recession fears are down on last year's report (16 per cent in 2024 versus 26 per cent in 2023).

These ambitious targets may well be reflective of the advantage SMEs feel they have with nearly three quarters (73 per cent) believing they can be more agile than larger businesses when it comes to recruitment and upskilling their workforce. This ability to be nimble in their approach has already helped SMEs when it comes to setting up technical education routes and reaping rewards. Over the past year nearly three quarters (74 per cent) reported seeing other businesses benefit from the available schemes.

Minister for Skills, Apprenticeships and Higher Education, Robert Halfon, said: "This report is testament to the hard work and 'can do' attitude of our brilliant small businesses, and I know that they will welcome the positive forecasts for growth, which have improved thanks to crucial government investment in skills.

"We've transformed the skills landscape with expanded apprenticeships and new T Levels, revolutionising opportunities for young people to climb the ladder of opportunity towards their first job or further study, and giving businesses the skills they need to thrive."

A partner of the Skills Horizon Barometer, Jane Gratton, deputy director – public policy at the British Chambers of Commerce, said: "Investing in a skilled and diverse workforce makes good business sense and is crucial to addressing the economic challenges and opportunities that lie ahead.

"While experience and qualifications are valued at recruitment, businesses are increasingly looking to develop their workforce on the job. This means accessing a wide range of flexible, technical and vocational training to upskill their staff and create an internal pipeline of talent. They know this will put them on the best footing possible, as the workplace evolves and demand for new skills and knowledge emerges."

To find training and employment schemes for a business, as well as support on how to implement these, visit: find-employer-schemes.education.gov.uk/

EngineeringUK responds to apprenticeships reforms announcement

Prime Minister Rishi Sunak is promising to create up to 20,000 more apprenticeships with a series of reforms, including fully funded training for young people and cutting red tape for small businesses.

Following the announcement Beatrice Barleon, head of policy & public affairs at EngineeringUK, said: "We welcome the government's commitment to offer more support for apprenticeships, particularly recognising the need to support SMEs with taking on more apprentices.

"We are particularly pleased to see the focus for the support is on young people aged 21 or under. Refocusing some of the apprenticeship budget money for young people is something we have called for in our recent *'Fit for the future'* report with Lord Willetts and Lord Knight.

"While these measures are certainly a step in the right direction, more still needs to be done to ensure our apprenticeships system is a success. Government needs to consider the recommendations put to them as to how to better support SMEs with the processes surrounding apprenticeships and how to better help young people to be able to access the opportunities available and be ready for work.

"It's clear there is still an apparent, and growing, mismatch between levy intake and the apprenticeship budget. In light of apprenticeship numbers needing to grow to meet demand in the engineering and technology sector, we would like to see greater transparency as to how this additional money is currently being spent." *www.engineeringuk.com*

SAVE THE DATE

Institute of Refractories Engineers

Annual Conference 2024

Sustainability for a Low Carbon World

13 November
Van Dyk by Wildes, Derbyshire, UK

Following the increasing success of the *IRE Annual Conference*, this year's event has been relocated to a larger venue, providing the opportunity for even greater networking possibilities.

Once again industry experts will impart their knowledge on a range of subjects as the global refractories sector works towards a reduction in carbon emissions for a more sustainable industry and indeed world.

- **TECHNICAL PARTICIPATION**
  Presentations are sought from interested parties, for more information contact Georgina Nicol on secretary@ireng.org

- **DELEGATES**
  Tickets will be released in the coming weeks, including special rates for IRE members and students. Keep checking social media and the IRE website for more details.

- **IRE TRAINING DAY – BEYOND THE DATA SHEET**
  Once again, the popular *IRE Training Day* will be held after the conference on 14 November at the same venue. This year's theme will be *'Beyond the Data Sheet'*. More information about what to expect from this day of expert tuition will be released in due course.

IRE Golf Day

The IRE is organising a Golf Day to take place in Q2 or Q3 this year at Wortley Golf Club, Sheffield (UK).

The day will provide an excellent opportunity to catch up with fellow golfers and take to the fairways at this highly regarded golf course. It's a chance to tee off with colleagues, customers and suppliers in convivial surroundings, then enjoy a social catch up when reaching the 19th!

More details, including the confirmed date, will be released in the coming weeks so please refer to the website regularly for booking details.

www.ireng.org

In view of the urgent necessity to switch from conventional technologies to CO_2 neutral and green energy sources, Otto Junker Solutions has developed an innovative power-to-heat system which allows a sustainable and efficient energy production across all branches of industry.

Image Source: Shutterstock

POWER-TO-HEAT TECHNOLOGY for sustainable industrial processes

For a successful energy transition, a change from conventional technologies which are mainly based on the combustion of fossil fuels towards new, more efficient technologies based on CO_2 neutral and green energy sources, is indispensable. The most popular energy source of this kind is power from renewable sources such as wind power and photovoltaic. It is therefore logical to push forward technological development on that basis.

To achieve CO_2 neutrality, an electrification of the transport, construction, industry and agricultural sectors is necessary. While heat pumps replace oil heaters and electrify the construction sector and e-mobility starts replacing petrol and diesel engines, the industrial sector still produces 72 per cent of process heat by means of fossil fuels, mainly gas.

Otto Junker Solutions is addressing this challenge and has developed a power-to-heat plant which, by means of electrical resistance, manages to heat up air to temperatures of up to 1,200°C. Apart from the direct use of hot air, e.g. in drying processes or the heat treatment of metal, the generated heat can also be used for a number of subsequent processes, such as the transfer to thermal oil by means of a heat exchanger or for steam generation. This extends the range of applications to the food, paper and chemical industries. A huge advantage is the fact that when changing from gas to power, the existing production plants can mostly be kept and can also be operated with both gas and the air heater, i.e. hybrid. This gives a certain degree of energy independence and crisis resilience in times of highly fluctuating energy prices as a consequence of international conflicts. Apart from that, additional cost advantages are created which the companies can take advantage of.

However, there is another obstacle to the expansion of renewable energies: the volatility of power generation. In the future, there will be an increased demand for storage capabilities to keep photovoltaic and wind power systems from having to be switched off if more power than necessary is generated.

USING SURPLUS POWER

Potential solutions for this are large battery storage, hydrogen electrolysis or gravity storage. However, high temperature heat storage is a far better solution, because it offers significant advantages, particularly for companies in the production industry. Using this concept allows the transformation of volatile energy into heat and its storage at low cost. The increasing number of renewable energies available in the electricity network is expected to cause more frequent fluctuations and low price periods in the power market. By combining a power-to-heat system with heat storage, these periods can be used to significantly save costs. On top of that, the system can generate additional income because transmission system operators are obliged to keep the network frequency constant at 50Hz and pay huge compensations for this.

The power-to-heat technology by Otto Junker Solutions offers a lot of potential for the reduction of CO_2 emissions and environmental protection. In various branches of industry, e.g. the food, wood, paper and plastic sectors, it allows an almost climate neutral production. In Germany, these sectors alone account for approximately 25 per cent of the overall energy consumption in industry. In the industry sector as a whole, the new technology can achieve an electrification of the process heat production of up to fifty per cent.

APPLICATION EXAMPLE

A typical paper factory in Germany requires approximagtely 41.7GWh of energy per year, with most of it being required for heat production. Based upon the current frequency and duration of low price

periods in Germany, this results in around two charging cycles per week of six hours each. This means that 267.3MWh of useful energy must be stored per cycle, i.e. heat energy which is above the temperature level of the processes. To be able to rapidly store this energy within six hours, the typical paper factory will require a power-to-heat plant with a power of 44.6MW. Without heat storage, approximately 3.2MW would be sufficient. The heat from the power-to-heat plant or stored in the heat storage can be used for steam production by means of a waste heat boiler of the type which is also used in powerplants. This can then be taken to wherever it is required via ducts and used for, say, drying processes.

The potential of this system with regards to environmental protection and CO_2 reduction is enormous. With a sufficient amount of green power, production in branches such as food, wood, paper and plastic can be completely climate neutral. In Germany, these sectors alone consume about 25 per cent of the energy in industry, in Europe it is even more than thirty per cent. The technology allows an electrification of process heat production in industry sectors by up to fifty

Application scheme. Source: OTTO JUNKER SOLUTIONS GmbH

per cent (34 per cent according to McKinsey, 41 per cent according to AEE), because many processes require heat between 100 and 1,200°C. Decarbonisation of these industries, in particular, will have a major impact, because they are particularly energy intensive. Just looking at the use of the air heater without heat storage in Europe, about seven per cent of the overall energy consumption could be electrified with just €17.4 billion.

