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The Bundesverband der Deutschen Gießerei-Industrie e. V. (BDG) and the Verein Deutscher Giessereifachleute e. V. (VDG) are jointly organising interesting forums for the foundry industry as part of GIFA/NEWCAST 2023. The focal points of this year's forums are topics that will make our industry fit for a climate-neutral future. For this transformation and the challenges associated with it special solutions are needed for our small and medium-sized industry. Concrete concepts and solutions will be presented in the course of our lectures at the BDG forums:

The GIFA Forum

addresses foundries and presents technological advances in the foundry supply industry:

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- > Resource and energy efficiency
- > Recycling & secondary materials
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- > Automation and digitalisation
- > Process simulation and control
- > Process and product development
- > Melting and casting technology
- > Plant and production technology
- > Model and mould making
- > Mould and core production
- > Casting chemicals and auxiliaries
- > Additive manufacturing

The NEWCAST Forum

presents the advantages of cast components and shows perspectives for the use of innovative casting products and casting materials. The contributions on the following topics will promote an active exchange between developers, designers, purchasers and foundrymen and facilitate the professional dialogue between research and practice:

- > Sustainability
- > Decarbonisation & climate neutrality
- > Material and energy efficiency
- > Component sizing and design
- > Lightweight construction and bionics
- > Digitalisation & Industry 4.0

For all conferences, presentations in English and German (simultaneous translation into English) will be accepted.

We kindly ask you to send your presentation proposal with an abstract and a short curriculum vitae by 30 November 2022 at the latest.

Please send these documents to:

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A special German path?

As you read through this new issue of Casting Plant and Technology you will notice that it has a particular emphasis: a focus on the German market and the specific challenges that it is facing. Long-term market and political developments, the transition from a Covid-oriented crisis to a Ukraine-related crisis, and the resultant energy emergency mainly determine the status quo in Germany and throughout Europe. And there were two very exciting sector trade fairs (in Nuremberg and Stuttgart) which were also heavily influenced by current affairs.



Photo: BDG

Martin Vogt
Editor-in-chief

e-mail: martin.vogt@bdguss.de

If we editors and publishers of CPT were granted a wish, one thing would be at the top of my list: knowing how you, the readers, perceive these topics in Germany and the rest of Europe. Are you alienated by the agenda, particularly in Germany? Do you already sense that these topics will also affect you?

In its 'Fit for 55' program, the EU announced that it intends to be climate-neutral by 2055, while Germany is even more ambitious and wants to achieve this by 2045. The events of the last few months – during which worldwide problems with supply chains, as well as massive price rises for raw and input materials have put pressure on the foundry industry – must also be seen against this demanding background.

During the year, the anyway especially high energy prices in Germany have risen even further, particularly for gas and electricity. These increases are

partly due to the idiosyncrasies of the German and European electricity markets – we will not be going into more detail about these peculiarities here.

It's the effect that matters: companies have yet another commercial challenge to overcome – namely having to shoulder galloping costs against the background of profit margins that are becoming even narrower – while remaining profitable as a business, i.e. surviving in a market characterized by worldwide competition.

We describe the entire path towards climate-neutrality, which also involves the electrification of transport, as the 'transformation'. There will be winners and losers. Unusually, you will find reports on two trade fairs in this issue. More detailed regarding the Euroguss die-casting trade fair and somewhat leaner when it comes to CastForge, the casting and forging trade fair in Stuttgart.

We provide many concrete examples of where the real problems are. And our business report on Harzguss Zorge also explains – in very practical terms – the challenges of dealing with the transformation facing a typical SME in Germany's periphery.

Have a good read!

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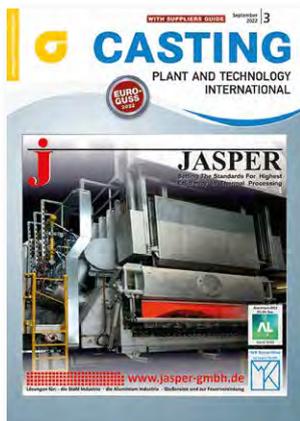
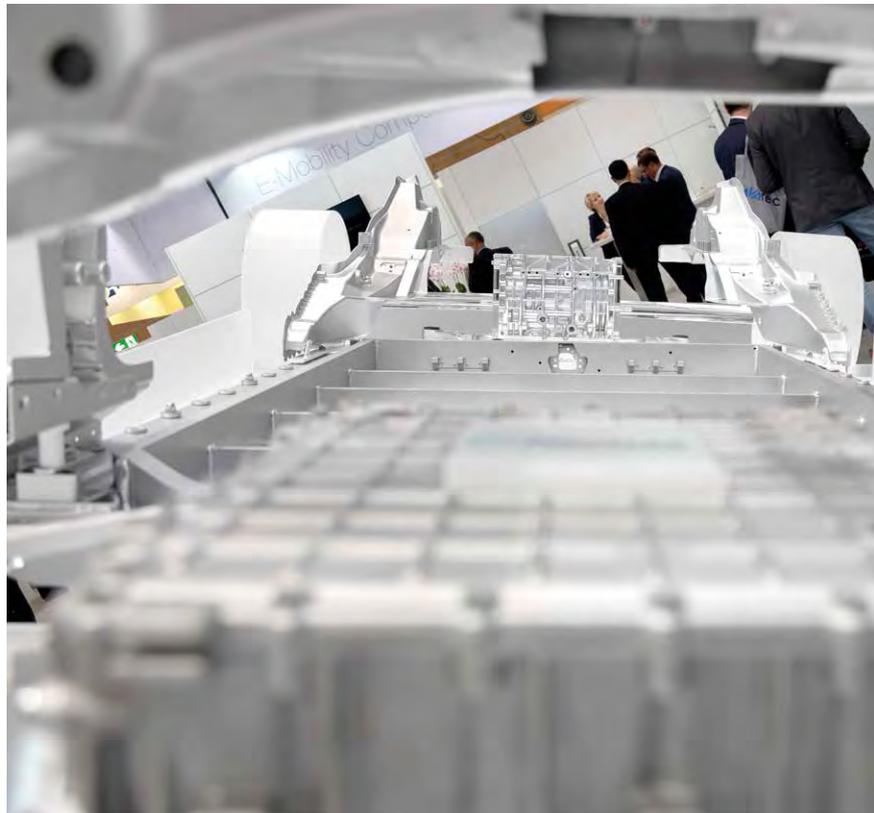
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Caster an forger met for the second CastForge trade fair in Stuttgart, which was twice as large as its predecessor. *Martin Vogt*



