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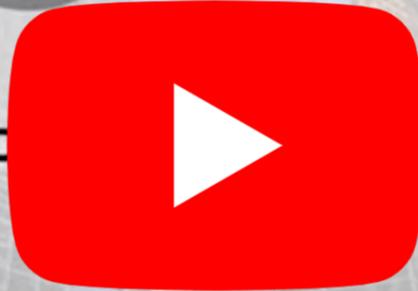
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ALUMINUM INDUSTRY 4.0: Drivers & Change Makers of 2021



Outlook for the Indian Aluminium Industry - In-depth industry analysis & forecast to 2026...

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OUTLOOK FOR THE INDIAN ALUMINIUM INDUSTRY

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Rupankar Majumder, Senior Manager – Content & Media Communications

Editorial

Dear Readers,

Industry 4.0 is a widespread concept of technological and organizational transformation of enterprises that includes among others is digitization and automation of technological processes. It cites a state-of-art juncture in the industrial revolution that cornerstones decisively on interconnectivity, automation, machine learning, and real-time data.

The technology succours to manage and reform all facets of manufacturing processes and supply chain. It grants access to real-time data and insights the requisite to make smarter, faster decisions on businesses that can eventually amplify the efficiency and profitability of your entire operation.

AlCircle, being an exclusive portal for the global aluminium industry, is zealous to explore and dispense information on the technical and technological innovations that are supporting the industry to become more efficient and sustainable. Following the successful launch of the

first “Aluminium Industry 4.0: Drivers & Change Makers” e-Magazine in 2019, AlCircle is bringing up to you another edition of the global trending topic “Aluminum Industry 4.0: Drivers & Change Makers of 2021”.

The term Industry 4.0 renders an assurance of a new industrial revolution—one that unifies ‘avant-garde’ manufacturing techniques with the Internet of Things to develop manufacturing systems that are not only interconnected but communicate, analyse and use the information to navigate further intelligent action back in the physical world.

The fourth industrial revolution and the impact of the drivers and technologies behind Industry 4.0 have been looked at from the perspective of various sectors after the concept was launched. However, the aluminium industry may not be the first sector that comes in mind when people think of Industry 4.0, as advanced technology is abruptly proving its worth for supporting companies remain resilient in a challenging marketplace.

A focus on sustainability is one key factor in helping aluminium producers succeed in the marketplace, but it is not the solitary concern. As per market analysis, it has been revealed that COVID-19 stroke the sector hard. The aluminium producers in the United States and Europe witnessed a temporary decline in production needs tied to a downturn in demand, but other sources predicted more than 4% growth in the global sector through 2025.

Here is our attempt to highlight the efforts of Industry 4.0 in driving the aluminium sector to a new height.

Best Wishes and Happy Reading!

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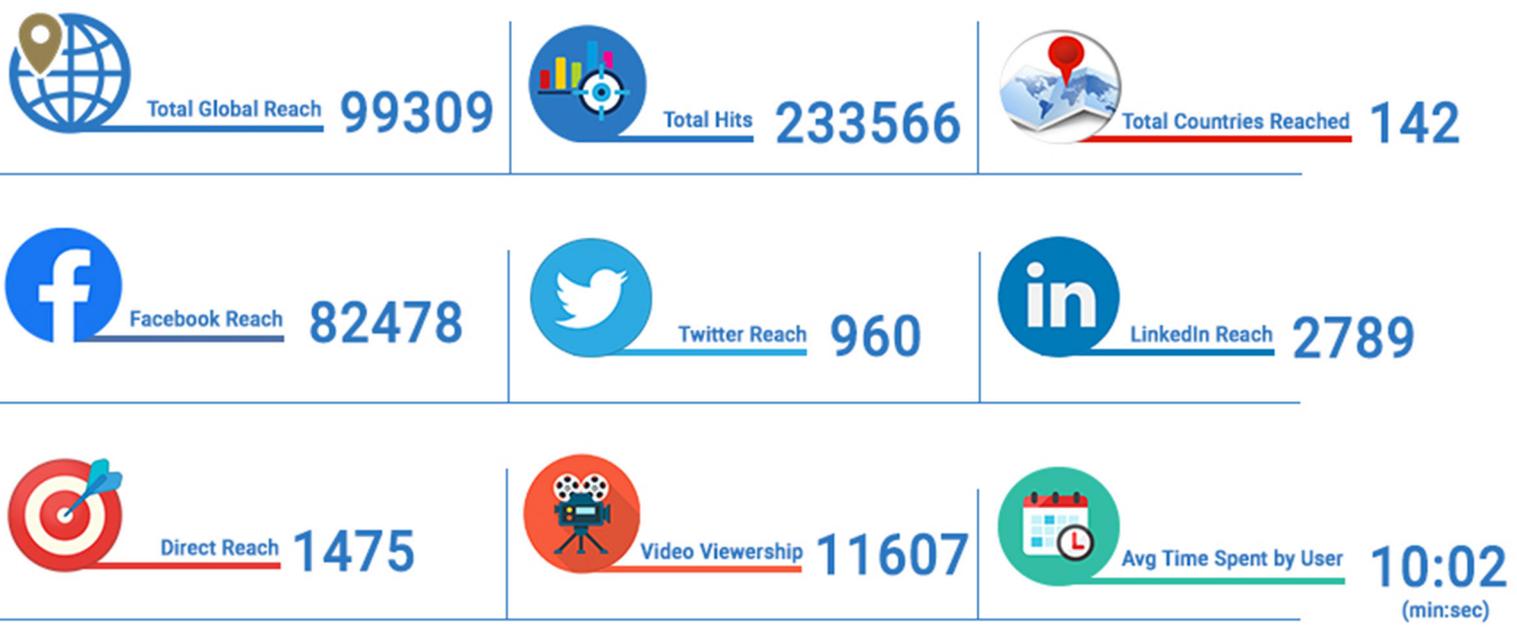
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Performance Dashboard: Previous AlCircle E-magazine



E-magazine Performance Statistics Aluminium LeaderSpeak 2021



E-Magazine Launch Date: 06 April 2021

Statistics Reporting Date: 5 June 2021

Aluminium LeaderSpeak 2021 Participants





Debanjali Sengupta, Deputy Manager - Content

Industry 4.0 – Saviour of Aluminium Industry during COVID-19 crisis and beacon of hope for 2021

The onset of the COVID-19 pandemic in 2020 has popularised the use of Industry 4.0 across all manufacturing industries, including aluminium. Until then, it was only a buzzword to many, despite being a dominating topic of discussion in conferences, summits and seminars. Thanks to the Fourth Industrial Revolution or Industry 4.0 that has helped the aluminium industry mitigate the COVID-19 impact at large. The intelligent use of advanced technologies such as the Internet of Things, artificial intelligence, and cyber-physical systems at aluminium smelters and plants has enabled them to augment their production capacity and conduct seamless operations during the pandemic.

It is an undeniable fact now that Industry 4.0 has proved to be an inevitable solution in the aluminium industry for the achievement

of higher productivity at a lesser time and with scanty workforce. Having experienced the robust outcome of the use of digitalization and automation during the COVID-19 crisis, a large number of aluminium smelters are increasingly harnessing the transformational potential of the 4th Industrial Revolution in a quest to position themselves as the 'Smelter of the Future'.

Role of Industry 4.0 in Aluminium Industry

Statistics show that the adoption of digital solutions has helped smelters who use electrolysis process to pull aluminium from its oxide boost productivity. Even 1 per cent gain in productivity leads to an annual global savings of \$970 million in total production costs. Investing in technology has also proven to reduce problems by providing more insights; for instance, data analytics can give details about temperature and chemistry, allowing plant managers to make proactive changes to cut down on wasted time or money.

While sustainability has become a way for aluminium producers to mark themselves different in the market, IoT sensors give them an idea of how much electricity they use over a given period. It makes easier to lessen the consumption of electricity if required.

On one hand, there are companies that are facilitating these digital solutions in the form of Automation, Machine Learning, Artificial Intelligence, Robotics, IoT, Data Analytics, etc.; on the other hand, there are companies who are adopting these technologies and transforming themselves into Smart companies & factories.

Leaders leading the way

For instance, Fives' Aluminium division, which develops smart, innovative and flexible solutions for the aluminium smelters, has innovated a comprehensive range of digital solutions to enhance productivity of smelters and achieve greener aluminium production. Being a worldwide leading solution provider for Green Anode Plant, Anode Baking Furnace equipment, Anode Rodding Shop, Fume & Gas Treatment plant, Potline cranes, Pot equipment, Fives' digital portfolio consists of more than 20 solutions that can be used independently or interconnected to act on Equipment Health

Monitoring, Process Optimization and Emission Control.

SECO/WARWICK Group, who has been shaping the global metallurgical and heat treatment industry for over 100 years, has developed a set of tools, known as SeCoil® for designing, optimizing and controlling the process of heating aluminum coils in real time. SECO / PREDICTIVE is another advanced device control system that enables detection of potential failures before their occurrence. This system is used to collect data from sensors and save them in the SECO/WARWICK cloud, and then to analyze the obtained information.

Among aluminium producers, Sohar Aluminium, the Middle East's youngest greenfield aluminium smelter has been using the leading-edge smelting technology with a progressive increase in amperage, deploying state-of-the-art production, efficiency and safety optimization tools, and technological innovation to become the benchmark smelter in the region. Their IT and automation team keeps Sohar Aluminium on the cutting-edge of smelting technology and operational excellence.

According to Vedanta, India's largest producer of green metal, the dynamic nature of the aluminium industry has greatly accelerated the adoption of automation and smart manufacturing, especially during the COVID-19 pandemic. Aluminium being a critical raw material for strategic industry sectors, from defence to aerospace to electrical distribution, the industry had to ensure business continuity despite reduced manpower, lockdowns, mobility restrictions and social distancing norms.

Leading the way for domestic manufacturers, Vedanta Aluminium has adopted digital-first ways of working to ensure real-time decision making, respond to fluid market conditions, changing customer needs, disrupted supply chains and employee safety with agility and accuracy.

Shaping up 2021

Over the last few decades, the aluminium industry has been aiming at augmenting production capacity with reasonable additional investment. But now, the reduction of greenhouse gas emission is an additional objective of the industry, wherein Industry 4.0 platform technologies is foreseen to open up further opportunities. The integration of the Fourth Industrial Revolution is expected to optimise predictive control and operation and become a key driver for low-energy cells. In other words, Industry 4.0 is anticipated to progress aluminium smelting towards sustainable production.



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SOHAR
ALUMINIUM

True to its reputation as a technology and innovation-driven company, Sohar Aluminium is harnessing the transformational potential of Industry 4.0 in its quest to position itself as the ‘Smelter of the Future’.

Sohar Aluminium: Poised for the Future

Overcoming the challenges posed by the COVID-19 pandemic since early 2020, Sohar Aluminium (SA) recorded an excellent annual production of primary aluminium totaling 396,929 tonnes in 2020. Timely business continuity measures initiated by the company management have greatly

contributed to this achievement. The year 2021 so far seems to be witnessing a similar trend in production and other overall key performance indicators (KPIs).

The Company is jointly owned by OQ S.A.O.C representing the Omani government (40%), Abu Dhabi National Energy Company - TAQA (40%), and Rio Tinto Alcan (20%) that also provides efficient AP39 smelting technology and sales support. The company's primary products include hot metal, primary aluminium Ingots, and primary aluminium Sows.