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[Figures based on Eurostat: https://ec.europa.eu/eurostat, 2022 and AEE https://www.unendlich-viel-energie.de/, 2022.]

New report shows increase in the number of businesses INVESTING IN ENERGY EFFICIENCY

A new report from the Energy Efficiency Movement has revealed that 99 per cent of businesses are already investing in, or are planning to invest in, making their energy usage more efficient. Notably, the number of businesses actively investing in energy efficiency has increased by seven per cent from two years ago. The report, entitled 'From Insight to Implementation: Business Perspectives on Energy Efficiency Investments' found that of the businesses investing, or planning to, 41 per cent cite the next twelve months as the timeframe for making these improvements.

Published ahead of the International Energy Agency's ninth *Energy Efficiency Conference*, which will be held in Nairobi, Kenya in May this year, the survey sought to investigate energy efficiency investment readiness. This survey was a follow on from its previous *Accelerating Ambition* survey conducted in 2022 and sought to analyse differences compared to 2022 across industries.

Moving data to the cloud (71 per cent) is the most common energy efficiency measure currently invested in by businesses, followed by performing energy efficiency audits (69 per cent), and improving energy efficiency of cooling systems (64 per cent). Businesses cite several key reasons for investing in energy efficiency. Over half (52 per cent) aim for cost savings, 48 per cent prioritise corporate sustainability commitments, while 41 per cent seek to improve energy resilience.

The global survey conducted in February 2024 gathered responses from 1,282 business leaders across thirteen countries, including China, Germany, Italy, the US, the UK, India, Sweden, Brazil, Spain, Mexico, Malaysia, Indonesia, and Argentina. Notably, there were large variances between respondent answers from different countries. For example, while moving data to the cloud was overall the most common energy efficiency measure invested in by businesses, only 56 per cent of businesses in China were undertaking this measure and this percentage jumped to 80 per cent for businesses in Mexico. Similarly, 77 per cent of Indonesian businesses are installing connectivity to their physical assets, while only 40 per cent of businesses in Sweden are doing so.

Respondents represented a range of industries such as manufacturing, transportation, energy generation and heavy industry, and reflected varying business levels – from owner and executive to managers and specialists.

While there is optimism and appetite among businesses to invest in energy efficiency, the survey also identified barriers. Remaining high costs (53 per cent) were seen as the highest barrier to improving energy, followed by downtime or disruption (34 per cent), and a lack of specialist resources (33 per cent) and digital skills (30 per cent). Notably, the number of businesses unsure of how to improve energy efficiency decreased in the two years since the previous survey (from 24 per cent in 2022 to 19 per cent in 2024). This shows that businesses are becoming more familiar with energy efficiency, again reflected in the fact that most respondents (93 per cent) feel that they have somewhat had access to support or information on energy efficiency.

There are growing concerns among industry leaders over the lack of grid power for businesses in the coming years, with 41 per cent of businesses expressing at least moderate concerns about the limited supply for production. To combat this, businesses are adopting energy efficiency measures (44 per cent), introducing on site renewable energy sources (42 per cent), and installing backup generators (38 per cent) among other actions.

To read the full report visit: www.energyefficiencymovement.com

In March Eletrobras, the foremost electric power company in Latin America, and Paul Wurth, a brand of the SMS group, officially entered into a memorandum of understanding (MoU) to collaborate in the renewable hydrogen (H_2) production and use in industrial processes in Brazil.

Exploring the potential supply of renewable hydrogen to industries in Brazil

A 10MW plant for green H_2 and O_2 production will be established in the neighbourhood of a steel plant and the studies for installation are expected to conclude in one year. Once completed, the plant's capacity will be 37 times greater than Eletrobras' Renewable Hydrogen Technology Development and Demonstration Platform located at the Itumbiara Hydroelectric Power Plant, on the border between Minas Gerais and Goiás.

The partnership embodies the synergy between the strengths of both organisations. Eletrobras, renowned for its expertise in clean electricity generation with 97 per cent of green energy matrix, joins forces with the solid 150-year track record of the SMS group, specialised in providing solutions for the metals industry. With the strategic incorporation of Paul Wurth, the SMS group has emerged as a forerunner in the development of green solutions.

"Eletrobras has been advancing towards its goal of providing customers with decarbonisation tools for their production, with green hydrogen now complementing hydroelectric generation in delivering clean energy. Our partnership is fully aligned with our net zero targets and the pursuit of new business opportunities, all while maintaining a steadfast commitment to environmental and social responsibility," said Ítalo de Freitas, vice president of commercialization and energy solutions, Electrobras.

"The SMS group is committed to providing sustainable solutions on a global and national scale. The co-operation with Eletrobras represents a significant step in this direction," said Paulo Pinheiro, managing director of Paul Wurth Brasil. "By combining Eletrobras' remarkable expertise

The partnership entails co-operation between the companies to assess the feasibility of renewable hydrogen production in Brazil, aiming to promote decarbonisation in the steel industry's industrial processes.

Image Source: Shutterstock

in clean energy and extensive reach with our technological know-how, we are not only advancing in the development of renewable hydrogen but also making its use more accessible. For this reason, we have determined that the construction of the plant would be in a strategic location, adjacent to major industrial plants. This decision aims to streamline the transportation and efficient utilisation of renewable hydrogen, which initially will replace natural gas in industrial processes. On a larger scale, it could serve as an alternative to various fossil fuels currently in use."

Decarbonisation technologies for the metallurgical industry

The signing of this memorandum is the culmination of a project initiated two years ago, marked by the signing of a confidentiality agreement between Eletrobras and Paul Wurth, a brand of the SMS group. This agreement aimed to align efforts in seeking environmentally sustainable solutions for the metals industry, with a focus on decarbonising the steel industry through the use of renewable hydrogen.

This commitment has triggered a series of feasibility and conceptual engineering studies, resulting in the current outlook of installing a renewable hydrogen production plant close to the main steelmaking hubs in the country, presenting a significant potential demand for green H2.

SMS group is renowned worldwide for its future oriented technologies and outstanding service for the metals industry. The company applies its 150 years of experience and its digital know-how to provide the industry continuously with innovative products and processes – even beyond its core business – and generates worldwide sales of around €3.1 billion. Paving the way for a carbon neutral and sustainable metals industry is the company's stated goal. *www.sms-group.com*

Image Source: Shutterstock

Groundbreaking project for GASEOUS HYDROGEN STORAGE AND DISTRIBUTION

A groundbreaking project set to revolutionise gaseous hydrogen storage and distribution solutions has been launched and includes expertise from the University of Sheffield AMRC.

The new Hydrogen Storage as a Service (HySaaS is being funded by Innovate UK and is a collaboration between the AMRC, University of Sheffield, Chesterfield Special Cylinders, Element 2 and HIVE hydrogen.

Partners will focus on three main areas: operator cost optimisation, enhanced safety and business model innovation, which aims to assess the feasibility of significantly reducing the capital cost of hydrogen storage via the HySaaS business model.

Stuart Dawson, chief engineer for hydrogen at the AMRC, said: "We're delighted to be a partner on this project, as it is a clear example of how our expertise in the Industrial Internet of Things (IIOT), can be tangibly applied to enable cylinder level condition monitoring to lower capex barriers, enhance safety and enable new business models."

Frank Ashton, hydrogen business development and partnerships manager for Chesterfield Special Cylinders, added that the business brings many decades of successfully providing hydrogen storage solutions to the project. "We are delighted to play a central part in bringing together this project collaboration, which won support from Innovate UK," he said.

"Ultimately, we believe it will accelerate decarbonisation through the earlier adoption of hydrogen thanks to lower than anticipated entry costs for hydrogen storage solutions, and by increasing the operational 'uptime'."

The chief operating officer for Element 2, James Harris, explained: "Effective transport and storage of hydrogen is a cornerstone of the UK's low carbon economy and is an area ripe for innovation.

"Element 2 is excited to be part of this innovative project team, and to support the consortium in designing and running a successful pilot.

"Ultimately, the technical and economic learning that this project provides will help the industry to improve quality, reduce lifetime operational costs, and to accelerate our plans for growth with confidence."

www.amrc.co.uk

MAIN FOCUS AREAS

Let's consider the three main focus areas for the project a little more closely.