COMPANY
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EUROGUSS
2022: An industry facing upheavals.



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INVERSTMENT CASTING
3D printing is integrated in the lost wax investment casting process for more design freedom and faster implementation.



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At the cupola furnace:
Managing Director Torsten Stein
in front of the cupola furnace. The
hot-blast cupola furnace has a
melting capacity of 25 tonnes/
hour and was purchased in 2007.



Photos: Christian Thieme



Harz Guss Zorge and its energy transformation

Power supply suspense

The will alone is not enough for finding a path to climate neutrality. Official regulations and the financial feasibility of infrastructural measures are major obstacles that must be overcome. The course has been set at Harz Guss Zorge, though its rural location drives costs up, making the transition to a climate-neutral melting plant almost impossible.

By Christian Thieme

At first glance idyllic. The grounds of Harz Guss Zorge are surrounded by forests that continue unbroken as they mount the hilly landscape. Melting, and the processing of the liquid metal to create innovative products, has been taking place here, in the middle of the valley basin, for more than 150 years now. The company specializes in complex finished and mounted components for engine construction, commercial vehicles, agricultural machinery, as well as refrigeration, compressor and drive technologies. With sales of 101 million euros, the works is also one of the largest employers in the southern Harz region, with about 450 personnel.

A cupola furnace in the machinery room of the tradition-rich foundry ensures the supply of molten metal. Up to 25 tonnes of iron are melted here every hour, with the energy coming from coking coal. "The cupola furnace plant was only rebuilt in 2007,"

explains Managing Director Torsten Stein. The company invested a total of 12 million euros at the time. Even during the planning phase in 2005/2006 it was clear that it would not be possible to use an electric melting furnace due to the lack of a grid infrastructure. "We decided on the cupola furnace at the time, and selected a size that meant that we did not have to participate in the EU's Emissions Trading System (ETS)," adds Stein. Now, 15 years later, this decision is threatening the existence of this production site.

Zorge's melting unit emits about 40,000 tonnes of CO₂ per year which, in addition to the actual raw material costs, drives prices even higher. "It is now the case that companies that participate in the EU's ETS are assigned 75 percent of their certificates free-of-charge. Only 25 percent are actually traded. As an SME, we are disadvantaged by this system because we have to pay the full CO₂ price, or only



receive partial exemption,” according to the Managing Director. The aim is clear: the company wants to start a transformation process so that it can remain competitive. The solution would be a new electric melting furnace, but the costs are enormous and the legal hurdles do not leave companies and the authorities any realistic leeway for implementing the plan.

The desire for a green melting operation

“Our site’s current power input is 6.8 MW,” continues Stein. “But we would need about 40 MW in a redundant power supply design for an electric melting operation.” The estimated costs for the new grid connection alone are estimated to be more than 19 million euros. “And rising,” adds Stein. Then there is the 6.4 million euros for the induction crucible furnace plant and another 6.5 million euros for the necessary infrastructural measures on the works grounds. All in all, the transformation to a more climate-friendly melting operation would cost 32 million euros at current prices, which would be simply unmanageable for the company by itself.

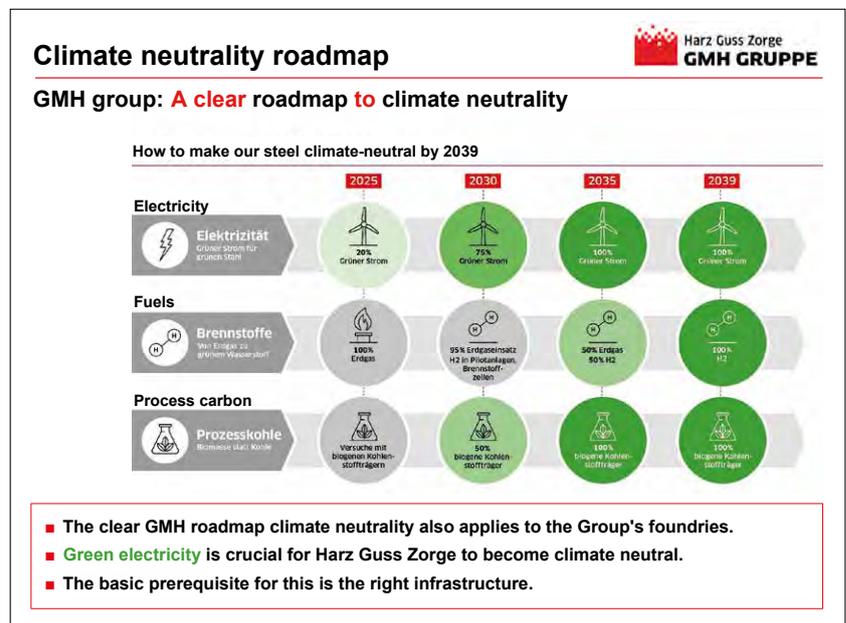
The idyllic location acts as a cost driver here. Stein says that, “The high costs for the grid connection are,

The company headquarters of Harz Guss Zorge.

among other things, due to the cable route. The nearest transformer station is ten kilometers away. And one also has to go around conservation areas. Then there’s the debate about whether to implement this as an overhead line or an even more expensive underground system.”