In its brief history of just over 10 years as one of the Middle East's youngest Greenfield aluminium smelters, SA has achieved several accolades and milestones attesting to its superior technological underpinnings and operational excellence. From the use of leading-edge smelting technology with the progressive increase in amperage to the deployment of state-of-the-art production, efficiency and safety optimization tools and technological innovation has long been the cornerstone of its ambition to become the benchmark smelter in the region.

Traversing this journey, SA has embarked on yet another exciting leap into the future aided by emerging technologies that form part of the 4th Industrial Revolution. From Mobile Connectivity, Artificial Intelligence and Big Data to Robotics, Internet of Things (IoT) and Machine Learning, Industry 4.0 has the potential to accelerate the digital transformation underway at the smelter.

Sohar Aluminium has embraced some elements of Industry 4.0 ever since it came on stream, and it continues to evaluate new technologies and innovations as they materialize on its continuous journey of improvements.

Automation – a key facet of Industry 4.0's suite of breakthrough technologies has long been the hallmark of Sohar Aluminium's investment in a modern smelter. Advanced automation technologies are a defining characteristic of the company's operations. Similarly, robotics is an integral part of the company's Casthouse operations, eliminating any potential for human interaction with unsafe material handling, thereby reducing the risk of injury to its operators. Robotic cranes assist in the stacking of the refined metal bundles and applying labels to them.

Adopting the Internet of Things (IoT) – an ecosystem of connected machines, equipment, devices, and physical objects that can communicate with each other has been another step forward towards the future. SA uses the Industrial IoT, which connects all its systems with the enterprise. This means that all the data from the shop floor, production units, and so on, is captured on the dashboards in real-time thereby adding increased value to the business.

Equally promising is the deployment of Machine Learning (ML) and Artificial Intelligence (AI) solutions to improve process control at Sohar Aluminium. With a combination of ML and AI, the IT department, in particular, the Automation team sees the potential to automatically record, network and use numerous machine and system parameters that can be harnessed to plan downtimes, increase productivity, and drive quality. Not surprisingly, some elements of Machine Learning are already a part of Sohar Aluminium's processes – the result of an abiding commitment to staying abreast of technology.

Data Analytics – another Industry 4.0 technological offering is also proving handy in enhancing maintenance and operational processes at Sohar Aluminium. Historical data is used

to forecast equipment failures and process deviations. This improves SA's uptime and allows for proactive maintenance rather than reactive while also enabling it to achieve a high level of operational production.

Sohar Aluminium believes that Industry 4.0 helps in improving productivity, efficiency, safety, resource utilization, increasing machine uptimes and reducing breakdowns by using smart sensors and such technologies. It also enables self-diagnosis, reduces turnover time, prevents breakdowns, and reduces human intervention which will reduce human errors.

The adoption of Industry 4.0 tools began in earnest a couple of years ago with members of the IT Team evaluating the applicability of these technologies and their deployment in key departments within the organization while also engaging with relevant vendors with a view to ascertaining their efficacy within Sohar Aluminium. Furthermore, members of the Automation team have come up with their in-house solutions as cost-effective alternatives to vendor-promoted offerings.

Being mindful that the roll-out of Industry 4.0 is no small feat, SA has embarked on a plant-wide awareness program designed to ensure that the company's sizeable technical staff are fully on board in the delivery of this ambitious project.

The company has taken a proactive approach to manage the impact of the COVID-9 pandemic. As always, the health and safety of its workforce have remained a top priority in addition to business and operations continuity. Several actions were taken including the formation of a special committee mandated with planning and overseeing the

implementation of actions and precautionary procedures. The workforce on site was reduced with work-from-home plans initiated which was made possible with the adoption of technologies that allowed its employees to work remotely without any loss of productivity.

As a testament to its glittering journey, Sohar Aluminium recently claimed the topmost position in His Majesty the Sultan's Award for Industrial Excellence 2021. This is the third time that the company has won this prestigious award, other than various other awards and trophies at local, regional, and international levels for Nationalization, Corporate Social Responsibility, Human Resources Administration and Development, Occupational Health, Community Service, and Environment Protection.

Sohar Aluminium was formed in September 2004 to undertake a landmark Greenfield aluminium smelter project in the Sultanate. Its establishment stands on a strong foundation of decades-long industry insight in design, specification, and construction. This has ensured efficiency, environmental protection, and the utmost safety of its workforce.

Continuing Our Journey of Excellence



2011 ر.هـ



2021 ر.هـ



2010 ر.هـ



World Quality Commitment award 2010



His Majesty's Cup for Best 5 factories 2010



His Majesty's Cup for Best 5 factories 2011



Nationalization Excellence award by Government of Abu Dhabi 2011



Manufacturer of the Year by Asian Manufacturing Excellence Awards 2012



Excellence Award in Social Responsibility 2013



Excellence Award for Environmental Initiatives 2014



Takatuf Excellence Award for Employee Relations Initiatives 2015



Takatuf Excellence Award for Leading Supporter of SME's 2015



GAC Health & Safety Award 2016



GAC Community Service Award 2017



GAC Community Service Award 2018



First position for His Majesty the Sultan's Award for Industrial Excellence 2020

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Improving the Heat Treatment of Aluminum Sheet Coils on the Course of the Industry 4.0 Concept

1. Introduction:

Industry 4.0 is a general concept of technological and organizational transformation of enterprises, which includes, among others digitization and automation of technological processes. One of the key branches for the development of the world economy is the production of aluminum, which consists of a number of stages, including heat treatment carried out with the use of industrial furnaces. SECO / WAR

WICK Company has developed modern tools dedicated for Vortex® furnace line, which fit into the Industry 4.0 concept and are aimed at increasing the efficiency and safety of production, as well as care for the quality of the processed product. In VORTEX® furnaces, intermediate or final heat treatment of load in the form of sheets or foil coils made of aluminum and its alloys is carried out, in particular, stress relief and recrystallization annealing. The aim of the article is to present selected solutions according to the Industry 4.0 concept, supporting the heat treatment of aluminum sheet coils carried out with the use of equipment belonging to the VORTEX® furnace line.

2. SeCoil®:

SeCoil® is a set of tools for designing, optimizing and controlling the process of heating aluminum coils in real time. The main element of the SeCoil® system is the mathematical model of load heating, which enables the determination of the temperature field in the cross-section of the coil at any time in the process without the need to use load thermocouples (Fig. 1).

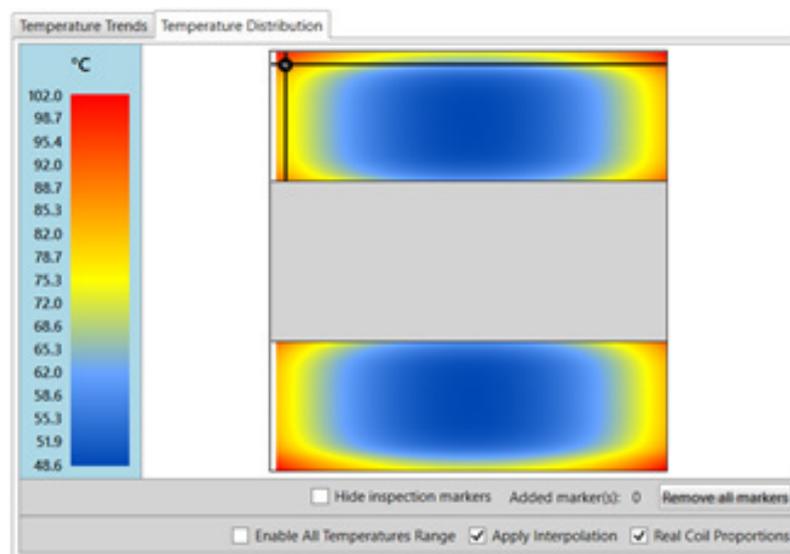


Fig.1. The window of the SeCoil® simulator with the temperature field in the cross-section of a aluminum coil and the location of the so-called virtual control thermocouple

Mathematical model can be used both for process simulation and design (offline simulator), as well as real time process controller. Mathematical model as online controller, in cooperation with the supervisory system of the furnace, simulates the charge temperature field on a current basis using the information of the current conditions in the furnace heating chamber (temperature, outlet velocity of the heating medium) and the parameters of the heated load introduced into the control system (width, diameter, sheet thickness, type of alloy). SeCoil® allows you to choose the location of the so-called virtual control thermocouples, the indications of which can be used to control and regulate the process. Fig. 2 shows a comparison of indications of virtual thermocouples (SeCoil®) with indications of load thermocouples during the annealing process of an exemplary aluminum coil. The presented comparison shows very good consistence between simulation results and measurement results.

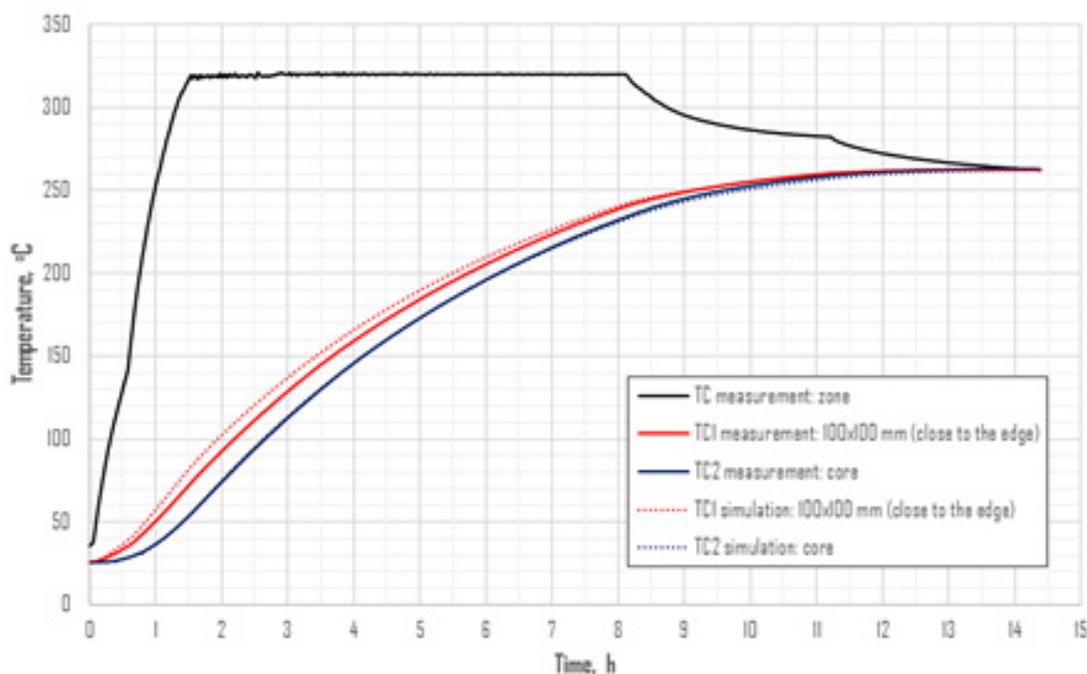


Fig.2. Comparison of indications of virtual thermocouples with indications of batch thermocouples

The following advantages of the SeCoil® system can be mentioned:

- No need to use and service load thermocouples,
- Any choice of the location of the so-called virtual control thermocouples,
- The possibility of archiving data about the temperature field of each processed coil in the cloud
- Possibility to optimize process time and energy consumption.