1. Operator cost optimisation

The HySaaS project is expected to reduce the capex costs required for storage and distribution for hydrogen refuelling and other small to medium scale value chain projects from the levels currently seen at this early stage of market development. The project will evaluate the operator cost benefits of a service model which includes 'renting' instead of selling hydrogen storage modules. Potential secondary benefits include increased operational 'uptime' and life of hydrogen storage and distribution solutions, thus, reducing operators' total cost of ownership at the same or better levels of safety.

2. Enhanced safety

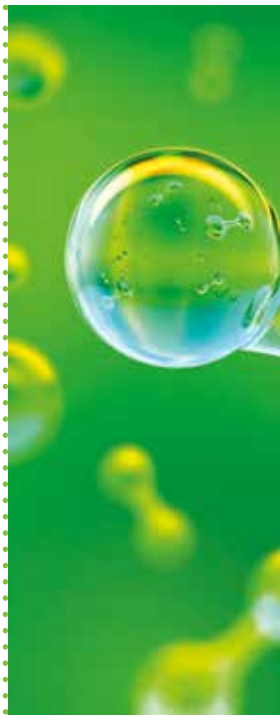
Condition monitoring of gaseous hydrogen pressure vessels is sometimes applied at a bundle level, where multiple cylinders are assessed as a unit. However, service conditions for individual cylinders can vary greatly over time, depending on operating parameters. Project HySaaS will explore the feasibility of cylinder level monitoring, therefore allowing more precise risk identification, and more frequent data collection to inform optimised preventive maintenance actions.

3. Business model innovation

The project will assess the feasibility of innovative deployment of a rental business model for hydrogen storage and distribution assets by exploring the stakeholder, technical and commercial implications of its long term use. This work will provide insights on how to deliver stakeholder and commercial solutions and to make this business model work alongside traditional sales models.

Diana Raine, HIVE Hydrogen director, shared her thoughts on the collaboration: "The HySaaS project provides the perfect opportunity to examine how new offerings can help optimise and accelerate the UK's hydrogen market whilst improving operational safety for the whole sector.

"We are excited to be part of this collaborative effort that has the potential to drive positive change."



Tyneside operation aiming for eight tonnes of green hydrogen per day

Global green and renewable hydrogen pioneer Lhyfe has unveiled plans for its first UK plant to support the country's net zero ambitions.

The company's proposed facility in the north east of England is receiving support from Shepherd Offshore, a leading maritime and energy service provider, following the signing of a land deal.

If plans are approved, Lhyfe's facility on the brownfield site of the historic Neptune Bank Power Station in Wallsend, North Tyneside, would have an initial capacity of 20 megawatts (MW), capable of producing up to eight tonnes of green hydrogen per day.

As an equivalent, eight tonnes would enable a hydrogen truck to travel approximately 100,000km without emitting any CO_2. With the same quantity, a car could go around the Earth twenty times or travel around 800,000km.

Named Lhyfe Wallsend, this plant aims to supply a range of organisations seeking to decarbonise their manufacturing and transport operations.

Lhyfe (EURONEXT: LHYFE) is one of the world's pioneers in the production of green and renewable hydrogen through water electrolysis, with its units being powered by green electricity.

Water is fed into the electrolyser, which is split into hydrogen and oxygen meaning the only by-product is oxygen.

The France based multinational's first plant in Pays de la Loire, Western France, has been operational since the second half of 2021, with two more sites inaugurated in the Occitanie and Brittany regions in December 2023. Several other sites are currently under construction or extension across Europe.

The announcement came eighteen months after Lhyfe launched its UK subsidiary, headquartered in Newcastle, to meet the increasing demand from companies aiming to reduce their reliance on natural gas and other fossil fuels.

In the UK, Lhyfe aims to become a major supplier to energy intensive industries and transportation, boosting the country's energy security and creating new economic opportunities. It also has ambitions to develop offshore hydrogen production, tapping into the huge offshore wind potential the UK offers.

The proposed plant will occupy four acres of leased industrial zoned land along the north bank of the River Tyne. This site was once part of the Neptune Bank Power Station, an early 20th century pioneer in high voltage power distribution and a model for the National Grid.

Lhyfe Wallsend will use green electricity from the grid, complying with the UK Low Carbon Hydrogen Standard. The company is also exploring options to source power from local renewable assets, such as solar and wind.

Lhyfe is in advanced talks with several energy intensive businesses in the area and across the UK, including those with transport fleets that could use hydrogen in their operations. Companies and sectors looking to decarbonise are encouraged to contact Lhyfe to discuss opportunities to collaborate.

The project is subject to obtaining notably building permission and a financial investment decision.

Chief business officer at Lhyfe, Taia Kronborg, said: "We are excited to announce North Tyneside as the site for our first UK green hydrogen production project. The development of green hydrogen projects is critical if major energy users are to decarbonise their operations. We hope this project will not only help the north east but the whole of the UK reach its net zero targets.

"At Lhyfe, we are demonstrating that green hydrogen is now a reality and a key driver of the clean energy transition. We have a strong ethos of working with partners and communities to create projects that deliver real local value, and this is a key focus in growing our operations in line with demand."

www.Lhyfe.com

Calderys is participating in HYDREAMS, an innovation project financed by the European Union addressing the challenges of the energy transition in the steel industry.

Playing a key role in the GREEN HYDROGEN REHEATING revolution

HYDREAMS, a project co-ordinated by French firm UGITECH, part of the Swiss Steel Group, aims to remove carbon emissions from steel treatment thermal processes by using green hydrogen made from renewable energy sources. Its stated objective is full decarbonisation of thermal processes for steel reheating and heat treatment by means of clean hydrogen oxyfuel combustion. The process will also improve the energy efficiency of the thermal treatments, and simultaneously cut nitrogen oxide (NOx) emissions.

CALDERYS INVOLVEMENT

By replacing natural gas with green hydrogen as a fuel source in reheat furnaces, steelmakers may have to adapt their industrial processes and their plant. As the only refractory maker involved in the project, Calderys will study how modifications made to the furnace – to allow the use of hydrogen in the combustion process – affect the refractory lining. Based on the data obtained, Calderys will re-engineer, or manufacture new refractories, as necessary, to withstand the conditions inside the modified, green hydrogen powered furnace.

Global vice president, innovation & technology at Calderys, Bruno Touzo, said: "I'm excited to see our teams of experts entering international research projects and placing their refractory expertise at the service of steelmakers making the energy transition. These projects are perfectly aligned with the journey on which we have embarked as a company – to strengthen our innovation at the service of our customers, their industries and the planet."

It is expected that successful completion of the HYDREAMS project will lead to investment decisions for deployment of green hydrogen reheating furnaces in at least five steel plants in Europe.

THE FUTURE IS GREEN HYDROGEN

According to the EU, renewable energy, including renewable hydrogen, is a central pillar of the REPowerEU Plan*. As well as increasing Europe's energy security, green hydrogen is important in the EU's push for net zero emissions, with a target to achieve a reduction of 55 per cent by 2030, compared to levels measured in 1990 *(Source: European Union, Energy)*

DIGITAL TWIN

Calderys is a key partner – and the sole supplier of refractories, in the Spain based TWINGHY project. As its name suggests, this project to modify the heat transfer process in reheating furnaces is being developed alongside a digital 'twin', which will be used to control the combustion of hydrogen and oxygen in hybrid burners. The aim of the project is to deliver significant carbon dioxide emission reductions while also saving energy and maintaining low nitrogen oxides (NOx) emissions.

Like HYDREAMS, TWINGHY is financed by the European Union under the Research Fund for Coal and Steel (RFCS). Initiated in the summer of 2023, the TWINGHY project will run until 2027.

Touzo said: "We'll be involved in many more hydrogen greensteel projects in the coming years, as the industry moves towards the EU's targets for zero emissions. What we're learning with HYDREAMS and TWINGHY will eventually bring operational and cost benefits to all our customers, and sustainability, not just in Europe, but worldwide."

WHAT IS GREEN HYDROGEN?

In industry, hydrogen is produced by the electrolysis process, which uses electricity to separate water into its constituent, atomic parts of hydrogen and oxygen. This simple, but energy intensive process allows the hydrogen to be caught and stored for use as a highly combustible, clean burning and efficient fuel.

To produce green hydrogen, the electrolysis process is powered by electricity generated by renewable sources, instead of fossil fuels. If one hundred per cent renewable sources (solar, wind and hydro) are used, the hydrogen is made with zero carbon emissions. Hence, green!