With a planning horizon of four to five years, time is pressing due to the inevitable further increase in production costs at Harz Guss Zorge during the coming years. But the Managing Direc-

The GMH climate neutrality roadmap also applies for the group’s foundries.





The Green Steel logo of the GMH Gruppe. The company is taking a clear path towards climate neutrality.

tor is actively seeking contact with politicians, the state of Lower Saxony, and regional representatives of companies and communities to raise awareness of the problems. "We have already had members of both state and national parliaments here to visit, for example Mr. Trittin (the former Federal Minister for the Environment) who, together with other politicians, strongly supports our cause," explains Stein. But the mills of politics grind slowly.

Whereby the GMH Gruppe, to which Harz Guss Zorge belongs, has done their homework and come up with a clear roadmap towards climate neutrality. The entire group is to be converted to 100 percent green electricity by 2039 at the latest. The transformation also includes substituting natural gas with green hydrogen, and the use of biogenic carbon carriers. Stein: "We are part of our society. We bear some responsibility for future generations who want to live here. And our customers also want us to decarbonize. Every company would therefore be well advised to get actively involved with this topic early on and work out an individual timetable."

In the case of Harz Guss Zorge, the company has developed an alternative plan that is still in an early planning phase. Torsten Stein tells us more about it in the following interview.

Interview with Managing Director Torsten Stein

"We have an idea and we are fighting to achieve it."

The site lacks the necessary grid infrastructure for melting the metal with electricity. So you want the local energy provider to be encouraged to bear the grid expansion costs. How do you intend to achieve this?

Stein: We in the countryside face a special challenge because we need greater electricity capacities. This doesn't only affect us, but many companies here in the region. So the grid needs to be expanded. According to the energy provider, the current 110 kV grid is no longer sufficient and a new transformer station must be built in Walkenried. This would involve an investment in the high double-digit millions, which the energy provider cannot afford. Ultimately, politics has failed to deliver the necessary conditions to enable grid expansion. In other words, funding opportunities must also be opened up for grid operators so that expansion can

take place and green electricity can reach industrial plants.

What needs to happen?

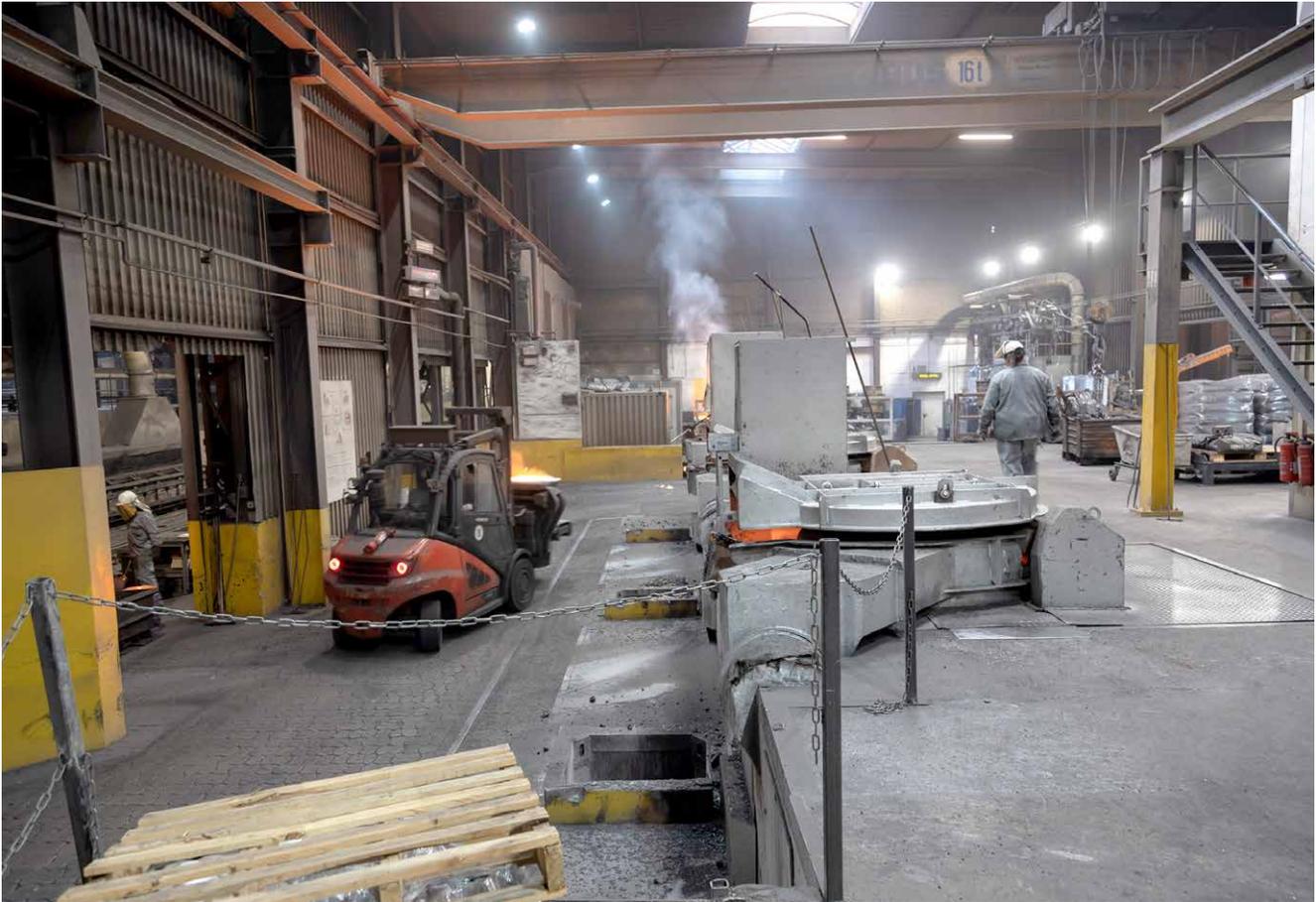
Stein: There should be a grid expansion plan that includes the 110 or 360 kV levels. An inadequate grid infrastructure automatically leads to companies losing their ability to compete and disappearing from the market. This has serious consequences, particularly for rural areas.