3. SECO/PREDICTIVE

SECO / PREDICTIVE is an advanced device control system that enables detection of potential failures before their occurrence. This system is used to collect data from sensors and save them in the SECO / WARWICK cloud, and then to analyze the obtained information (Fig. 2). The solution is complemented by a remote access and notification system as well as a reporting and analysis function. Optionally, SECO / PREDICTIVE can cooperate with the SeCoil® system in order to analyze the charge heating curves for possible deviations from the norm.



Fig.2. SECO / PREDICTIVE software window with the analysis of the obtained information

SECO / PREDICTIVE can be used in VORTEX® furnaces, among the others, for:

- informing about upcoming fan problems by monitoring currents, temperature and vibrations,
- informing about the wear status of the drive system of bypass fans by monitoring vibration.
- informing about upcoming problems related to individual heating elements by monitoring the currents (option of a furnace with electric heating),
- informing about the upcoming problems related to individual burners (option of a gas-heated furnace),
- control of the cooling system,
- control of the load car operation,
- control of UPS operation and computer disks.
- In addition, the system provides the user with cyclical information about upcoming periodic inspections.

SECO/WARWICK

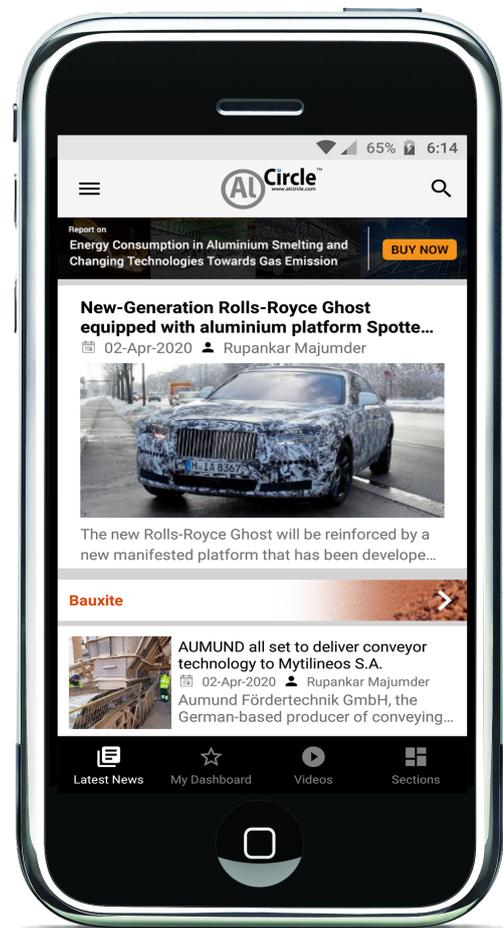
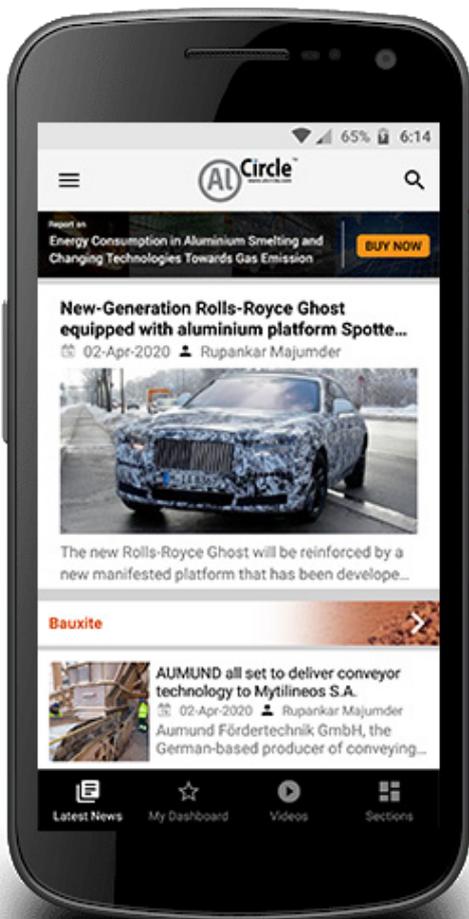
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By Benjamin Ulmann, Regional Sales Director - Middle East & North Africa

Fives' Digital Solutions for Equipment Monitoring, Process Optimisation and Emission Control

Since 2007 and the introduction of Amelios, Fives' Aluminium division has developed a comprehensive range of digital solutions to enhance the productivity of smelters and achieve greener aluminium production.

Being a worldwide leading solution provider for Green Anode Plant, Anode Baking Furnace equipment, Anode Rodding Shop, Fume & Gas Treatment plant, Potline cranes, Pot equipment, and thanks to the combined expertise of Fives Solios and Fives ECL, Fives sets-up a cross-organizational and transdisciplinary team to further develop digital solutions. As of today, Fives' digital portfolio consists of more than 20

solutions that can be used independently or interconnected to act on Equipment Health Monitoring, Process Optimization and Emission Control.

Equipment Health Monitoring – SMART solutions

SMART solutions (e.g. SMARTCrane, SMARTFilter, SMART-Vibro, ...) consist of software solutions plugged in existing equipment for real-time and remote monitoring. The purpose of the SMART solutions is to increase the availability and reliability of the equipment and maximize the Overall Operations Effectiveness (O.E.E.)

SMART solutions aim to enhance smelters' operations, maintenance and process by providing a new equipment experience with indicators, dashboards and recommended actions to anticipate fragilities and drifts.

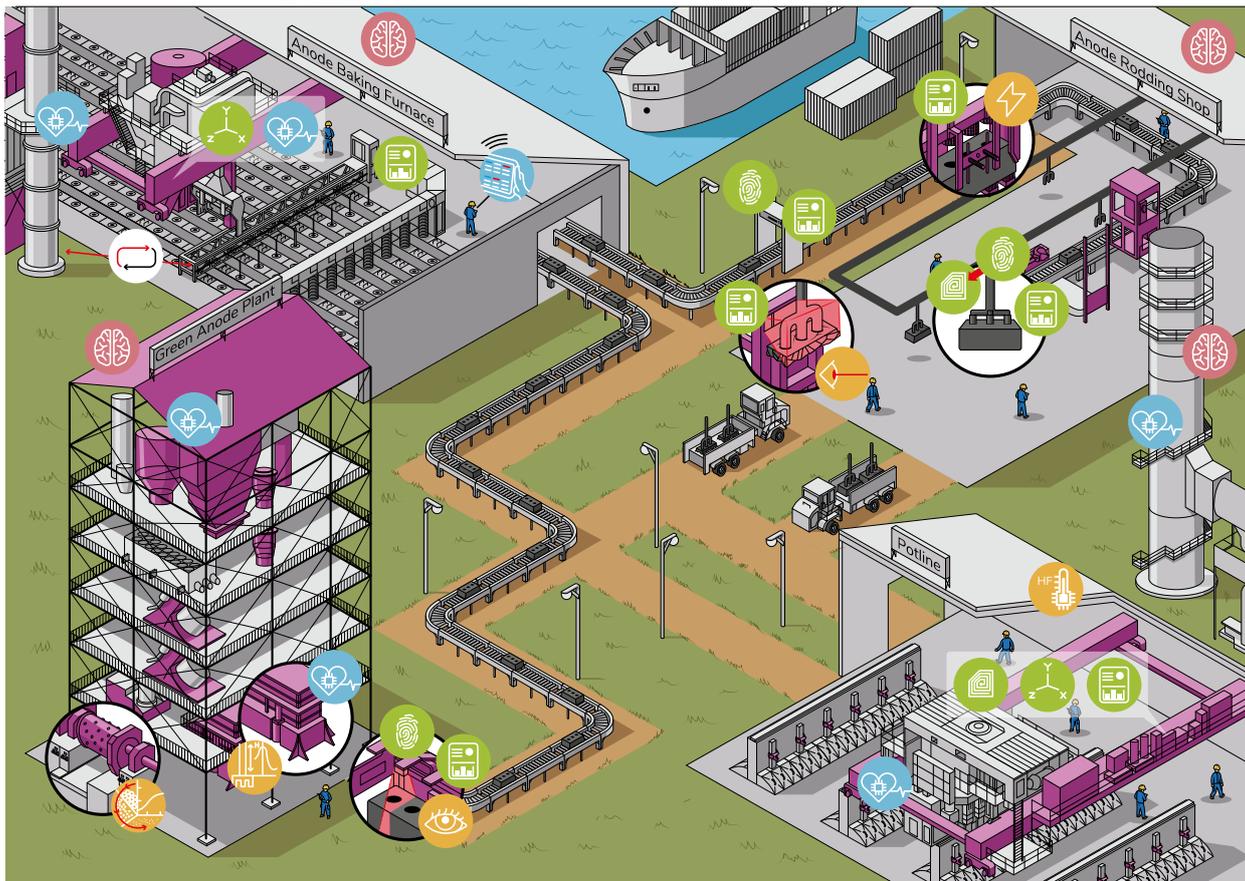
Process Optimization – Amelios Suite

Based on advanced process monitoring & Amelios data analytics software, the Amelios Suite for Green Anode Plant, Anode Baking Furnace and Rodding Shop includes:

- **Advanced sensors & Advanced control functions:** AVI, MIREA, SOFIA, Dynpac, Optibinder...
- **Innovative tracking solutions:** ATS, RTS, a trusted database (Anode ID card) along with a first level of Data Analytics ...

The purpose of the Amelios Suite is to lower the Net Carbon Consumption (NCC), consequently the CO₂ emissions as well as the consumption of raw material and energy and ultimately to increase the production of aluminium.

Fives' digital solutions for Equipment Monitoring Process Optimisation and Emission Control



Process Optimisation Solutions



Equipment Health Monitoring



Advanced Sensors & Advanced Control



Tracking System



Amelios Suite allows to:

- minimise the carbon reject at all stages,
- create a better intimacy between carbon and reduction sectors,
- maintain key anode parameters,
- guarantee the performance of the reduction process,
- stabilize the production against the raw material variability and aging of the plant,
- Improve operation teams responsiveness for better anode quality control, and
- reduce the direct CO2 emission from the pot and anode baking.

Process Optimization – e-GTC

Based on Continuous Emission Monitoring System (CEMS) and advanced process control, the Fives' e-GTC allows for enhancing smelter environmental performance and reducing operating costs through constant monitoring of emissions and equipment.

The above-mentioned solutions have been validated by proof of concept or are already implemented in smelters worldwide with proven track records (e.g. SMARTCrane, Amelios

Suite for Green Anode Plant, SOFIA, MIREA...). Additionally, the whole Amelios Suite has been labelled by the SOLAR IMPULSE FOUNDATION in 2021, and the Anode Tracking System based on Vision has been awarded by Light Metal Community (TMS) in 2020, and some solutions are patented.

With more than 660 employees worldwide based in multiple locations across the globe, the Aluminium division of Fives has the ability to support smelters on the definition and the implementation of their digital roadmap locally.

Please visit our new website for the latest information on our digital solutions and to request a tailor-made presentation to suit your needs.

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Each day, Fives demonstrates that **Industry can do it.**



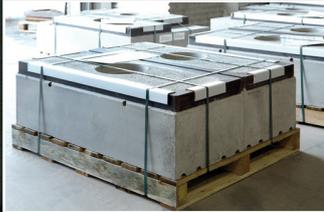
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Gouda Refractories is an Andus Group company within the Manufacturing division.

The other divisions include Services & Maintenance and Contracting.