**** Launched in May 2022, REPowerEU is a program launched by the EU, helping EU:***

- ***Save energy.***
- ***Produce clean energy.***
- ***Diversify its energy supplies.***

More information: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

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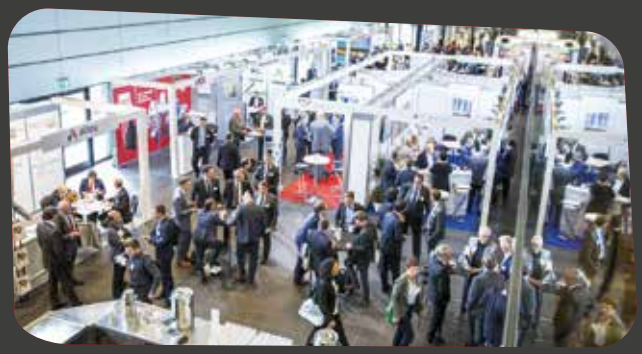

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THREE DECADES OF ALPHABOND 300: an overview of its technical advantages

Stefan Kuiper – Almatis BV, Rotterdam, The Netherlands; Dagmar Schmidtmeier, Sebastian Klaus, Andreas Buhr – Almatis GmbH, Frankfurt/Ludwigshafen, Germany; and Jerry Dutton, Stourbridge, UK

ABSTRACT

Alphabond 300 has been used in many applications since it was developed three decades ago. In this paper an overview is presented of the different technical advantages for applications where Alphabond 300 is used. Alphabond 300 is a calcia-free hydratable alumina based on pure alumina. In castables containing components such as silica and magnesia the melting temperatures could be reduced when calcia is present in the binding system. Therefore, better refractory properties could be achieved with Alphabond 300. The specific surface area of Alphabond 300 is up to 300m²/g and therefore the right castable formulations need to be selected, having good water demand and rheological behaviour. In general, the cured strength is lower in castables with Alphabond 300 compared to those using calcium aluminate cement. In addition to using Alphabond 300 as a binder it is also used to improve the properties of cement based castables. Flow and setting properties are more robust when small amounts of Alphabond 300 are added to cement based castables. This is especially true when silica fume of fluctuating quality is used. More reliable castable performance can be achieved with an addition of Alphabond 300.

INTRODUCTION

Alphabond 300 was developed in the 1990s as a hydratable alumina binder[1]. Since then it has been used in several applications to improve the refractoriness of castables in the side wall and bottom of steel ladles, delta sections of electric arc furnaces or ladle furnaces, and in precast refractory shapes[2-3]. To obtain the right performance of refractory castables, a selection of the right components must be made. Castables may contain components with different metal oxides; most individual metal oxides such as alumina, silica, calcia or magnesia have high melting temperatures. When sintering occurs at higher temperatures these components will convert to the most thermodynamically stable phases. In most cases the phases formed will have lower melting temperatures than the original components and the refractoriness of the final material could be lower. In castables with alumina, magnesia, silica and calcia the lowest melting temperature could be increased significantly by leaving out calcia. This can be achieved by replacing calcium aluminate cement as the binder with hydratable alumina. Alphabond 300 is an amorphous alumina with a high specific surface area of around 300m²/g[4]. This makes the alumina soluble and alumina hydrates are formed which will lead to strength development. The first types of Alphabond – Alphabond 100 and Alphabond 200 – were developed with additives to obtain good rheological properties. In the 2000s Alphabond was further developed and improved and Aphabond 300 was introduced to the market. Alphabond 300 is free of additives. Following this, another additive containing Alphabond, Alphabond 500, was introduced[5]. However, this did not succeed in the market because the additive-free version is preferred by customers because of its higher flexibility in castable formulation. The dispersion and setting can be controlled with the accelerating and retarding dispersing aluminas or with other standard additives systems used in refractory castables[6].

In addition to using Alphabond 300 individually as a binder it may also be used in combination with cement. Additions of Alphabond 300 to cement containing castables will cause interaction between the binders[7]. During the hydration of calcium aluminate cement, calcium and aluminium ions are dissolved into the pore solution and hydrates based on the

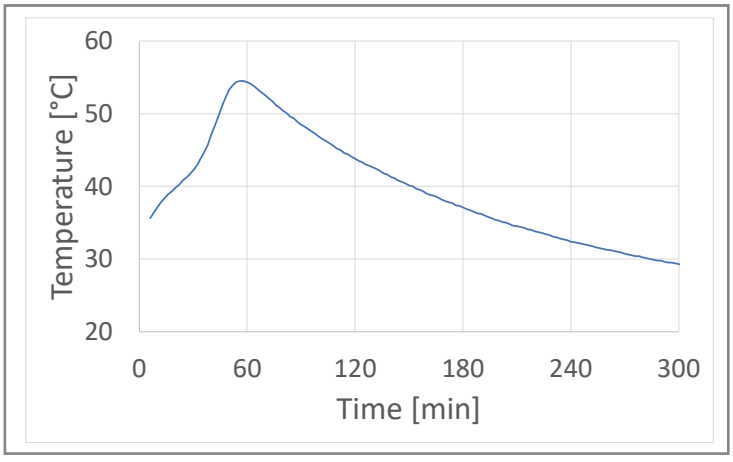

Fig.1 Exothermal measurement hydration Alphabond 300 with water (1:1)

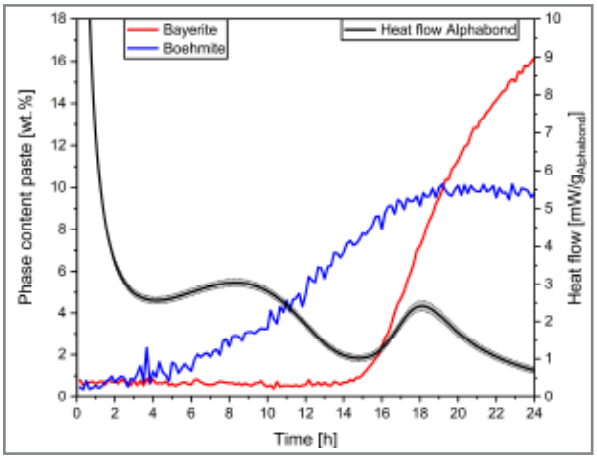

Fig.2 Heat flow calorimetry of Alphabond (black line) and phase development by in-situ XRD of Boehmite (blue line) and Bayerite (red line)

hydroxides of calcium and aluminium are precipitated. Alphabond 300 provides additional aluminium ions in the pore solution which influences setting and flow properties of the cement hydration.

In this paper a compilation of research on the technical advantages of Alphabond 300 are reported.

Hydration behaviour of pure Alphabond 300

Alphabond 300 is very hygroscopic and starts to hydrate immediately when it comes into contact with water as shown in fig.1. Here a mix containing 50 weight% Alphabond and 50% water was investigated. The temperature of the mixture rises immediately when Alphabond 300 is mixed with water and in about an hour the temperature is higher than 50°C.

Heat flow calorimetry and in-situ XRD were performed to determine the hydration mechanism of Alphabond 300. The overlay of the results from both measurements are plotted in fig.2. Three different heat flow events could be determined. The first peak is a sharp intense peak which is related to the interaction of the amorphous alumina with water. During the first heat flow event no hydrates are formed and therefore workability during this period could be expected. After four hours the first hydrate formed is Boehmite which is correlated to the second heat flow event. After 16 hours the third heat flow event occurs which is related to the formation of Bayerite. The formation of hydrates is slower for Alphabond 300 than with calcium aluminate cement[8]. With the slower formation of hydrates slower strength development can also be expected.

Alphabond as a binder in castables

The properties of an Alphabond 500 (3wt%) based castable (NCC) were compared to an ultra-low cement (2.5wt%) based castable (ULCC) by Kockegey-Lorenz[4]. As Alphabond 500 behaved like Alphabond 300 with dispersing aluminas ADS/W, the results are also representative for Alphabond 300. The castables were based on alumina, spinel, magnesia and silica fume. Similar hardening times and flow behaviour could be achieved by using 0.5wt% ADS 3 and 0.5wt% ADW 1 for the ULCC compared to the NCC based on Alphabond 500 which contained additives. It has to be noticed that the wet-out time of Alphabond 500 is clearly higher than cement based castables.