Do you think that reactivating nuclear energy in Germany could help solve the problem?

Stein: I tend to think that this would be a bad approach. It would be much more

Managing Director Torsten Stein is seeking discussion with politicians and authorities in order to realize the transformation process of the foundry.





important to judiciously push on with regenerative energy. It took seven years to put up four wind turbines in my home town. We'll never achieve the transformation if we carry on at that rate. Here, too, it's up to the politicians to create the conditions that enable rapid expansion. Reactivating the nuclear power plants would lead to a sudden reduction in the pressure to expand renewables. We would have gained nothing and would actually make the problem of the unresolved search for final storage sites even worse – after all, longer running times also means more nuclear waste.

Should the industry become a role model for society regarding transformation?

Stein: Not just that. The transformation pressure from customers will increase even more. The carbon footprint of a product is increasingly being focused on and we, as foundries, can do a lot to influence how climate-neutral a product ultimately is. As a foundry, one would be well advised to consider the topic now, and to work out solutions for how one's production can be truly climate-neutral. Climate neutrality will practically become a sales argument.

A look at the company: Zorge's processes also require a lot of energy – increasingly via electricity.

Production is aligned towards core-intensive complex components for vehicle construction and general mechanical engineering.

A high price for electricity also increases the pressure on German foundries. What's the situation compared to other EU countries?

Stein: You only need to cross a border to find completely different economic conditions. Here in Germany, the conditions have gradually got worse and worse, while in the surrounding coun-



tries the problems are being tackled at a very different tempo. My understanding of a united Europe would include climate policy being shaped within the European community and not by every country doing their own thing. We run the risk of experiencing a de-industrialization here in Germany.

Does this particularly affect the metal-processing industry?

Stein: No, it also affects other sectors – wherever energy plays a central role. We must be careful not to drive primary industries (and I include our sector) out of the country with our energy-related conditions. Entire value-creation chains are built upon our products. These value-creation chains will collapse when the primary industries have been lost. That's also why it's so important that we shape the energy transition together, to ensure that the foundry industry can keep pace. Whereby expanding the grid is vital.

What do you think is the next step towards driving forward grid expansion here at the site?

Stein: Harz Guss Zorge cannot solve the problem alone. We are therefore looking for alliances here in the region so that we can find a solution together and everyone can participate in it. The aim is to enable regenerative energy generation here in the region – together with the necessary infrastructure via which we can then obtain the electricity. At the moment, we are in intensive discussions on a major photovoltaic project. But we are right at the start and there is still a lot to be clarified. I think that this route is currently the only hope for affordable grid expansion here in the region, which would enable us to complete the transition from coal-based cupola furnace to electric induction furnace.

“The only hope” means that there is no realistic chance of getting a new electricity link?

Stein: Not at the moment! All those involved are struggling with the problem. The expansion costs are too great for the energy provider; legislation stipulates that expansion cannot be carried out for a single company; and the state of Lower Saxony is not allowed to take on the costs. And the costs of such a plan are continuously rising. At some time the point will be reached where investments in our site no longer pay.

But the PV park would be an alternative?

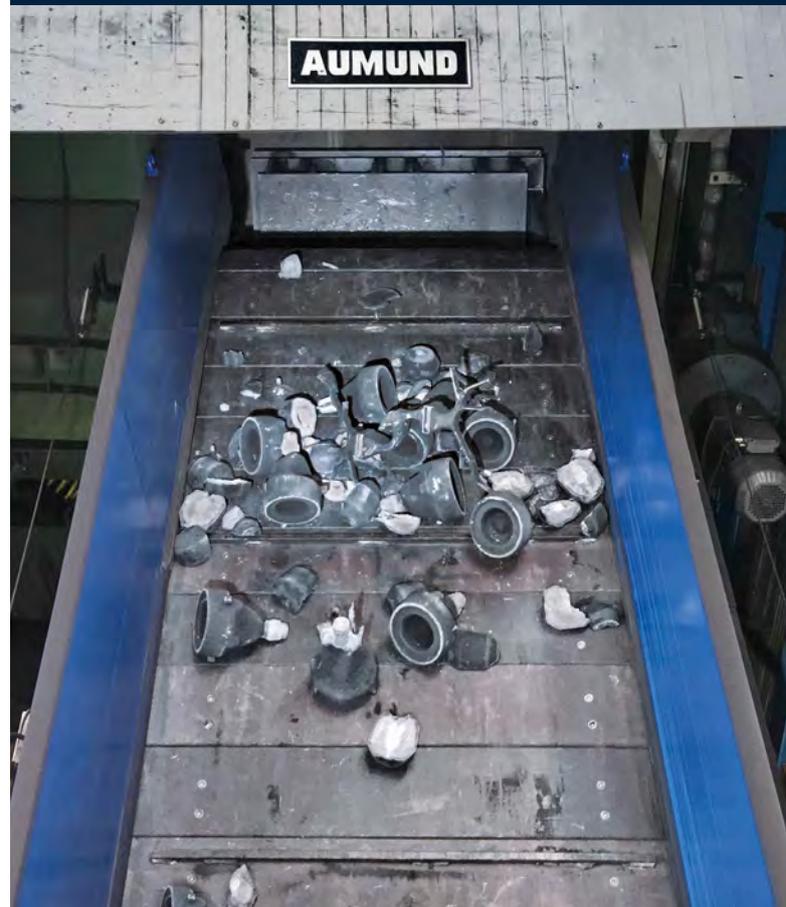
Stein: Would the project be possible, we could shorten the new supply route from ten to about three kilometers and wouldn't have to cross any conservation area. Then we could also use the new transformer station of the photovoltaic power plant. Overall, in this project, we are talking about a peak power of 200 megawatts per hour. We would not be able to completely cover our three-shift operation regeneratively, but we would be in a position to complete the transition to electric melting. At present, however, we are still in a very early phase in which everything is still unresolved. The local communities and the landowners are all with us, but whether one can actually get approval for such a plan is another matter altogether.