***Author - Kevin Williams, General Sales Manager
- Primary Metals at EPIQ Machinery.***

Modern anode handling and cleaning system for Industry 4.0 technologies

Manufacturers are under continuous pressure to lower costs and improve quality. To assure optimum technical and financial performance of the Carbon Plants and anode block manufacturing, Aluminium manufacturers are moving forward in the adoption and integration of Industry 4.0 technologies as part of their roadmap to the aluminium plant of the future.

One of the main ideas that separate Industry 4.0 from 3.0 is the notion that data coming from one part of the manufacturing process can help with upstream or downstream process optimization. In a typical modern anode manufacturing plant, all of the equipment and systems are tied together with an industrial network, a good foundation for the integration of technologies. Looking at an aluminium smelter on how Industry 4.0 technologies can be beneficial.

Anode quality is a key variable of overall efficiency and production costs. Any improvements in quality will help lower energy consumption, lower greenhouse gas (GHG) emissions and increase productivity. Furthermore, inputs to the anode production process such as petroleum coke and coal tar pitch are variable and difficult to control. The process which supports the continuous supply of the pre-baked carbon anodes requires independent production and operation facilities:

- Green anode plant (GAP);
- Bake furnace plant including bake furnace (ABF), fume treatment (FTP), Furnace tending cranes (FTAs) and firing systems;
- Green and Baked Anode Storage facility; and
- Rodding Shop.

For a fully integrated, automated smelter, the physical system that ties all of the above independent process plants together is the Anode Handling and Cleaning System.

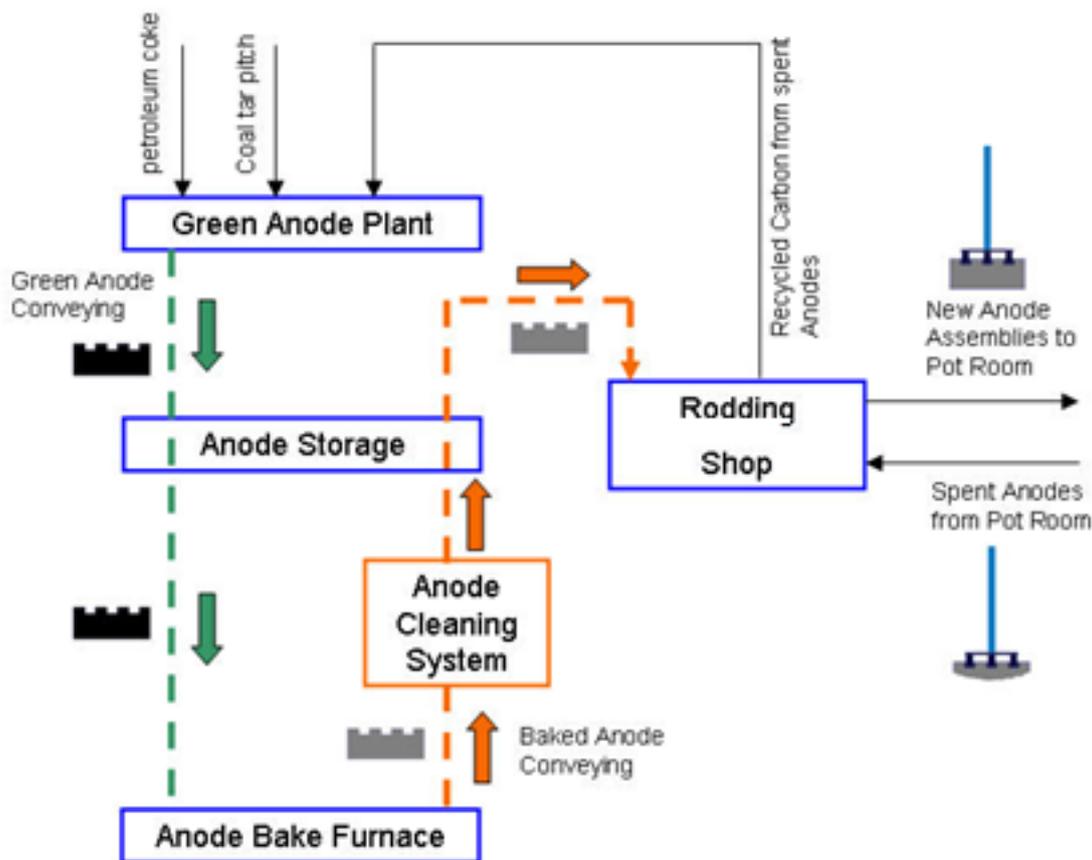


Figure 1: Simplified Anode block production process flow

Anode Tracking:

One important part of the backbone of adding Industry 4.0 technology to the anode production is an anode tracking system. Most smelters do not have an anode tracking system that keeps track of an anode's pedigree from the green anode plant through its complete lifecycle because current industry available marking devices do not survive the anode baking process. This problem is getting solved with Industry 4.0 technologies in a number of parallel developments.

The anode tracking system will include readers located at strategic locations throughout the anode handling system. These readers will, for the most part, be confirming an internal blind system tracking which will keep track of the anodes between the readers.

Once an anode tracking system is in place, a new digital and automated line of communication between the anode manufacturing processes is created. This opens up numerous additional Industry 4.0 implementation possibilities.

Anode quality control using inline resistivity checking:

A relatively new and increasingly popular technology being developed and integrated into anode handling systems is inline real time anode resistivity measurements. The inline resistivity checking is still in its infancy stage as it is being integrated into anode handling and cleaning systems.

The data gathered by the inline resistivity checking of the green and baked anodes, in combination with the anode tracking system will allow real time feedback to operations control for immediate improvements to GAP and ABF operating parameters. In addition, the population of a database (Big Data) which can be the subject of future deep learning and AI technologies will allow further optimization of the GAP and ABF processes.

Anode Cleaning and Inspection:

In a modern anode production facility, the handling and cleaning of the anodes is completely automatic and without operators. That said, most plants do have an inspector / manual cleaning station downstream of the anode cleaning machine. New and increasingly economic solutions for

visual inspection combined with industrial robotics will, in the near future, eliminate the need for the current manual task.

Predictive Maintenance:

Moving on from product tracking, quality control and process improvements that Industry 4.0 technologies can bring to the anode production we come to predictive maintenance. Predictive maintenance is considered as one of the most valuable applications of the Internet of Things (IoT) on the factory floor. It is estimated that predictive maintenance strategies and implementations will save companies hundreds of billions of dollars by the year 2025.

A typical system has many sensors on board with data readily available on the existing control system to implement some predictive maintenance strategies. One example in the anode handling and cleaning system where predictive maintenance strategy will have a significant financial impact is the anode slot cutter. Sawing operation is demanding and requires the use of costly diamond cutting tips. In EPIQ Mecfor's Anode Slot Cutting Machine (ASCM), thermal sensors are used to detect the temperature of the anode upon entry. If too hot, the machine will be bypassed to prevent damage to the cutting tips. In addition, the ASCMs already have a high degree of self-diagnostic systems on board to detect alarm/ abnormal conditions and these are all open for remote monitoring and troubleshooting.

Industrial Augmented Reality (IAR)/ remote connectivity:

IAR is still in its infancy but offers promising benefits by enhancing the complete lifecycle of a machine or system. IAR will drive continued investment and improvement of the base technologies, promoting future integrations into aluminium anode production with a greater ROI.

Conclusion:

Anode Handling and cleaning systems in modern aluminium smelters connect all of the anode production processes through a highly automated system. Numbers of new Industry 4.0 technologies are ready now for integration to improve product quality, reduce energy consumption, increase operator safety and ergonomics. Each manufacturing facility will have to evaluate and develop their roadmap for adoption based on a case-by-case basis. In addition, there are emerging technologies such as IAR which may not yet be mature enough for full scale integration but may be interesting for trials in areas where there are problems or high expenses related to machinery reliability and efficiency.

Furthermore, the O.E.M. aluminum industry equipment suppliers will be using technology providers' building blocks along with industry research and development to provide fully integrated Industry 4.0 solutions as they are delivered. These integrations and advancements will open up new opportunities for reduced environmental impacts, increased efficiency and productivity and improved operator safety for the aluminium smelter of the future.



MECFOR & **AD**

Advanced Dynamics & Mecfor join their forces

The new parent entity EPIQ MACHINERY is a company capable of supplying and improving material and process flow through the carbon plant, pot room and cast house.

EPIQ will offer the best of overhead, ground level and mobile automated material handling and processing technologies for heavy industry.

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Passion for
challenges



A Virtual Aluminium Ecosystem

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Christian Ferman, Senior Electrical Engineer and Project Manager, Granco Clark.

“The benefits of automation are multi-faceted in this industry. Our fully automatic systems allow for the entire process to be carried out with minimal human contact”, Christian Ferman, Senior Electrical Engineer and Project Manager, Granco Clark.

Christian Ferman is a Senior Electrical Engineer and Project Manager with 11 years’ experience in the design of control systems, embedded systems and safety systems for

Granco Clark. A graduate from Grand Valley State University in Grand Rapids, Michigan with a degree in Electrical Engineering, Christian is also a certified Safety Engineer with a CMSE accreditation.

AlCircle: How Industry 4.0 has changed the dynamics of the aluminium extrusion industry?

Christian Ferman: Industry 4.0 is revolutionizing the industry for personnel at every level of the process.

Maintenance staff can now take advantage of predictive analytics that uses sensor and process data. This allows Granco Clark equipment to notify them of potential process or equipment failures before they happen.

Production engineers have access to more process and equipment data than ever before. Granco Clark systems archive and analyse this data, then present it to engineers in a graphical or table-based summary. This allows extruders to optimize their process to a level not previously possible without extensive manual data collection and analysis.

Management staff can now check on the status of any given facility, production line, or even individual equipment from a smartphone, tablet, or PC. Granco Clark systems now feature apps that a customer can use to access this data globally if they choose.

AlCircle: How is the acceptance of Smart Manufacturing in the global aluminium sector?

Christian Ferman: Smart Manufacturing is becoming a “must-have”. The drive to collect and analyse process and equipment data continues to increase as extruders

strive to provide the highest quality products in their market.

AlCircle: What is the role Granco Clark playing to navigate the aluminium sector towards the adaptation of Industry 4.0?

Christian Ferman: Granco Clark is working alongside our customers and partners in the aluminium industry to tailor industry 4.0 solutions to both the industry itself, and the needs of individual customers. The benefits of which speak for themselves.

AlCircle: Can you elaborate on the vital investments Granco Clark is planning concerning Industry 4.0?

Christian Ferman: We are investing heavily in providing an Industry 4.0 solution to the aluminium industry. Using data from sensor communication protocols such as IO-Link, we are collecting valuable diagnostic data of all sensing devices in real-time. Process data is constantly being monitored, with alert systems to notify personnel of any deviation using a variety of platforms. These include push notifications via text messages and in-app messaging with visual notifications. We are continuously improving the development of our Supervisory Control System (SCS) to archive and analyse this data.

With the development of our mobile applications, the resultant analysis is easily accessible using any device. This allows production, quality, and management personnel greater insight into the process, confidence in quality, with tracing and accountability for every step of that process anywhere in the world.

Granco Clark is taking Industry 4.0 into account at every step in our process. We continue to look for more ways to gather

and provide data to the customer with every new design.

AlCircle: Automation and Robotics is the new game-changer for improving efficiency, productivity in the aluminium industry. What is your assessment of this factor?