The 24 hours curing strength of the NCC is higher than that of the ULCC. For a cement based castable the strength could

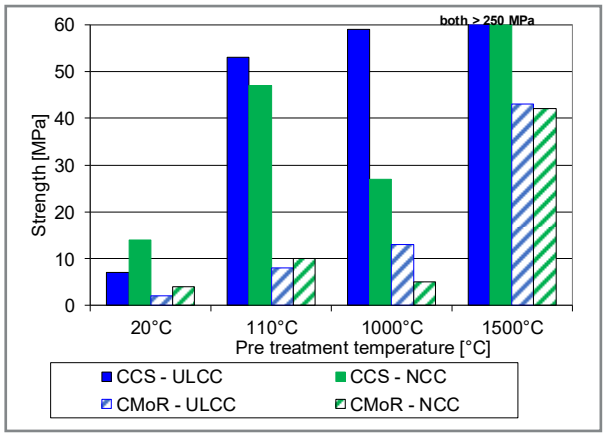

Fig.3 Strength development of different temperature treatments of NCC and ULCC

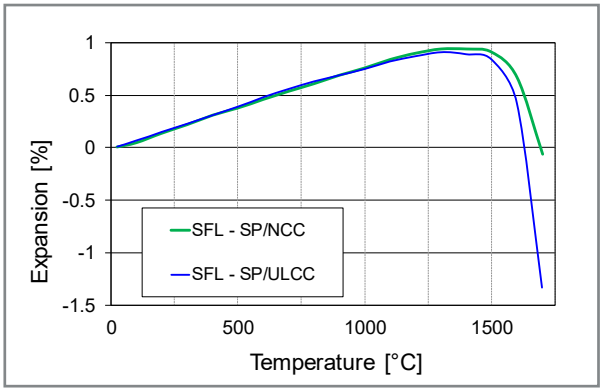

Fig.4 Refractoriness under load of calcium aluminate cement based castable (ULCC) and Alphabond 500 based castable (NCC)

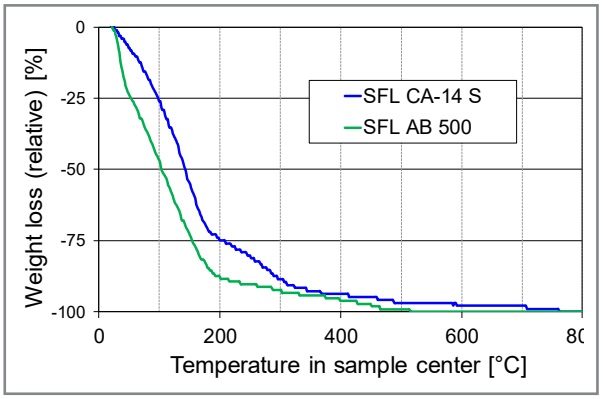

Fig.5 Water loss over time of calcium aluminate cement bonded castable compared to Alphabond 500 bonded castable

be increased by increasing the cement content, as shown in fig.3. When Alphabond 300 is used as a binder, its content cannot easily be increased due to the high specific surface area of Alphabond 300. With a higher Alphabond 300 content the water demand will be increased which negatively impacts the strength properties. Therefore, a binder content of 3wt% is recommended when using Alphabond 300. The strength levels are increased when the cured bars were dried at 110°C for another 24 hours. The strength levels of the NCC and ULCC are similar. The strength of the NCC is lower after dehydration at 1000°C, while the strength of the ULCC increases at 1000°C. When the bars were further sintered at 1500°C high sintering strength was obtained for the CAC containing castable and for the Alphabond 500 containing castable. The strength is measured when the bars were cooled to room temperature. The liquid phases which were present in the calcia containing castable were crystallised or solidified as amorphous glass phase and didn't affect the strength at low temperature.

The lowest melting temperature of the material will determine the refractoriness of a material. When the material is exposed to high temperatures and pressure the material starts to deform when a melt is formed. The occurrence of melt and its formation temperature in a castable can be determined by refractoriness under load. The dimension change during heating is measured and shown in fig.4. When there is no melt present the materials expand with increasing temperature. Even with small amounts of molten phase, the material starts to contract as the liquid phase acts like a lubricant in the refractories. The deformation occurs at lower temperatures and is more pronounced in the calcia containing castable then in the NCC, due to the low cement content in a ULCC, where the

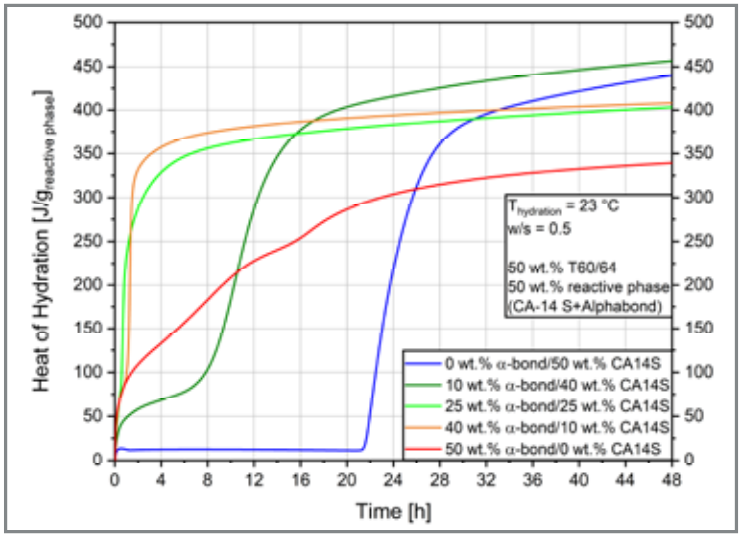

Fig.6 Cumulative heat flow calorimetry curves of mixtures of Alphabond 300 and CA-14 S as binder

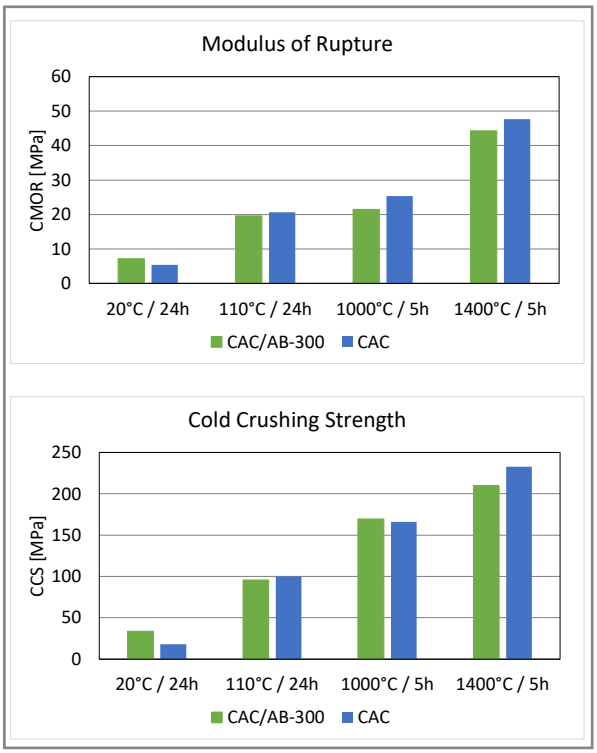

Fig.7 Strength development of different temperature treatments of NCC and ULCC. Cold modulus of rupture (top) and cold crush strength (bottom)

calcia level was only 0.7%. It is expected that a castable with higher calcia content such as a LCC, will form more melt which will impact the refractoriness under load even more.

Drying tests were performed with cubes (40 * 40 * 40mm) from a self-flowing castable based on CAC and Alphabond[4]. The weight loss was measured as a function of temperature and the drying curves are plotted in fig.5. The cubes were cured for 24 hours then dried with a heating rate of 1°C/min while hanging in a furnace equipped with a mass balance. The weight loss of the NCC occurs at lower temperatures than the LCC. This means that when Alphabond is used lower temperatures are sufficient to dry the castables.

During the development of Alphabond there were concerns that castables based on Alphabond 300 would be more susceptible to explosive spalling, due to the formation of aluminium hydroxide gels. Although Alphabond 300 has been used in the refractory industry for three decades there are no major issues reported relating to explosive spalling. The lack of reports on explosive spalling with Alphabond 300 based castables is in line with the results from this drying test.