What sort of planning horizon are we talking about here?

Stein: Two years in the best-case scenario. Then it would take another two years to build the electric melting plant. The CO₂ price will rise further during this time. And as mentioned earlier, at some time we will reach a point when investments in this site no longer pay, and we want to prevent that at all costs!

Thank you for the interview.

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E-Mobility Component



The international die casting industry meets at the biggest trade fair for die casting in Nuremberg.



Euroguss 2022

An industry facing upheavals

Summer feeling or a sense of crisis? Following its unavoidable pandemic-related hiatus and postponement, the Euroguss die casting trade fair (traditionally biennial) took place in summer for the first time in its history. But the industry, with the upheavals it faces, was tense despite the unaccustomed date and comfortable external temperatures. The current extremely high energy prices weigh heavily, while the future promises major challenges and remains uncertain.

By Jan Kretzmann and Martin Vogt

Nevertheless, there was a buoyant mood as the largest sector get-together of the year started – the mild temperatures allowed the traditional opening celebration at Nuremberg’s Imperial Castle to be held as an open-air event this year. The initial meet-and-greet among the sector representatives – who were all happy about this first major reunion with a physical presence – was accompanied by jazz and a barbecue. During his inaugural speech, Clemens Küpper, President of the German Foundry Association (BDG), stressed the value of personal discussions for the sector and its products, but also mentioned current difficulties, such as the Ukraine conflict and its associated challenges. He also again

emphasized the importance of political action and talks with those involved. This tone continued when, on the following day, Hartmut Fischer, Chairman of the Association of German Die Casting Foundries (VDD), demanded stable political framework conditions during his opening speech to the International Die Casting Congress. Whereby Fischer described the main factors as an adequate gas supply, a dependable supply of green electricity, quicker and easier approval processes, and greater independence regarding raw materials – defining the difficult situation in which German die casting, in particular, is operating. Politicians also visited Nuremberg: Roland Weigert, Deputy Minister at the Bavarian State Ministry

for Economic Affairs, took time for a tour of the trade fair and participated in the opening discussion.

“It’s up to us to find technical solutions”

Parallel to this Nuremberg trade fair (on Wednesday, 8 June), a majority of the EU Parliament voted for a sales ban on new cars with internal combustion engines from 2035 – a decision that was rather calmly acknowledged at Euroguss. “I think that this decision was to be expected,” said Achim Sach, Managing Director of the Nuremberg-based foundry 595° Solutions, which had recently been restructured – more on this in our interview in this issue. “For us casters life goes on. We must adapt

EUROGUSS

to this technologically," Wolfgang Schmidt commented on the decision. And for the Chairman of the Management Board of Albert Handtmann Metallgusswerk GmbH & Co. KG this meant further development of the company. For SMEs, this also involved the topic of giga-casting. "Our Bühler 6100 machine is expected to be commissioned during the first quarter of 2024 – an investment involving double-digit millions of euros. We are very capital-intensive," said Schmidt. The new machine will mainly be used to produce chassis and battery components. In addition to the topics of transformation and qualification – also in the company's own Technology Center – Schmidt quoted the topic of energy costs as the central challenge. "Of course it's up to us to find technical solutions. The digitalization of processes and the monitoring of energy use are the type of measures that we will implement ourselves," Heiko Pfeiffer, a colleague of Wolfgang Schmidt on the Management Board, referred to the company's own activities but added that, "politics and customers must participate." Galloping energy costs are an increasingly decisive driving force in the sector – and an enormously important topic practically everywhere. At suppliers too – who are doubly affected by the topic: concerning both their own energy costs and, of course, customer pressure regarding products. "The decisive question for us is how we can help the customers become more efficient – and thus have lower costs," said Kerstin Berndt from the Borken-based supplier Foseco. "Process stability and the reduction of rejects are the main goals. And, of course, energy consumption plays an important role," said the specialist in non-ferrous molten metal treatment. It was not by chance that the brand presented the e-motor housing of the current drive from Volkswagen's ID.3/ID.4/ID.5 e-cars at its stand. After VW had problems casting the housings and had too many rejects, Berndt's team at Foseco provided support in optimizing the melt. Of decisive importance here was the FDU Smartt Unit, an innovative process control system for the rotary degassing of aluminum melts. "The machine gives the customer process reliability. And a certain leeway," said Berndt. One side-effect is that the process can be run a couple of degrees lower, decreasing energy costs.

The NemaCar e-Light, the aluminum chassis of the Mercedes EQS.

The former Schulte and Schmidt foundry is now operating under the name 595° Solutions. Visitors to its stand could take a look at the digitalized foundry plant via virtual reality.