Christian Ferman: The benefits of automation are multi-faceted in this industry. Automation provides not only increased productivity and higher quality product but also creates a safer work environment by limiting human exposure to the many hazardous conditions within the process. Granco Clark's fully automatic systems allow for the entire process to be carried out with minimal human contact. In cases where manual intervention is required, our safety systems provide the safest environment possible when a human must interact with the equipment.

The level of automation in Granco Clark systems provide the industry with the opportunity for increased output, at a higher quality, in a safer environment, while doing all of this with lower production costs.

AlCircle: What according to you are the key benefits the global aluminium value chain is gaining from Industry 4.0?

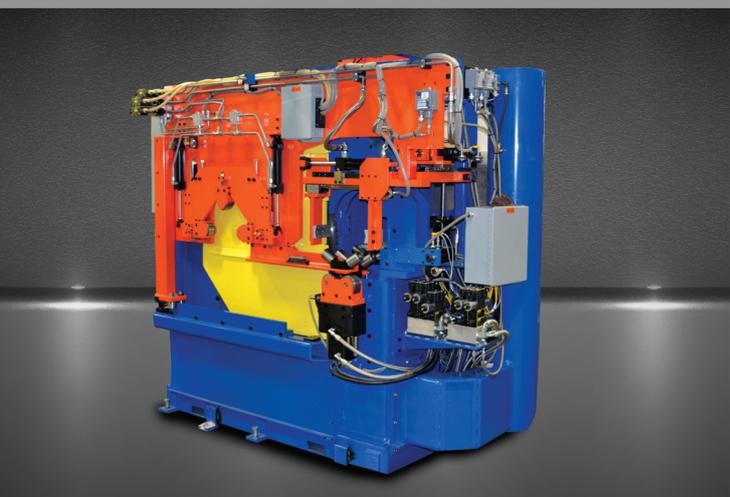
Christian Ferman: The key benefits:

- Increased traceability for every step in the chain.
- More transparency in the process, resulting in:
 - » Greater efficiency
 - » Increased quality
 - » Less downtime
 - » Safer environments

- Access to critical process data quickly, allows for faster innovation of products, expanding the opportunities of the aluminium market.
- The ability to track any discrepancies in the process that may impact product quality, and to quickly perform root-cause analysis to correct said discrepancies.

AlCircle: Has the COVID-19 pandemic triggered the Industry 4.0 movement? Please detail us.

Christian Ferman: COVID-19 has forced fundamental changes in human interaction across every industry, although Granco Clark recognized the value of Industry 4.0 and began development pre-pandemic. As COVID-19 continues to be a global issue, it has never been more important for the industry to maintain vital production at pre-pandemic levels, with far less direct human interaction. This has definitely pushed Granco Clark and our partners in aluminium to focus our efforts on a quality smart manufacturing system that provides the benefits of the Industry 4.0 movement.



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All Granco Clark equipment comes from our 92,000 square foot modern Michigan facility providing the industries most innovative custom equipment built with the exceptional quality you come to expect from Granco Clark. Our repeat customers attest to that.

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Granco Clark is your all-inclusive turn-key system supplier. Expect superior performance, industry knowledge, unmatched and proven solutions, onsite commissioning, support, and responsive service technicians.

Our industry knowledge and experience are unmatched and proven, with our custom-engineered equipment delivering the solutions and performance you expect from Granco Clark.

Being a full-service company means we are with you from system ordering and startup...through the times you need unmatched industry service and support.

Our Spare Parts Department is available 24/7. Our global team of trained service technicians are available to keep your production facility running smoothly at all times. They will find the best solution to meet your needs and provide on-site service (*in most cases, within 24 hours*) and spare parts whenever necessary.



THE PATHWAY OF TOMORROW



Pramuk Dediwela, Managing Director of Alumex PLC

**“For an extrusion company, on-time decisions facilitated by Industry 4.0 would run the manufacturing processes very smoothly increasing the efficiency”,
Pramuk Dediwela, Managing Director of Alumex PLC.**

Mr. Pramuk Dediwela started his career in January 1989 and has over 32 years of experience in the fields of Marketing and Sales, Material and Logistics, Finance, Manufacturing and Administration as well as Human Resources management

under Alumex Group. He joined Alumex PLC and its subsidiaries in December 2010 as an Executive Director. Later on, in November 2017, he became the Chief Operating Officer and then became the Managing Director in July 2018.

Mr. Dediwela is a Marketer cum Financial Economist and holds a Master in Financial Economics (University of Colombo), Master of Business Administration (University of Southern Queensland), Post-Graduate Diploma in Business and Financial Administration (CA Sri Lanka/Cranfield - UK), Postgraduate Diploma in Marketing (Chartered Institute of Marketing - UK). Mr. Dediwela is a member of the Advisory Committee on Light Engineering sector under EDB, Ministry of Industry & Supply Chain Management and holds Membership of Sri Lanka Economics Association. He is a Council Member of the Foundry Development & Services Institute of Sri Lanka.

AlCircle: How do you anticipate Industry 4.0 to reshape the global aluminum industry in 2021 in the backdrop of the ongoing COVID-19 pandemic?

Pramuk Dediwela: We understand that the world is realizing the wavy nature of the Covid-19 outbreak while it has impacted the local and global activities in almost all the segments. Meanwhile, the Aluminum Extrusion industries are not an exception in the global scenario and need to seek major changes and transitions in manufacturing and other related processes with innovative technologies to sustain their activities amidst the pandemic. The global Aluminum industry which is currently utilized by computer control can be anticipated to integrate with industry 4.0 which enables the integration and automation of the manufacturing processes and supply chain management and empowers systems, processes, and standards to be real-time effective

with a reduced and optimum workforce. Industry 4.0 introduces autonomous process control and realizes the hidden hindrance at the correct time to avoid future potential failures in manufacturing processes. These all measures would reduce the human interactions in Aluminum Industry giving less chance to spread such an epidemiological disease in the end.

AlCircle: Being a leading provider of best-in-class aluminum extrusion profiles, how do you plan to execute automation and digitalization in your production process in 2021 and beyond?

Pramuk Dediwela: The digitalization of the physical world in the Aluminum industry over the newer technologies does not happen over a night. Alumex has planned to take an approach in which the drive to Industry 4.0 and beyond will be achieved progressively as part of a strategic approach and planning. Launching an Extrusion Management System (EMS) in 2021 will be the first significant initiative in this drive integrating all the stand-alone systems within the premises. We hope this will facilitate easy access to the process and production data to take decisions evidently. As the second phase of this initiative, PLC integration and subsequent autonomous control will be addressed reducing the manual data entry points and delayed decisions occurring due to lack of data.

AlCircle: Do you think the implementation of Industry 4.0 can increase the productivity and efficiency of Aluminum profiles output?

Pramuk Dediwela: Of course, yes, the well-planned strategic approach over the correct combination of underlying technologies and execution can progressively deliver the

required efficiency in Aluminum output. For an extrusion company, on-time decisions facilitated by Industry 4.0 would run the manufacturing processes very smoothly increasing the efficiency. Not only the efficiency, but this autonomous control also simply reduces the manufacturing rejections and future potential failures in machinery with early determinations promoting the productivity in Aluminum output as well.

AlCircle: As you are committed to revolutionizing the Aluminum manufacturing process, do you think Industry 4.0 will help you achieve the goal in a quicker time?

Pramuk Dediwela: The question cannot be directly answered because it needs deep insight. If EMS is particularly concerned as the first initiative, the cultural adaptation and machine compatibilities in system integration would take some time to be in satisfactory level whilst the progressive results will always be seen. In the second phase of EMS, determination of the proper sensor combination and neural learning of the network will take months to years for pattern recognition and realization. Pilar technologies in Industry 4.0 always conclude that technological success is not a destination and reflect the results in real-time as much as utilized. Simply our goal is to achieve the results progressively.

AlCircle: Please share your views on the utilization of Industry 4.0 in the production and installation of industrial aluminium.

Pramuk Dediwela: The Alumex has its unique signature in terms of standards, processes, equipment, staff, context, etc. Therefore, the path and strategy to Industry 4.0 will be different for Alumex from another Aluminum industry. In the utilization of industry 4.0, all the sub-processes cannot be taken simultaneously. One production extrusion press

is to be concentrated with strategy first and the expertise will closely monitor the inclines and declines after integration. Thereafter fine-tuning will take the Alumex to the desired productivity. In the beginning, key quantitative parameters in our industry such as processing temperatures, speeds and pressures will be traced by the autonomous system and qualitative controls will be subsequently planned to understand the surface qualities of Aluminum output by utilizing texture analysis in image processing and machining learning. This type of analysis will one day identify the surface defects in real-time in Aluminum processing that cannot be inspected by the naked eyes of quality controllers. But we hope this does not happen over a night and more focus on R&D works will be needed.

AlCircle: How do you think the Aluminium industry in Sri Lanka is responding to Industry 4.0 this year?

Pramuk Dediwela: In case of increasing demand for Aluminum extrusions in Sri Lanka, the current industry wants to respond to the newer technology to enhance the productivity and maximum utilization of existing resources in demand fulfilment. Different profiles are being added to the product catalogue day by day than ever happened. Accordingly, the number of extrusions dies in the availability list raises proportionally. The manual handling of such an availability list composed of thousands of dies is not an easy and correct approach. If the initiatives address this type of problem with Industry 4.0 within 2021, the handling of a large number of extrusion dies will be very convenient in the context of die performance, capacities, testing and correction records, etc. This is just one of the major problems experienced by Aluminum industry in Sri Lanka where industry 4.0 could potentially come up with dedicated solutions. Recently, Aluminum industry in Sri Lanka is responding to seek immediate

solutions for this kind of problem with low-hanging technologies.

AlCircle: Do you think the adoption of Industry 4.0 is imperative in the global aluminium industry to mitigate the impact of the COVID-19 pandemic?

Pramuk Dediwela: Aluminum industries' adoption of Industry 4.0 amidst the Covid-19 pandemic is leading in terms of quality, efficiency, effectiveness, and throughput. It becomes inevitable that the rest who wants to succeed will take it up. This approach will be helpful to mitigate the impact of the pandemic. What if the pandemic would be controlled within the next few years? Then this implementation would handle the future threat of potential risks coming from this kind of situation with minimum involvement of human interactions.



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For over 30 years, at Alumex, we have been in the business of building a new world, one where aluminium reigns supreme, freeing up the forests and nature to do its own thing. Through a host of breakthrough innovations and expert capabilities, we are Sri Lanka's leading provider of best-in-class commercial, industrial, residential and architectural aluminium extrusion profiles. This is why we make sure that every single product we deliver is a result of meticulous craft and standard, which has in turn brought us closer to those of you from all across the world.