		LCC-CAC/AB-300	LCC-CAC
Tabular T60/T64		77	77
Raw Kyanite		5	5
Reactive alumina		10	10
Silica fume		3	3
Binder	AB-300	1	
	CA-14 M	4	5
Additives	M-ADS 1		0.7
	M-ADS 3	1	
	M-ADW 1		0.3
Water		4.5	4.5
Self Flow	10 min	258	205
	30 min	248	223
	60 min	184	202
EXO	Start 1	77` / 24.6°C	65` / 24.3°C
	Start 2	4.2 h / 27.1°C	3.4 h / 26.3°C
	Max	5.8 h / 30.8°C	5.4 h / 28.8°C

Table 1: Recipe of silica fume based LCC

Interaction of Alphabond 300 with cement

Model experiments were performed to understand the interaction between Alphabond 300 and CAC. Heat flow calorimetry was performed with pastes of 50wt% fine tabular alumina (-45 microns) and 50wt% binder. The binder was a mixture of CA-14 S and Alphabond 300 with mixing ratios of, 50/0, 40/10, 25/25, 10/40, 0/50. The results are shown in fig.6.

As described above the formation of hydrates from Alphabond 300 is slow. When a 10wt% of CA-14 S is used with 40wt% Alphabond 300, the formation of the hydrates is accelerated. The formation of heat in the first hours is similar to that with pure Alphabond 300. Almost instantly, when the first hydrates start to form, a sharp heat of hydration peak is observed. This indicates that the strength development could be increased by adding small amounts of CAC. The dormant period of CAC is much longer compared to Alphabond 300. The setting time of CAC is accelerated when 10wt% Alphabond 300 is added to 40wt% CAC and could be even further accelerated by using a ratio with more Alphabond 300.

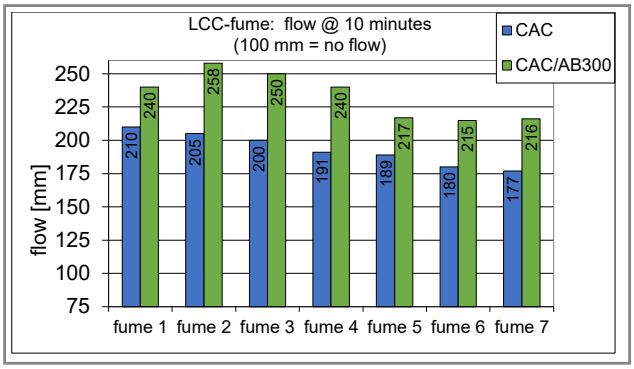

Fig.8a Flow values after 10 minutes of LCC with different qualities silica fume

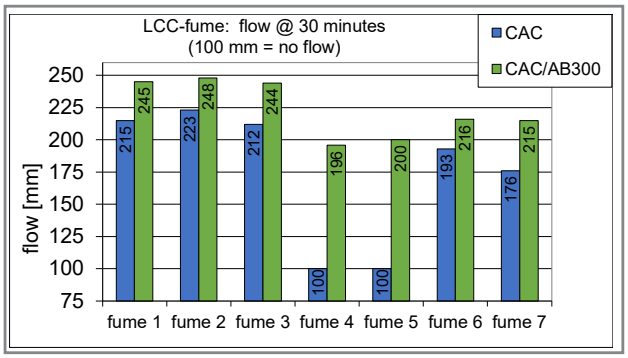

Fig.8b Flow values after 30 minutes of LCC with different qualities silica fume

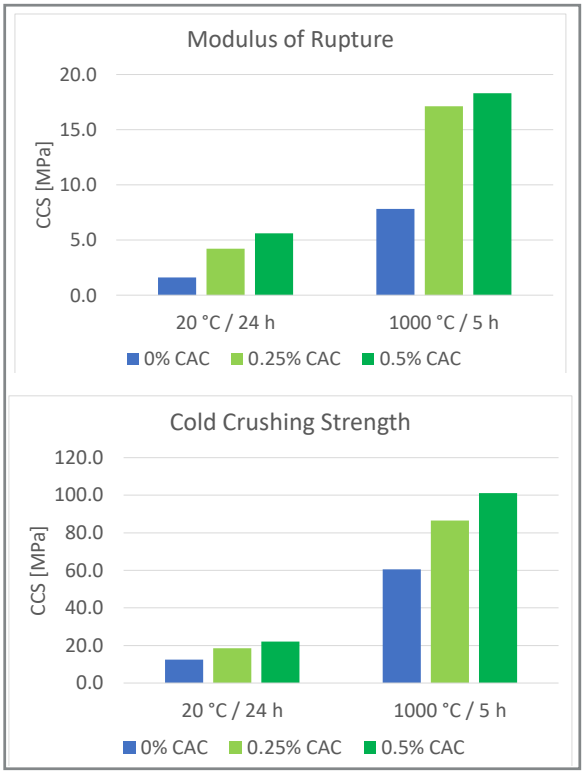

Fig.9 Strength development of different temperature treatments of NCC and ULCC. Cold modulus of rupture (top) and cold crush strength (bottom)

Addition of Alphabond 300 to a cement based castable

Alphabond 300 was used as an accelerator for a silica fume based LCC which is shown in table 1. 1wt% Alphabond 300 and 4wt% of CAC was used instead of 5wt% CAC. To achieve comparable workability and hydration times no accelerator (M-ADW 1) was used and instead of M-ADS 1, M-ADS 3 is needed to retard the hydration. With the same amount of water higher flow values were achieved.

A higher cured strength was obtained when Alphabond 300 was added, as shown in fig.7. This could be explained by the faster setting behaviour. The dried and fired strength levels from the castables of both binder systems are similar. The main advantage of the addition of Alphabond 300 could be seen in the setting and flow behaviour of the castable.

It is well known that different qualities of silica fume could negatively impact the flow behaviour, especially with regards to early flow decay[9]. Alphabond 300 improves the flow behaviour of the castables. Therefore, different grades of silica fume were used in the LCC. As expected, different flow properties were found as can be seen in figs.8a and 8b. For two grades of silica fume the standard castable ceased flowing after 30 minutes. Alphabond 300 counteracts against fluctuations with different silica fume grades. All silica fume grades still had good flow properties after 30 minutes when Alphabond 300 was added.

		NCC	NCC	NCC
Tabular		80	80	80
E-SY 2000		15	15	15
Reactive Al_2O_3		1.5	1.5	1.5
Silica fume		0.5	0.5	0.5
Binder	AB-300	3	3	3
Additives	ADS 3	0.8	0.8	0.8
	ADW 1	0.2	0.2	0.2
Water		4	4	4
CA-14 M		0	0.25	0.5

Table 2: Recipe for NCC with CAC additions

Addition of calcium aluminate cement to an Alphabond 300 based castable

In the model system with CAC and Alphabond 300 it is found that a relatively small amount of CAC will accelerate the hydrate formation and with that it is expected that the strength development will also be accelerated. To determine the impact on strength small amounts of CAC were added to alumina-spinel based NCC castables. The castable recipe used is shown in table 2. The calcia content is increased slightly when 0.25wt% or 0.5wt% CAC is added to the castable and the impact on the refractoriness is expected to be limited.

As shown in fig.9, with an addition of 0.25wt% CAC the cured strength increases from a modulus of rupture of 1.6MPa to 4.2MPa and the cold crushing strength increases from 12.4MPa to 18.6MPa. The strength could be increased even more when more CAC is added. A modulus of rupture of 5.6MPa and a cold crushing strength of 22.2MPa were obtained when 0.5wt% CAC was added.

The strength after firing the bars at 1000°C is also significantly improved with the addition of CAC. The modulus of rupture could be increased from 7.8MPa to 17.1MPa and 18.3MPa with additions of respectively 0.25wt% CAC and 0.5wt% CAC. The cold crushing

strength could be increased from 60.5MPa to 86.6MPa and 101.0MPa with additions of respectively 0.25wt% CAC and 0.5wt% CAC. It is clear that the accelerating effect of CAC on the hydrate formation of Alphabond 300 is having a positive effect on the final strength. The effect of the higher strength is even present after complete dehydration when the test bars were exposed to 1000°C.

Ageing and packaging

Alphabond 300 reacts immediately with water and therefore the shelf life is dependent on the storage conditions. Shelf life studies on castables containing calcium aluminate cement or Alphabond 300 show that the shelf life was still good after 11 months in multi layered paper-plastic bags. The shelf life of calcium aluminate cements could be increased significantly by changing multi layered paper-plastic bags to plastic bags[10]. The plastic bag is a good barrier for moisture and no moisture pick up was found for >10 years, when the plastic bag was still in a good condition[11]. Therefore, the shelf life of binders stored in plastic bags could be increased from 12 months to 24 months. The use of plastic bags for Alphabond 300 will increase the reliable performance, and stable hydrating properties can be expected as long as the plastic bags are in good condition.