Nemak going all out

Light construction specialist Nemak, focused on supplying the automotive industry, made a big effort – starting with its impressive stand. The presentation centered around its NemaCar e-Light showcase project, the aluminum chassis of the Mercedes EQS e-car. Personnel at Nemak are proud of the Group's latest development, the largest currently available one-piece battery housing for hybrid vehicles. It is used in Mercedes GLA, C- and S-Class models. The transition to the production of e-drive components is in full swing at Nemak: "At the moment, the proportion of combustion engine parts produced is still at about 75 percent," explained Global Marketing Manager

Daniel Moscara. "But nothing more will be developed in this field, and roughly 60 percent of our activities are already directed towards the new technologies. The proportion of research and development work is currently considerably higher than for conventional components," continued Moscara. Production units are going all out to re-equip existing capacities for the requirements of new drive technologies. The Slovakian site has meanwhile transitioned to a pure producer of battery trays. Another works, in Poland, where up to now only parts for internal combustion engines have been produced, is currently in the middle of its transition process. New direction, new problems: the effects of the Ukraine conflict and the difficult



Green island: The topic of sustainability is also reflected in the design of the ae Group's stand. The company specializes in the CO₂-neutral production of light metal components.



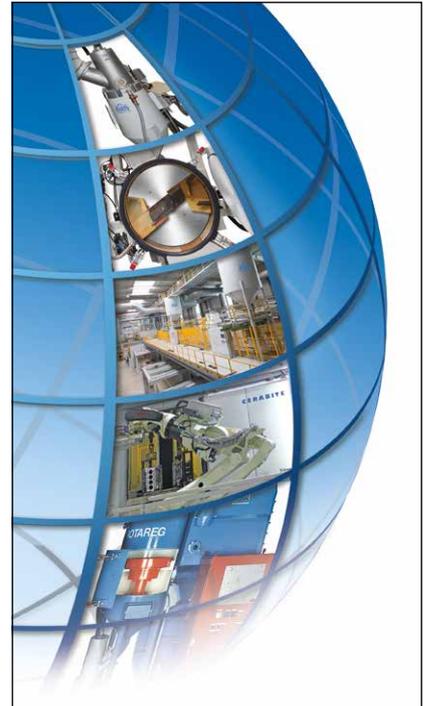
GF Casting Solutions demonstrated its competence in light metal construction for car-makers. The Renault show car exhibited here has a hybrid design with a battery housing produced by GF.



The traditional opening celebration was held at Nuremberg's Imperial Castle as an open-air event.

energy situation do not stop outside the gates of a big player like Nematik. "Rising energy prices are hitting us hard," according to Moscara. "We have to talk to our customers about passing on costs. Whereby some are cooperative and others are less pre-

pared to discuss the matter. In general, as a supplier, we are very understanding about the position of the buyers because we have a very close-knit customer circle." One problem regarding the finished die cast parts is storage capacity – numerous compo-



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EUROGUSS

nents are currently staying in stock longer than is usual, so storage capacities must be expanded and increased costs accepted. "In short, the current situation is preventing sales growth," said Moscara. "We are, however, a supplier that offers a variety of casting processes and does not limit itself. We don't see ourselves as just service providers for our customers, but also as development partners and consultants. We offer customers, for example, casting training courses and other events to inform them about current processes and future trends. This could become even more important for future processes. We are well positioned," the Marketing Manager summed up the situation.

ae Group presents efficient cooling solutions

The ae Group is also concentrating on the special requirements of electrical drive technologies. At its stand, the German automotive supplier and aluminum specialist presented its latest solutions for cooling channels in die cast housings. These are for control devices, power modules, inverters, and other electrical components. Efficient cooling without unnecessary parts, screws, seals and welded seams – the die casting process is ideal for this, as the ae Group proves. One exhibit was an aluminum die cast housing produced using the lost-core process, with a thin cooling channel of only up to three millimeters width. The cooling efficiency and tightness of the prototype was demonstrated live at the trade fair. The project was implemented in collaboration with the Fraunhofer IFAM and other development partners.

New trends in surface treatment

Plasmatrete is an old acquaintance when it comes to pretreating surfaces. Metals such as aluminum can be freed of unwanted residues, e.g. release agents, using a jet nozzle and prepared for further coatings. The company, founded in 1995 and active worldwide with its headquarters in Steinhagen in Lower Saxony, constructed a plant at the trade fair with which metallic surfaces can be protected against corrosion. The AntiCorr process is suitable, for example, for application on smaller die cast components, such as control housings for electronic components. What is special here is that the whole thing functions within a few minutes using Plasma gassing from jet nozzles, and can replace time-consuming immer-

Foseco employee
Ondrej Fazekas
explains the func-
tions of the new
FDU Smartt System,
with which alumi-
num melt can be
cleansed of oxides
and hydrogen.
Chemical salts are
automatically added.
Many parameters
can be taken into
account via the digi-
tal terminal.

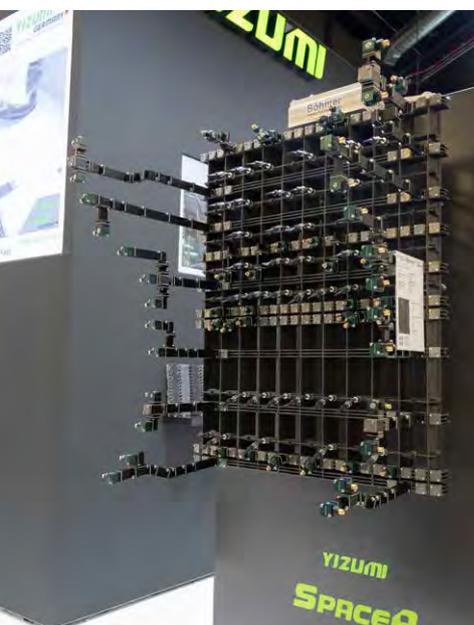
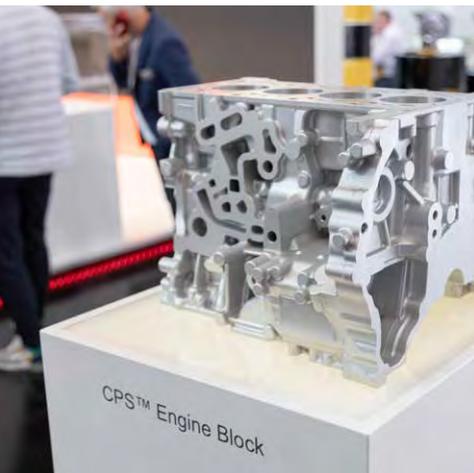
Trade fairs can also
be fun: Exhibitors'
Evening with live
music.