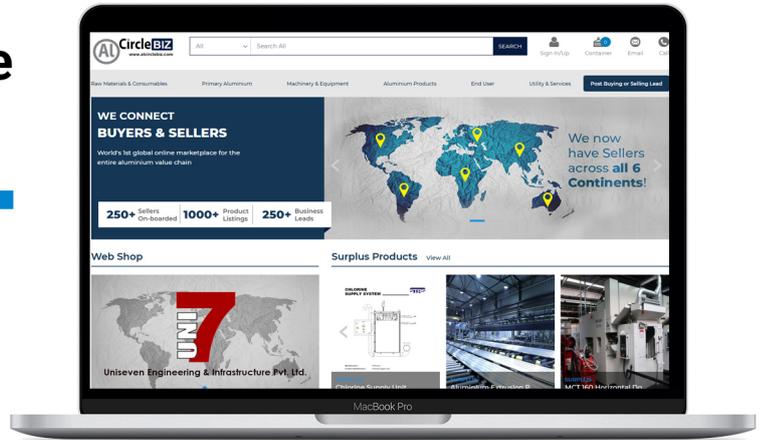


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**Mr Rahul Sharma, CEO – Aluminium Business,
Vedanta Ltd**

Industry 4.0 allowing Indian Aluminium to participate in globalized manufacturing

India is gradually waking up to the potential of its minerals and metals industry. This was one of the few industry sectors that continued to be productive despite the ravages of the pandemic. In fact, India's mining GDP increased from INR 739.90 billion in the fourth quarter of 2020 to INR 913.03 billion in the first quarter of 2021, as per data from the Ministry of Statistics and Programme Implementation (MOSPI). This

This industry has a critical role to play in fueling India's ambitious journey towards a self-sufficient 5 trillion-dollar economy over the course of 5 years.

Aluminium is a strategic metal and currently, the second most important metal in the world. Growing nearly 20x in the last sixty years, it has shown the most promise. Aluminium's inherent properties like high strength-to-weight ratio, exceptional design flexibility, 100% recyclability, high electrical and thermal conductivity, non-corrosiveness, and durability, have made it the metal of choice for various applications across critical industry sectors. From aviation and aerospace to automotive, building & construction, infrastructure, electrical, renewable energy and packaging, aluminium caters to a wide gamut of industries.

The global Aluminium Industry is currently calibrating itself against the vagaries of pandemic, such as supply shortage in the face of production limitations in China, restricted bauxite supply due to military coup in Guinea, the second-largest bauxite supplier in the world, as well as the decade-high price of aluminium. As the world looks at a 'China+1' strategy for diversifying their value-chain of key goods and services, these facets pose a great opportunity for India to leverage its caliber as one of the largest producers of aluminium in the world. Unlocking this opportunity calls for the Indian Aluminium Industry to adopt Industry 4.0 to the fullest.

Aluminium hailing automation for growth

Aluminium being a critical raw material for strategic industry sectors, from defence to aerospace to electrical distribution, the industry had to ensure business continuity despite reduced manpower, lockdowns, mobility restrictions and social distancing norms. Such dynamic greatly accelerated adoption of automation and smart manufacturing.

India is the world's third largest producer of aluminium and houses a vibrant primary and downstream aluminium manufacturing ecosystem. Indian producers such as Vedanta Aluminium have deployed cutting-edge smart manufacturing technologies to produce the widest range of aluminium products, which cater to raw material needs of numerous industries. Smart manufacturing is enhancing the prospects of Indian aluminium manufacturers further.

Vedanta leading the way

Leading the way for domestic manufacturers, Vedanta Aluminium has adopted digital-first ways of working to ensure real-time decision making, respond to fluid market conditions, changing customer needs, disrupted supply chains and employee safety with agility and accuracy. The tech and automation initiatives have enabled the company to unlock value across its entire value chain in ways that provided a positive step change in productivity as well as design and quality.

Some of the key innovations and technology augmentations deployed at Vedanta Aluminium business include:

- Vedanta's smelter at Jharsuguda is India's first and the world's third smelter to deploy Digital Smelter Solution using digital twin technology, which allows remote monitoring and control of potline operations, enhances energy efficiency, and arrests wastage of material.
- We are deploying first-in-industry Deep Learning algorithms and other cutting-edge technologies for Advanced Asset Performance Management at our power plants.

- Next-gen operational Data Lake and Manufacturing Execution System (MES) implemented across our plants are ensuring visibility of all critical plant operations and allowing for decision making remotely through mobile applications, thus ensuring seamless sustainability of operations while employees maintain social distancing and yet fulfil their activities on the plant floor.
- We have developed Digital Logistics Control Towers for coal, alumina and bauxite which use classical Machine Learning and OR (Operations Research) based mathematical modelling to reduce commodity costs, pilferages, and process ineffectiveness from mines through plants to ports.
- We are deploying advanced predictive solutions for quality control of finished goods, which will improve material quality and volume.
- A Centralized Surveillance Management system oversees our security operations using Image Analytics, Drones and real-time alerts through Video Management System (VMS).
- Improving Health, Safety and Environment performance by using Image Analytics and centralized real-time fire systems monitoring for better control and governance.
- Our complex and diverse procurement of commodities, materials and services are fully automated through the e-procurement platform, unlocking substantial cost savings with faster O2C cycle and business realizations.
- Using real-time Thermal Vision Analytics in multiple plant sites for identification of hot spots in Information and Communication Technology (ICT) which helps in improving asset reliability and reducing safety hazards.

Industry 4.0 going beyond manufacturing

Vedanta's early adoption of smart manufacturing is also helping it realize latent business potentials as Industry 4.0 is creating room for effective process assimilation through monitoring, enhanced industrial efficiency, increased asset performance, creation of predictive maintenance and real-time quality management.

The 'Make in India' initiative led the wider adoption of 'Industry 4.0' in the country, is bringing a new dawn to Indian Aluminium Industry. It has officiated severance from age-old practices of blunt resource consumption for manufacturing processes and facilitated contextual innovation. We are witnessing the successful marrying of computer-programmed automation with digital technologies such as analytics, artificial intelligence (AI), and the Internet of Things (IoT) on the production line. Since its inception, Industry 4.0 has spread beyond the factory walls to encompass a broader digital transformation that spans processes, functions, and industries. This technology-driven transformation is changing the way many organizations make sense of information and act upon it to make decisions that are impacting overall operations.

Advanced manufacturing – in the form of additive manufacturing, advanced materials, smart, automated machines, and other technologies – is ushering in a new age of physical production. At the same time, increased connectivity and ever more sophisticated data-gathering and analytics capabilities enabled by the Internet of Things (IoT) have led to a shift toward an information-based economy. This has made it possible to build smarter supply chains, manufacturing processes, and even end-to-end ecosystems. Companies are taking full advantage of technology improvements of the

last 25 years, which result in hyper-connectedness via the digital economy, transforming the structure of their business operations.

The prospects of smart manufacturing go beyond merely optimizing manufacturing processes. It also contributes to effective process assimilation, such as energy saving through power monitoring, enhanced industrial efficiency, increased asset performance, creation of predictive maintenance and real-time quality management.

As smart manufacturing slowly gets customized for India, it is also weaving in human components in the process while striking a well-designed balance between automation and digitization. India, a country of 1.33 billion, has to create ample blue- and white-collar jobs for the dual purpose of generating livelihoods and becoming a manufacturing hub. Industrial manufacturing processes thus need to have equilibrium between automation and manual labour functions to provide jobs for all and incorporate them in the nation-building process. An enabler of this equilibrium is smart manufacturing. Technology is helping the process of modification so as to successfully achieve resource optimization and efficiency. It will allow room for the incorporation of manual power in the manufacturing assembly line to guarantee effective control, conduct and capitalization while constructing a bridge between digitization and optimal usage of human resources to achieve the ultimate goal of sustainable manufacturing.

Smart manufacturing's potential to unlock Aatmanibhar Bharat

As India takes long strides towards its journey of self-reliance, the Aluminium Industry will play a major role in realizing its dream of becoming a \$5 trillion economy. Indian Aluminium's transition to Industry 4.0 will place it at par with global players. The present undertakings of smart manufacturing by Aluminium Industry leaders also sets the precedent for other manufacturing sectors. It can well be assumed that with greater commercialization of smart manufacturing technologies, it will lead to slow filtration of it to SME and MSME level for true realization of Make in India.

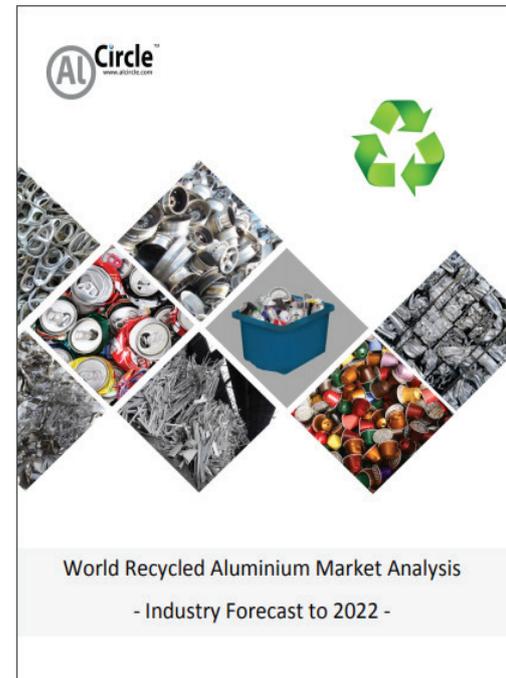
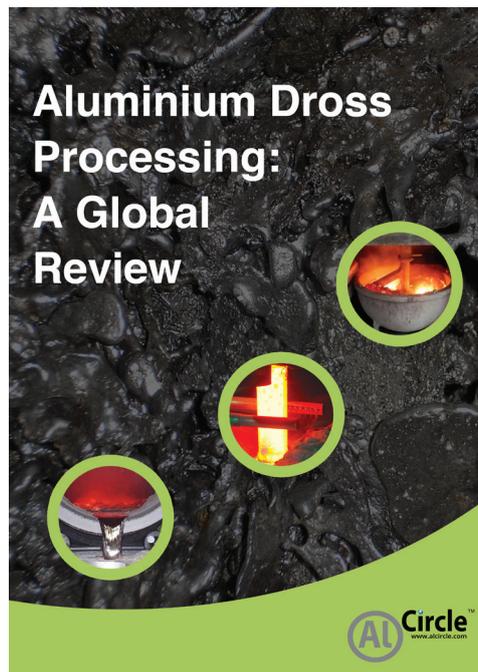
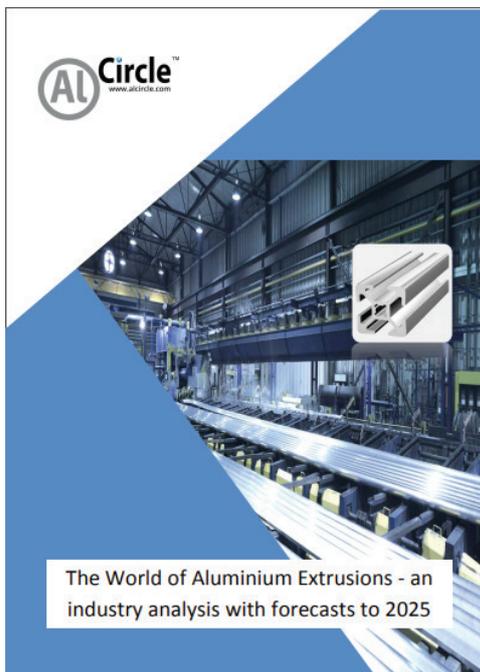
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THINK ALUMINIUM, THINK ALCIRCLE



John Courtenay, Managing Director, Aluminium Casthouse Technologies (ACT)

BatchPilot furnace weighing system for increasing casthouse productivity and production gets major IT upgrade, John Courtenay, Managing Director, Aluminium Casthouse Technologies (ACT)

A top-selling furnace weighing system from Aluminium Casthouse Technologies (ACT) is embracing the advance of Industry 4.0 with a major IT upgrade.