CONCLUSION

Alphabond 300 could be used to replace calcium aluminate cement as a binder when calcia lowers the melting temperature in castables containing alumina, magnesia and silica. Castables based on Alphabond 300 have improved hot properties over cement based castables. The cured and dried strengths of castables based on Alphabond 300 is lower. It was found that if higher cured and dried strength is needed small amounts of CAC may be added to increase the strength significantly.

Alphabond 300 could also be added to CAC based castables which has an accelerating effect. The addition of Alphabond 300 also improves the flow behaviour and Alphabond 300 is counteracting against flow decaying impurities from within silica fume.

The shelf life of Alphabond 300 packed in plastic bags could be increased to 24 months.

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REFRACTORY GUNNING EQUIPMENT

Gunform (Equipment Supplies) Ltd
33 Carsthorne Road,
Carr Lane Industrial Estate,
Hoylake, Wirral,
Merseyside CH47 4FB
Tel: (0151) 632 6333 Fax: (0151) 632 6444
Email: info@gunform.com
Website: www.gunform.com

Markham (Sheffield) Ltd
Marspal House, Lawn Road Industrial Estate, Carlton-in-Lindrick, Worksop, Nottinghamshire S81 9LB
Tel: (01909) 730861 Fax: (01909) 733584
Email: sales@markham-sheffield.co.uk
Website: www.markham-sheffield.co.uk

REFRACTORY GUNNING INSTALLATIONS

Gunform International Ltd
33 Carsthorne Road,
Carr Lane Industrial Estate,
Hoylake, Wirral,
Merseyside CH47 4FB
Tel: (0151) 632 6333 Fax: (0151) 632 6444
Email: info@gunform.com
Website: www.gunform.com

S.H.L. Refractories (U.K.) Ltd
Celcius House,
Lawn Road Industrial Estate,
Carlton in Lindrick, Worksop,
Nottinghamshire S81 9LB
Tel: (01909) 731959 Fax: (01909) 731579
Email: sales@shl-refractories.co.uk
Website: www.shl-refractories.co.uk

REFRACTORY GUNNING MACHINES

VELCO GmbH
Haberstr. 40, 42551 Velbert,
Germany
Tel. +49 (0) 2051 2087.13
Fax +49 (0) 2051 2087.20
E-mail: cwolf@velco.de
Website: www.velco.de

REFRACTORY GUNNING ROBOTS/MANIPULATORS

VELCO GmbH
Haberstr. 40, 42551 Velbert,
Germany
Tel. +49 (0) 2051 2087.13
Fax +49 (0) 2051 2087.20
E-mail: cwolf@velco.de
Website: www.velco.de

REFRACTORY INSPECTION SOFTWARE

4D Delta Pty Ltd – Australia
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4D Delta Cloud service delivery platform for Refractory inspection
International reseller enquiries welcome
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Email: sales@4ddelta.com
Tel: +61 8 6150 9998

REFRACTORY RAW MATERIALS

Almatis GmbH
Lyoner Strasse 9, Frankfurt,
Hesse-60528
Tel: +49 699 573 4150
Email: Gizemnur.Oezdinc@almatis.com
Website: www.almatis.com

Wilfrid Smith Ltd
Elm House, Medlicott Close,
Oakley Hay, Northants NN18 9NF
Tel: +44 (0) 1536 460020
Website www.wilfrid-smith.co.uk
Contact: Andy Hoyland
Email: ahoyland@wilfrid-smith.co.uk
Tel: 07824 062121

REFRACTORY RECLAMATION AND RECYCLING

M&M Energy Systems Ltd
Ollerton Road, Tuxford,
Newark, Nottinghamshire
NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

Richmond Reclamation Ltd
325 Coleford Road,
Sheffield S9 5NF
Tel: +44 114 243 3141
Fax: +44 114 256 0088
Email: richmondreclaim@gmail.com

REFRACTORY SHOTCRETE EQUIPMENT

Gunform (Equipment Supplies) Ltd
33 Carsthorne Road,
Carr Lane Industrial Estate, Hoylake,
Wirral, Merseyside
CH47 4FB
Tel: (0151) 632 6333 Fax: (0151) 632 6444
Email: info@gunform.com
Website: www.gunform.com

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Marspal House,
Lawn Road Industrial Estate,
Carlton-in-Lindrick, Worksop,
Nottinghamshire S81 9LB
Tel: (01909) 730861 Fax: (01909) 733584
Email: sales@markham-sheffield.co.uk
Website: www.markham-sheffield.co.uk

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Email: sales@swpuk.com

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NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

SILICON METAL

Elkem Silicon Products
17 Jessops Riverside,
Brightside Lane,
Sheffield S9 2RX England
Website: www.elkem.com/contact/
Tel: +44 7810 428768

SILICON METAL POWDER

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10 Market Square, Lytham, Lancashire,
FY8 5LW
Tel: +44 (0)1253 738121
Fax: +44 (0)1253 735831
Email: sb@sandablackwell.com
Website: www.sandablackwell.com

SPECIALITIES FOR REFRACTORIES

Almatis GmbH
Lyoner Strasse 9,
Frankfurt,
Hesse-60528
Tel: +49 699 573 4150
Email: Gizemnur.Oezdinc@almatis.com
Website: www.almatis.com

Elkem Silicon Products
17 Jessops Riverside,
Brightside Lane,
Sheffield S9 2RX England
Website: www.elkem.com/contact/
Tel: +44 7810 428768

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Fibercon UK Ltd
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Epinal Way, Loughborough, Leicestershire
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Fax: +44 (0)1509 211862
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Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

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Website: www.accsltd.co.uk

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M&M Energy Systems Ltd
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Nottinghamshire NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

Quartis Ltd
PO Box 138, Cranbrook,
Kent TN17 9AF
Tel: (01580) 754747 Fax: (01580) 754949
Email: quartis@fccu.com
Website: www.fccu.com

TESTING AND ANALYTICAL

Trent Refractories Ltd
Menasha Way,
Queensway Industrial Estate,
Brigg Road, Scunthorpe
DN16 3RT
Tel: (01724) 858684 Fax: (01724) 281577
Email: enquiries@trentrefractories.co.uk
Website: www.trentrefractories.co.uk

THERMAL INSULATION

Siltherm Europe Ltd
Paramount Court, Corrig Road,
Sandyford Business Park,
Sandyford, Dublin 18, D18 R9C7
Republic of Ireland
Tel: +353 1 255 1800 Fax: +353 1 495 9201
Email: sales@siltherm.eu
Website: www.siltherm.eu

StudWeldPro-UK
Ollerton Road, Tuxford, Newark,
Nottinghamshire NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

TRAINING

CHB South Africa - Third Party Inspectorate
23 Delius Street, Vanderbijlpark, Gauteng,
South Africa 1910
Tel: +27 (0) 82 557 2755
Mob: +27 83 275 8948
Email: dcbiggs@mweb.co.za
Website: www.chbinspection.com

M&M Energy Systems Ltd
Ollerton Road, Tuxford,
Newark, Nottinghamshire
NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

REFRACTORY BUSINESS DIRECTORY

VERMICULITE (LOOSE FILL AND BOARDS)

StudWeldPro-UK
Ollerton Road, Tuxford,
Newark, Nottinghamshire NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

WEAR ALUMINA MOSAIC MATS

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Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

WEAR RESISTANT ALUMINA TILES

M&M Energy Systems Ltd
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Email: sales@swpuk.com

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Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

WEAR RESISTANT EPOXIES

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Ollerton Road, Tuxford, Newark,
Nottinghamshire NG22 OPQ
Tel: +44 (0) 1777 874500
Email: sales@swpuk.com

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Tel: (01782) 819616 Fax: (01782) 837174
Email: minchemhmp@btconnect.com

QUICKSHOT DIRECTORY

Institute of Refractories Engineers

Corporate Packages

IRE Corporate Packages enable existing and new members to access an increasing number of benefits and they encourage greater input from individuals in the company. Each package enables a company to nominate several individuals for membership, plus giving the company an opportunity for added value at a highly competitive rate, including complimentary and discounted advertising in ***The Refractories Engineer*** and complimentary and discounted attendance at IRE conferences and courses.