sion bath processes. Rösler has made a name for itself in the field of blasting machines and brought its latest flagship product to Nuremberg. The wire mesh belt blast machine with four (expandable to eight) mounted high-power turbines can treat very complex workpieces. The Gamma-generation turbines are equipped with buckets designed in a Y-shape that can simply be turned when one side becomes worn, so that the service life of a set of buckets can be doubled – that's clever.

Die casting and more from the Far East

Chinese machine producer Yizumi, which has made a name for itself in the fields of additive processes and thixomolding, presented a wide range of products. The new LEAP die casting machine – developed in collaboration with experts from Germany and Switzerland – was the centerpiece of its stand in Nuremberg. The latest generation has an improved mold closing system and an energy-saving drive group. Users can easily set, adapt



Yes, they still exist: aluminum four-cylinder engine blocks from Nemak, produced using the core package system (CPS). The light construction experts are also facing upheavals, and are re-orienting all their future production for electric and hybrid vehicle technology.

A bullseye? No, this circular aluminum die cast housing holds the current e-motors for Volkswagen's ID.3/ID.4/ID.5 models. After Volkswagen had had problems with the melt, non-ferrous specialist Kerstin Berndt's team at Foseco provided VW with support.

The Chinese die casting specialist Yizumi presented this spray nozzle produced via 3D printing. The polypropylene part is 60 kilograms lighter than a conventional spray nozzle of the same design.

and monitor production parameters such as speeds, pressures, waypoints, piston resistance in the shot sleeve, clamping force, temperatures, technology data and other parameters via the control system. The LEAP range of die casting machines meets all process requirements in casting aluminum or magnesium alloys, as well as semi-solid applications. "During development we used European expertise with production in China. We believe it is important to build bridges to Europe and to establish ourselves with a wide range of products at attractive prices – both here [in Europe] and on the North American market," explained Stefan Fritsche, Chief Strategy Officer at Yizumi. 3D printing is another of the Asian supplier's competences, presented live here at the trade fair. In a display case, plastic components were produced from granulate while astonished visitors followed the precise backwards and forwards motion of the printing head that printed one part after another. What were they making? One only needed to go a few steps further to find out. Here, Yizumi had mounted the prototype of a spray nozzle made using 3D printing on one of its die casting machines. The final product is made of polypropylene, is about 60 kilos lighter than a conventional aluminum spray nozzle, and can be produced in just 96 hours. The production process also provides great design freedom for customers, with countless different plastic alloys available for material composition. "A totally new development with which we want to increase integration of the possibilities of additive processes in existing processes. Initial resonance here at the trade fair is thoroughly positive," said a satisfied Fritsche.

Summary

How to sum up the 2022 Euroguss? The sector is not standing still; it is making progress – regarding processes and technologies. The political and economic conditions are changing and are creating major challenges for the die casting industry. Challenges to which the sector is reacting with a variety of measures. Suppliers are increasingly becoming advisory partners to their customers and taking more active roles in the development process. The current situation and future prospects are seen with skepticism, though technical advances and expertise contribute towards confidence and the conviction that casters are in a strong industry that can react to new situations with flexibility and sustainably.



Interview

New name, new orientation: trade show booth of the former Schulte und Schmidt foundry, now 595° Solutions GmbH.

“China has a problem”

Companies go, companies come: the former Schulte and Schmidt foundry in Nuremberg is doing business again under the name 595° Solutions. Among other changes, investor and Managing Director Achim Sach, Works Manager at Georg Fischer for many years and, in the interim period, long at home in the world of motorhomes, has been on board since June 2018. Jan Kretzmann and CPT Editor Martin Vogt talked with Sach about trends and topics in the sector, as well as the future of 595° Solutions.

CPT: Let's start with a question of topical interest, Mr. Sach. Were you surprised by the majority vote of the European Parliament on stopping sales of new combustion engine-driven cars from 2035?

Sach: No, not really. I expected this decision.

CPT: Will it affect your business?

Sach: Luckily, we are not affected given

this long time horizon. We do produce a lot for the automotive industry and the sector will remain an important pillar for us, but typical combustion engine components are already being substituted by electronic and electrification components.

CPT: But the former company was affected. Ultimately, a victim of the coronavirus crisis that could no longer

cope with the delivery bottlenecks, production stoppages and falling sales. How do you, as 595° Solutions, want to be more successful in future?

Sach: We currently have optimum starting conditions because we have really strong investors on board, namely Do Capital Partners and the Bavarian investment company BayBG from Munich. This constellation permits us to make future-oriented investments.

CPT: Then you are doing better than some competitors who cannot make any major progress due to the narrow margins in the sector. What investments will you make with the fresh capital?

Sach: The priorities are the really well-targeted renewal of our machine park, and investments in new projects. The company must also be strategically realigned. The first magnesium thixomolding plant from Japan Steel Works (JSW) is already in place – a 1.74 million euro investment. The machine has a clamping force of 850 tonnes and operates using the thixomolding process, whereby granulate is heated inductively. As far as I know, this is the first JSW plant in Europe with such a clamping force. We will commission a total of five new machines and invest about ten million euros within a period of 18 months.