The BatchPilot, an innovative technology used in casthouses worldwide to accurately measure furnace liquid metal weight and determine exactly what is wanted aluminium and unwanted dross, is now installed with the latest Siemens S7 central processing unit and software for an even more accurate online process data logging and more user-friendly smart screens.

The upgrade of the Batchpilot system will, ultimately, allow customers to achieve greater gains in productivity, leading to even higher production levels at a time when the London Metal Exchange is rising sharply.

Knowing the correct weight of metal in the furnace is crucial to ensure slabs are consistently cast to the precise length ordered by the customer. The BatchPilot means casthouses don't have to rely on visual estimates of furnace heel weight, which are notoriously unreliable, often leading to short casts, overfilling of the furnace or potentially restricting the number of slabs cast, all hugely wasteful.

Bringing an overall increase of more than 15% in production without the need to install new capacity, the system is an invaluable addition to the casthouse and this IT upgrade embraces the spirit of Industry 4.0, making operations even more efficient and improving the user experience.

The BatchPilot uses unique technology for the accurate electronic measurement of furnace heel weights and transfer weights and is based on the principle of measuring changes in the furnace hydraulic cylinder pressure with furnace tilt angle. This allows precise measurement of furnace liquid metal weight, heel weight and dross build up.

Increasing 'right first time' batching, other benefits include increased number of ingots per cast, elimination of short casts, increase in yield due to reduction in overlength casting and energy savings due to reduced furnace waiting times.

Easily fitted to existing furnaces without interruption of production, it is a simple, fully automated, retro fitted device that is fully integrated into the batching process.

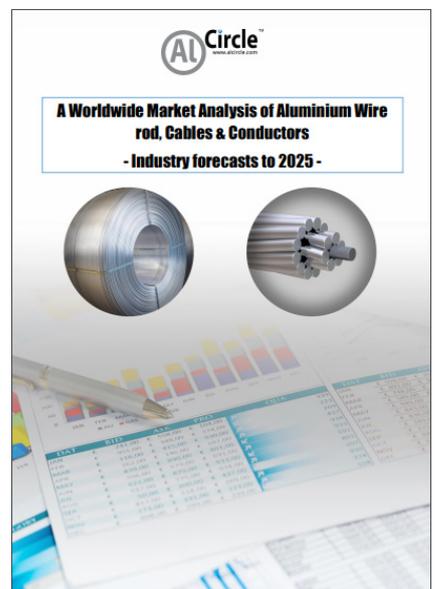
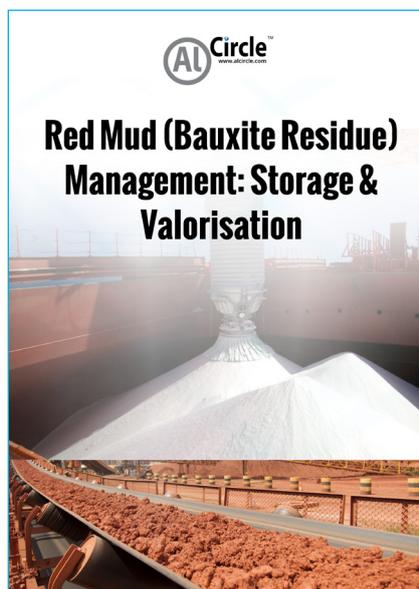
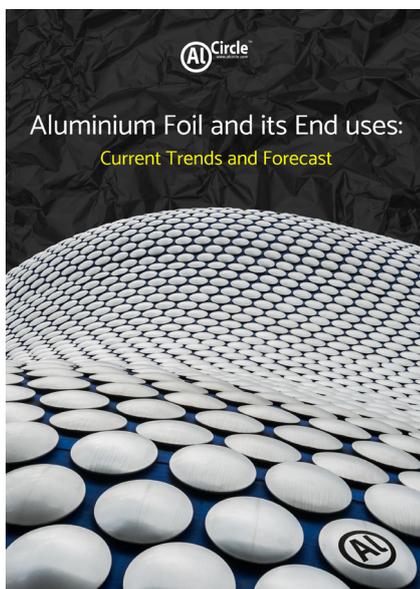
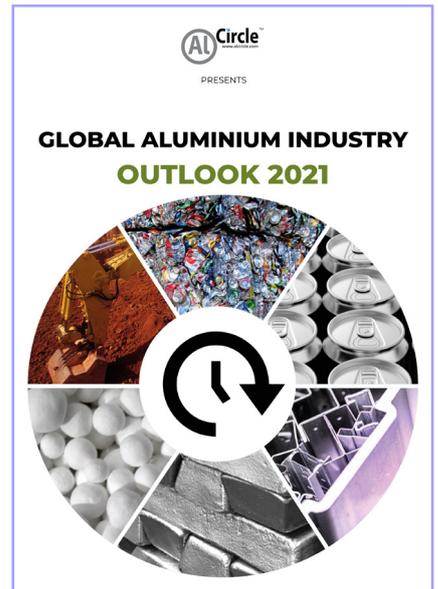
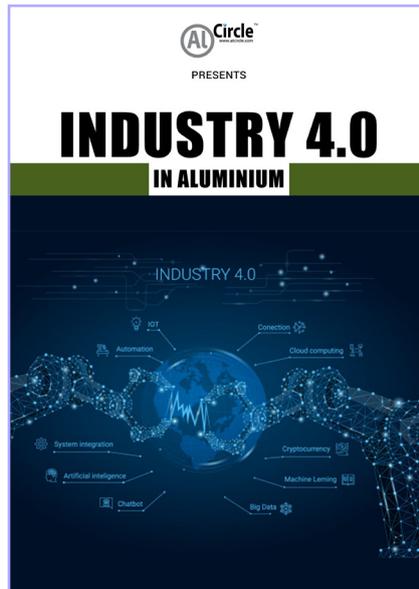
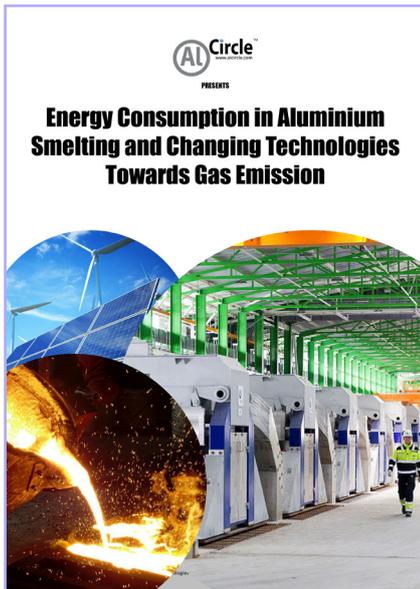
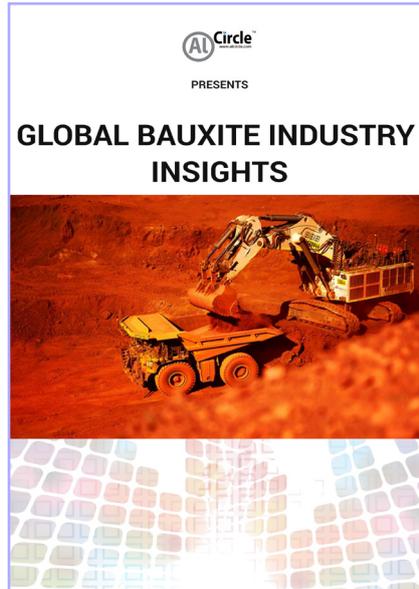
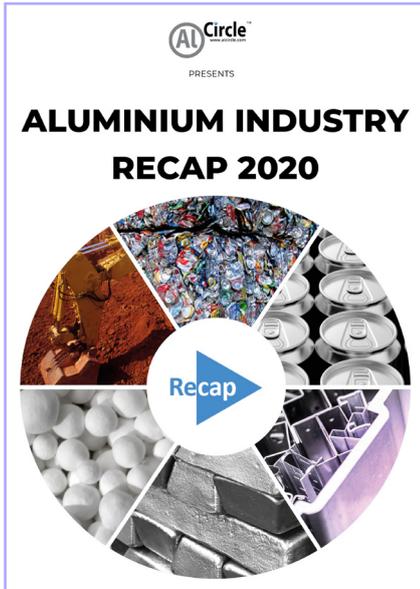
In terms of return on investment, with prevailing premiums, the payback time for a BatchPilot fitted on a 70MT furnace is less than three months due to the productivity gains it brings.

Crucially, the system – which has successfully been in production usage for over 10 years with fifty five units installed in casthouses around the world - can be tailored and customised to individual customer needs.

ACT is owned and managed by the Courtenay family, also shareholders and directors in aluminium grain refiner producer MQP. MQP's parent company is Sitong Group, one of the largest producers of master alloys in the world and manufacturer of MQP's high efficiency Optifine grain refiner.

As well as the BatchPilot, ACT provides the aluminium industry with a range of well-established casthouse products including Refinal fused fluxes and Casiflux environmentally-friendly launder coatings, together with comprehensive back-up support through distributors, agents and technical personnel.

More from AlCircle Reports





The importance and emergence of Industry 4.0 during the COVID-19 pandemic

By Peter Unwin, Global Industry Manager – Metals, AMETEK Land and AMETEK Surface Vision

Even before the COVID-19 pandemic, AMETEK Land and AMETEK Surface Vision had identified the need for connectivity and moved into Industry 4.0.

Industry as a whole depends on getting accurate data from systems and providing this to management within companies, enabling them to make data-driven decisions.

Industry 4.0 facilitates this by allowing operators to access accurate data at any point in time and from anywhere, which is exactly what has been needed during the pandemic to ensure companies can make key decisions quickly and remotely.

This has been emphasised by market sectors such as textiles and aluminium, which have experienced high demand during the pandemic – they are operating in a very fast turnaround situation, for example when producing personal protective equipment (PPE). They need systems in place to solve problems fast and allow them to transform their processes to respond quickly to changes in demand.

For a lot of companies, this period has been a proving ground for Industry 4.0, with many businesses having seen the benefits. However, for instrumentation providers like AMETEK Land and AMETEK Surface Vision, it has simply been the continuation of a theme that we have been working on for many years.

We have found that many companies have the data but do not know how to manage and use it to their advantage; this is where we come in. Our technology can generate large quantities of data, for example video files, but this is useless unless you know what to do with it – it simply uses up computer space.

Our experts and engineers, however, can understand the processes and systems of a company, and use our expertise to refine, tailor and fine-tune the technology to deliver the most useful information.

At both LAND and Surface Vision, we spend a great deal of time working out problems and providing solutions.

Our systems tailor information and provide customers with the specific data that is important to them.

LAND is focusing on melting furnaces in the aluminium industry, where we can transfer the extensive experience we have gained in the glass and steel industries, using our range of thermal imaging borescopes, to provide live thermal images of conditions inside the furnace.

By measuring conditions within the furnace, we can deliver increased efficiencies by ensuring the furnace is not operating too hot and expending too much energy, which helps to reduce emissions. This is supported by our flue gas monitoring solutions to ensure greenhouse gas emissions are minimised.

Some furnaces have been running for more than 40 years using the original operating system, with only a couple of people who are able to manage it. Thermal imager borescopes can provide details on individual burner combustion performance and allow remote live refractory inspection.

AMETEK Surface Vision is a leader in surface inspection of aluminium strip products, providing live video streaming and intuitive defect identification and classification data for operators and management tailored to suit individual requirements.