Bronze

A *Bronze Corporate Package* entitles a company to:

- ❑ Complimentary quarter page advert in *The Refractories Engineer*
- ❑ 2 x *Business Directory* entries
- ❑ 2 IRE individual memberships
- ❑ 1 online conference fee
- ❑ 1 online training fee

£1,023.00 worth of benefits for just £600.00

Additional benefits

- ❑ 10 per cent discount on additional advertising.
- ❑ 10 per cent discount on conference and training day attendance.
- ❑ 10 per cent discount on additional individual membership fees.

Silver

A *Silver Corporate Package* entitles a company to:

- ❑ Complimentary half page advert in *The Refractories Engineer*
- ❑ 4 x *Business Directory* entries
- ❑ 2 IRE individual memberships
- ❑ 2 online conference fees
- ❑ 2 online training fees

£1,628.00 worth of benefits for just £850.00

Additional benefits

- ❑ 12.5 per cent discount on additional advertising.
- ❑ 12.5 per cent discount on conference and training day attendance.
- ❑ 12.5 per cent discount on additional individual membership fees.

Gold

A *Gold Corporate Package* entitles a company to:

- ❑ Complimentary full page advert in *The Refractories Engineer*
- ❑ 6 x *Business Directory* entries
- ❑ 5 IRE individual memberships
- ❑ 5 online conference fees
- ❑ 5 online training fees

£2,810.00 worth of benefits for just £1,500.00

Additional benefits

- ❑ 15 per cent discount on additional advertising.
- ❑ 15 per cent discount on conference and training day attendance.
- ❑ 15 per cent discount on additional individual membership fees.

For more information and to take advantage of all the benefits an IRE Corporate Package has to offer, contact Georgina Nicol at IRE on: secretary@ireng.org or visit www.ireng.org

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Vice-President:
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1994/95	B Sansby, MIM, MIBF, FIRef Eng
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1997/98	B M Davies, FIRef Eng
1998/99	R M Hanley, FIM, FIRef Eng
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2005/06	P Bottomley, MSc, MIMMM, FIRef Eng
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2007/09	T Staton, CEng , BTech, MIMMM, FIRef Eng
2009/11	P Rooney, MSc, FIRef Eng
2011/13	C Windle, BSc Hons, FIRef Eng, MIM3, FSGT
2013/15	K Andrews, B Met, BSc, MSc, FIRef Eng
2015/17	C Arthur, FIRefEng
2017/19	J D Theron, B Tech ChemIng,FIRef Eng
2019/22	Mrs K Moss, M I Ref Eng
2022/23	P Walls

* Deceased

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Institute of Refractories Engineers, Unit 102, 88 Queen Street, Sheffield S1 2FW, UK

Admin Assistant:
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Email: secretary@ireng org

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Institute of Refractories Engineers

The Refractories Engineer

What to expect from your favourite refractories publication in 2024

COMPANY PROFILES

More in-depth company profiles enable you to offer an insight into your company, your technical expertise and your product range. We can write company profiles on your behalf to help you publicise your abilities in ***The Refractories Engineer.***

ADDED VALUE

An online portal for international refractory sector news – **www.ireng.org** – offers added value to help you reinforce your traditional printed magazine advertising message. There are a variety of additional advertising and promotional options by working with ***The Refractories Engineer***. Help us to help you target your existing and potential customers.

The Refractories Engineer Editorial Programme 2024

Already Published

Issue 1 – March 2024

- ❑ Iron and Steel Production
- ❑ Waste Management
- ❑ Measurement and Inspection

Editorial Deadline: 19th December 2023

Advertising Deadline: 12th January 2024

Issue 2 – June 2024

- ❑ Growth of Hydrogen
- ❑ Energy Supply and Efficiency
- ❑ Material Developments

Editorial Deadline: 15th March 2024

Advertising Deadline: 11th April 2024

To be Published

Issue 3 – September 2024

- ❑ Ferrous and Non-Ferrous Foundries
- ❑ International Colloqium on Refractories Preview
- ❑ Decarbonisation

Editorial Deadline: 21st June 2024

Advertising Deadline: 12th July 2024

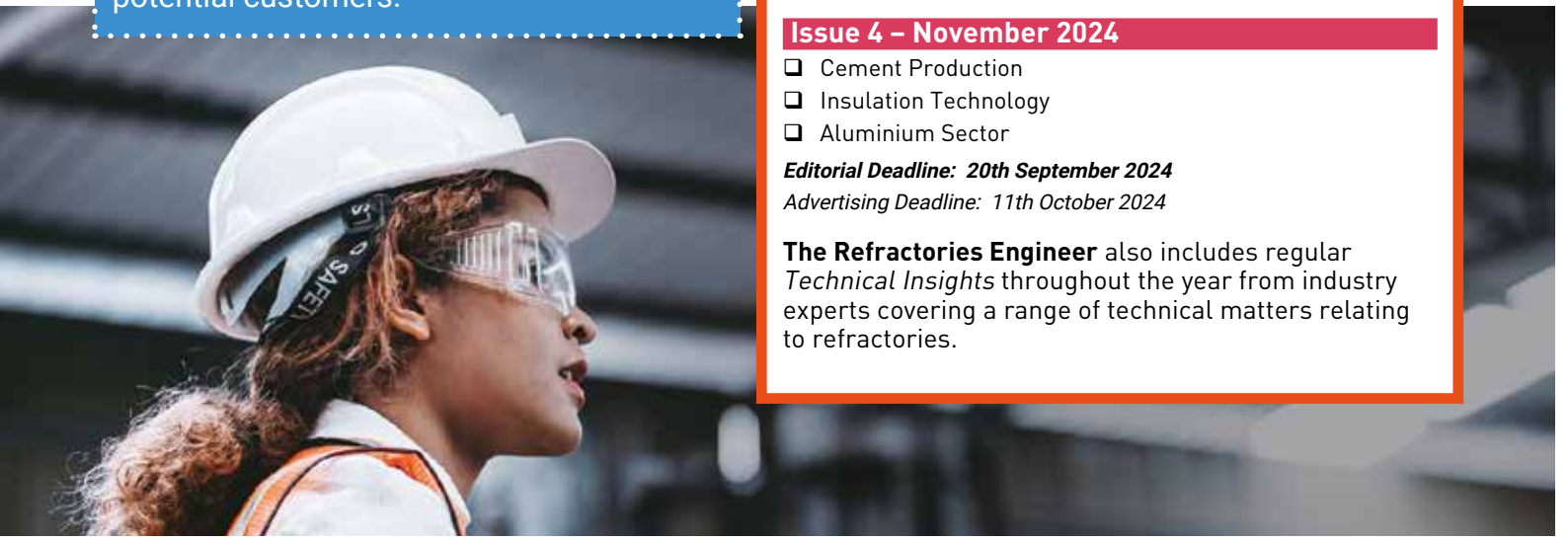
Issue 4 – November 2024

- ❑ Cement Production
- ❑ Insulation Technology
- ❑ Aluminium Sector

Editorial Deadline: 20th September 2024

Advertising Deadline: 11th October 2024

The Refractories Engineer also includes regular *Technical Insights* throughout the year from industry experts covering a range of technical matters relating to refractories.



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Insertions Each Full Colour	1	3	4
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Quarter Page	£445.00	£395.00	£380.00
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Business Directory with logo *(single column)*	£120.00 per entry for four journals Discounts apply for multiple entries		

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Inside Front Cover	£1,160.00

Mechanical Data

Front Cover including bleed	237mm x 218mm
Front Cover trimmed	229mm x 210mm
A4 page including bleed	305mm x 213mm
A4 Page trimmed	297mm x 210mm
Page	265mm x 185mm
Half Page vertical	265mm x 87mm
Half Page horizontal	128mm x 185mm
Quarter Page vertical	128mm x 87mm
Quarter Page horizontal	61mm x 185mm
Eighth Page vertical	61mm x 87mm
Quickshots Vertical	90mm x 60mm

All prices are quoted in pound sterling and are exclusive of VAT
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Andrew Turner on +44 (0) 7802 420917
email: advertising@ireng.org or

Lynn Postle on +44 (0) 7973 403657
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The Refractories Engineer is printed on FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification) paper.

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Supplier News

Supplier adds split bedding cart to refractory maintenance lineup

Elkem acquires VUM to further expand customer offering in carbon solutions

Funding success for two-year hydrogen research project for UK ceramic sector

Sustainability strategy and goals to reduce environmental impacts


Technical Insights

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Technical Papers

Institute of Refractories Engineers

Institute of Refractories Engineers

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We're a global community with members in over 40 countries. Almost 40 per cent of our members are located outside the UK, in places as far afield as Australia.

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