AMETEK Land and AMETEK Surface Vision have both been challenged during this period. Historically, our service, support and maintenance activities all take place on-site. The restrictions imposed by the pandemic has meant we have fast-forwarded our plans to expand our service provision by offering more remote services.

Continuous remote monitoring, using live information, has been much more appealing to many people in this pandemic, as it means no contact is needed. This is especially important when sites and locations are on complete lockdown. It is also faster, as data can be checked almost immediately, without the delays of travel or waiting time.

Because of this, there now appears to be more of an acceptance for OEMs to move to remote monitoring as a solution, both during the pandemic and beyond.

The pandemic has changed the way that people work and think about work. There has been a significant move to home-working unless there are business-critical reasons to prevent it. It has been proved that many companies can operate just as efficiently working from home, or remotely from the office or site.

Some manufacturers have looked at what technologies they have and how they can be adapted to meet immediate demands during the pandemic. AMETEK Land is an expert in the field of industrial non-contact temperature measurement systems, so we have been able to develop our existing systems for human body temperature screening because we already had the systems, processes, technologies, and expertise in place.

This has led to the rapid deployment of the VIRALERT3 screening system, which scans individuals at the point of entry to a facility, from a distance that complies with social distancing. By identifying high body temperatures which could indicate a fever, this supports other precautionary measures against the transmission of COVID-19 and other viruses.

New product development and improvement has always been a priority for both AMETEK Land and AMETEK Surface Vision. We saw the need for connectivity and Industry 4.0 some time ago, and the pandemic has only accelerated our ongoing efforts in this area. We are now integrating Industry 4.0 into all of our products and ensuring they are compatible with all systems.

It is not a case of providing one single solution; there are many different ways that people want to connect to devices, so we are ensuring all our products are connectable to any form of digital and analogue communication.

The advantage is that we do not have to get up-close to devices – as long as there is an internet connection, we can access performance information and data.

Post-COVID-19, businesses appear to be slowly getting back to normal operation levels where possible, but many industries, including metals, are going to change. Processes will have to be more resilient and be able to cope with demand (both up and down), which will likely be highly variable while we go through the transition of back to work.

For example, metals processing working in a high-volume sector has seen a change in demand. People are uncertain about the future, so the demand for new cars has reduced significantly.

Automotive steel and aluminium manufacturers run high-volume production processes, continuously manufacturing thousands of tonnes of high-quality strip products. These processes tend to be quite stable and just change-monitored. As we go through this pandemic phase, we will likely see that automotive demand is slow to pick up, but other

sectors might emerge quicker.

This means that cold mills and process lines that are set up for automotive markets will probably become more versatile, responding to where the demand comes from.

This changing industrial landscape will require better control and faster feedback to enable quicker production changes, utilising existing lines, equipment, and resources – and that is accomplished through digitalisation.

Artificial Intelligence is another factor in changing business models and Industry 4.0. It allows for faster response through digitalisation. We are now in a situation where we can develop and let machines learn from feedback from the data. As we finally emerge from the COVID-19 pandemic, this will become ever more important.

About AMETEK Land

AMETEK Land is a business unit of AMETEK, Inc., a leading global manufacturer of electronic instruments and electro-mechanical devices with 2020 sales of more than \$4.5 billion. AMETEK Land designs and manufactures a wide range of instruments for industrial non-contact temperature measurement, combustion efficiency and environmental monitoring.



Rahul Prajapat, Founder and CTO, TVARIT

Automation and Robotics have become important aspects when talked about the global Industrial sector. Especially, automotive, infrastructure and packaging industries are using aluminium as one of the key materials for manufacturing of relevant components, Rahul Prajapat, Founder and CTO, TVARIT.

Driving the world towards sustainable and zero waste manufacturing is something that holds as a vision for a young and passionate technocrat like Rahul Prajapat, Founder and CTO, TVARIT. He is responsible for the Technology and Go to Market activities of the TVARIT GmbH. Prajapat having strong expertise and huge insights in the segment of Smart factory, Industry 4.0, and Metal manufacturing, under his leadership, TVARIT has substantially grown the business and major roll-outs of TVARIT's platform TiA are currently ongoing.

AlCircle: How is Industry 4.0 changing the dynamics of the global aluminium and metal industry from TVARIT's point of view?

Mr Rahul Prajapat: The global aluminium and metal industry is facing severe challenges such as high scrap rate, low production due to unplanned downtime, high energy consumption, just to mention a few. To overcome these challenges, TVARIT visions itself to drive the world towards sustainable and zero waste manufacturing by using a Hybrid AI model combining modern AI technology with metallurgical and production process knowledge which is used to provide a solution for predictive maintenance, predictive quality, predictive energy and AI-assisted production planning. This hybrid AI and machine learning technology is developed by integrating manufacturing process knowledge into Ai and machine learning models in terms of machine maintenance schedule, product geometry and logic rules based on production engineers.

AlCircle: How TVARIT is driving the aluminium industry with its AI solutions?

Mr Rahul Prajapat: In order to understand the implications of our AI solutions, it is first obligatory to know the various day-to-day manufacturing challenges faced by the Aluminium Industry.

Deviations in the chemical composition of the material such as H₂ content and geometrical characteristics (percentage of crown) are repeatedly causing quality deviations of the aluminum coils during the production process. This is resulting in a high reject rate as well as additional efforts and therefore increased cost due to rework or discounted sales.

No real-time information on the multi-stage manufacturing process is available and the quality of the batch can only be determined after the evaluation of laboratory tests, which are only accessible after two days on average. Therefore, the potential performance level of the entire production is limited.

Solution: In order to address these challenges we have developed a **hybrid AI and machine learning technology** by integrating manufacturing process knowledge into AI models in terms of machine maintenance schedule, product geometry and logic rules based on production engineers. This Hybrid AI model provides a solution for predictive maintenance, predictive quality, predictive energy and process optimization or technology enriches the AI model with manufacturing process knowledge. Hence it can be scaled to various materials and processes with minimal effort. We use cognitive machine intelligence to further reduce scaling efforts and can start with a small sample of data. This gives us a unique advantage against our competitors.

The TVARIT Industrial AI platform (TiA), displays the results of the data analysis and the AI model in a clear and customizable dashboard. This enables quality managers, process engineers and manufacturing engineers to gain actionable insights based on the captured process parameters which are processed by the software in real-time. Notifications and alarms ensure that anomalies and potential failures are detected during the production process. In addition, the concrete recommendation for optimal process parameters provided by TiA helps to stabilize product quality. This is reflected in shorter lead times, a reduction of the scrap rate by up to 75% and by over 25% increased machine up-time, higher overall effectiveness, and thus increased productivity.

AlCircle: Can you please outline TVARIT's investments and further expansion plans concerning industry 4.0?

Mr Rahul Prajapat: TVARIT's main focused geographical markets are Germany and Europe. But we are also expanding and targeting other regions like India, Japan and USA with our solutions and offerings. The industrial market segment we are targeting is the metal processing industry (Automotive industry, Piping and structural equipment manufacturing). The main target processes are low pressure die-casting, welding technology, injection molding, bayer process and cold forming. Also, areas like remaining tool life in the (milling and drilling) market segment as well as hot forming are focused in our go to market approach. TVARIT generally focuses on four core areas i.e., predictive quality, predictive maintenance, predictive energy and AI-Assisted Production Planning. We believe in core research, always trying to build a consortium of Industry-academia research relationship to solve the problem and thus can be scaled to multifarious applications. We have an academia relationship with worlds top notch research Institutes such as Stanford University, TU

Darmstadt, IIT Bombay and IIT Delhi. So, high efforts are invested in core R&D to build the product right from scratch. TVARIT is headquartered in Germany and has a research and development center in India. In future, TVARIT plans to extend operations in the US and the important markets in Asia like Japan, South Korea and Taiwan for both strategic business expansion and investment purpose.

AlCircle: Automation and Robotics are revolutionary in the global industrial sector including aluminium in regard to improvising efficiency and productivity. What is your assessment of this factor?

Mr Rahul Prajapat: Automation and Robotics have become important aspects when talked about the global Industrial sector. Especially, automotive, infrastructure and packaging industries are using aluminium as one of the key materials for manufacturing of relevant components. Main hurdles of these industries are to reduce the scrap rate and energy consumption. Automation and robotics have started rescuing these industries. The advanced technology has now conquered the long spent human efforts by completing the task effectively and is available 24/7 without any additional labour costs. In addition to this, with the aid of automation and robotics, it becomes very easy to implement AI technology which helps the manufacturing industries to reduce scrap rate, increase machine efficiency, improve production planning and save energy. The AI technology also helps to reduce the human caused errors as these human errors are associated with considerable time consumption and money-waste. And why these technologies shouldn't be credited as they provide a resulted benefit on the operational cost by overtaking the human enforced assembly lines in limited workplaces. Hence, even small business owners can benefit of them although it comes with an unavoidable initial cost

because the return on investment has more weightage. The new Industry revolution will enforce some of the most unexpected implications on humans and businesses. It all requires having a detailed understanding of your own operations and applying the right AI technology to the most required area for beneficial results.

AlCircle: What is your opinion about Industry 4.0? Has Covid-19 stimulated the industry 4.0 movement? If yes, please detail it.

Mr Rahul Prajapat: Industry 4.0 is a new buzz word among manufacturing industries. But we also know that it was industry 3.0 that led the introduction of computers and logic-based systems to automate manufacturing processes. Even though manufacturing processes were automated, human input is still required to manufacture and monitor them. This is where Industry 4.0 differs. The aim is to not only automate the manufacturing process, but also to automate it without human intervention. e.g. In steel manufacturing manual inputs are provided and changed during the manufacturing process, which is essential for maintaining the required grade and quality of the product.

There are usually three big problems in manufacturing Industry- cost reduction pressure, ESG Regulation and process experts and machine operators retiring which is the major concern. The solutions like predictive quality, predictive maintenance, predictive energy and AI assisted Production Planning can help overcome the major challenges and lead to sustainable manufacturing.

Even though Industry 4.0 comes with a huge set of benefits, but the current pandemic has affected the industry 4.0 movement. The pressure on manufacturing and production

companies caused by the ongoing Corona crises has forced them to go new ways to increase efficiency and to remain profitable. Slumping demands, disruption of supply chains and a lack of staff cause a severe reduction of capacity and profit. This in return puts pressure on manufacturing companies, forcing them to further cut expenses through measures like short-time work, which again lowers capacity and therewith cash flow.

New challenges require new solutions. And besides cutting expenses, there is one way of increasing profit: Increasing efficiency. A higher degree of efficiency can be attained through an improved ratio of useful work by a machine or in a process to the total energy expended or taken in. In a nutshell, by increasing machine-uptime and reducing waste.

To achieve this, manufacturing companies can make use of one of their most important assets – an asset that, in many manufacturing companies, is still used very little: Production and machine data. The data collected from machines and quality inspections throughout the production processes contain information about the root causes of quality defects and machine breakdowns. Leveraging sophisticated algorithmic AI modules, accurate real-time predictions of quality defects or machine breakdowns can be made and optimal process parameters to increase the quality and to prevent machine breakdowns can be assessed. A variety of industrial use-cases have proven that scrap-rate reductions of over 75% and by over 25% increased machine up-time can be realised with the help of AI. The ongoing pandemic is presenting unacquainted challenges for industries. These are difficult times for manufacturers, but they will eventually pass. However, it is now the time to use all available assets and to leverage the capabilities of digitalisation to not only face these challenges but to use it as an opportunity to move forward.



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