CPT: The thixomolding process requires relatively low temperatures – is this where your new company name comes from?

Sach: Yes indeed, the so-called liquid temperature (at which solids become liquids) of magnesium AZ91 is 595 degrees. We decided on this process and this machine because we believe it offers two advantages: firstly, the components we produce exhibit excellent mechanical properties and, secondly, of course, we save on energy costs due to the low temperature.

CPT: What products are you focusing on?

Sach: The material is increasingly magnesium; the products continue to be focused on the automotive industry. They are components in the dashboard area, i.e. the interior – thin-walled and light. We are highly specialized in this work and supply high-precision components. There are also high customer demands: for example regarding purity, residual dirt and tolerances. We are also acquiring a wide variety of other sectors, such as the aviation industry.

CPT: Germany is an expensive country to operate in – you already mentioned energy – not the cheapest. And supply chains became a matter of concern during the pandemic years. What trends can you see here?

Sach: We discuss energy prices with our customers. Opinions are divided, though there is basically understanding for the situation. Regarding sourcing, I



Achim Sach, Managing Director 595° Solutions GmbH.

see a trend away from China and towards local-for-local. Let me put it this way: it is not the case that a part is bought from China for 98 cents when we can supply it for 99 cents. And there are several aspects involved here: dependability of the supply chain, the enormous price rises for transport, and the CO₂ emissions along the delivery route.

CPT: Do you think that this is already reflected in the criteria of carmakers?

Sach: To some extent. Sourcing from China is negative in the points system of a major producer. So China has a problem in this regard. That helps Germany as an industrial location, whereby geographical closeness to the buyers is also a good prerequisite for closeness in the partnership.

CPT: How is this expressed in concrete terms?

Sach: I am convinced that the sector must consistently continue along a path that is predefined: being a development partner, actively contributing our own competences. We must be involved in development at an early stage. So we need to be optimally positioned and technically up-to-date. As we are – with our digital twin.

CPT: What does this cost and does it pay?

Sach: Definitely several hundred thousand euros. And we need two to three years before this investment pays off. In the form of

fewer rejects and shorter machine downtimes. Whereby we have also taken a big step forward with our planning of production halls and production processes.

CPT: A final question: what do you think of giga-casting?

Sach: This development is certainly of technical interest but involves great practical hurdles. The components are large and logistically demanding, so one must be in the immediate vicinity of the customer. We do not want this dependency. We are also on the skeptical side regarding the ease of repairing a car after an accident. We have found our commercial approach and would prefer to remain in the small to medium-sized range of machines.



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„We see the feedback from our BDG members regarding their intensive customer contacts as a very positive sign that the trade fair is actively used by casters as an opportunity“

Always in conversation: the specialists of the BDG as central contacts for the sector.



An industry facing upheavals – 2

Those involved with casting and forging met for the second CastForge trade fair in Stuttgart, which was twice as large as its predecessor. Raw material and energy prices were much-discussed topics, as they had been at the earlier Euroguss. Nevertheless, very many discussions at the high-quality B2B trade fair confirmed the excellent potentials for cast products offered by the coming transformation.

By Martin Vogt



Pumps are his future: GMG Managing Director Thomas Bunk.

CastForge 2022 can be defined in formal figures as follows: the number of exhibitors rose from the 153 at the first event in 2018 to a solid 322, with the majority (104) coming from Germany, followed by Italy (58), Turkey (36), the Czech Republic (18) and France (17). A total of 27 nations exhibited at CastForge 2022. The very spacious show hall, which still had free space remaining, also showed that there is undoubtedly potential for further growth – the two exhibition halls were not entirely filled despite the doubling of exhibitor and visitor numbers.

Perhaps it is necessary for a truism to become more widely acknowledged: 'only those who participate in a trade fair can benefit from it'. As, for example, Frankenguss/Sachsenguss. "We had a lot of customer contacts – also new ones, i.e. potential customers," Managing Director Josef Ramthun emphasized

the classic strength of trade fairs as places for personal and professional encounters, which Max Schumacher, General Manager of the German Foundry Association (BDG), underlined: "We see the feedback from our BDG members regarding their intensive customer contacts as a very positive sign that the trade fair is actively used by casters as an opportunity."

The foundry industry will come to a standstill without gas

Opportunity is an important keyword. Much has been said about the coronavirus-related crisis of the last two years – with its various disruptions to delivery chains and availability, which not only affected the die casting and automotive industries. A crisis that seamlessly merged into the crisis caused by Russia's war of aggression. Tobias Hain, Managing Director of the German Forging Association also called this "a multiple

Many trade visitors took advantage of the second CastForge event.



Communication is everything: the trade fair as a place for conversations and exchanges.



crisis". Galloping energy prices and concerns about gas shortages characterize the business of casters, as Schumacher also made clear at CastForge: "No caster can work without gas – the foundry industry will come to a standstill without gas."

The topic is obviously also relevant for politicians, some of whom, of course, were also present at CastForge – Michael Kleiner from Baden-Württemberg's State Ministry of Economic Affairs visited the trade fair. And the stands of several casters. "Tell me about your problems," asked the Ministerial

Director at Fondium's stand, for example. "There's a pretty long list. First of all, energy and raw material prices," answered Achim Schneider, Spokesman for Fondium's management team. In passing, Kleiner learnt that the SME operates its cupola furnace with climate-neutral biocoke, i.e. is taking great steps towards decarbonization.

The transformation, i.e. the desire of companies to transition from a fossil to a regenerative energy basis, is the topic on the future horizon that dominates all efforts in the present. Transformation, it can be said, will create winners,

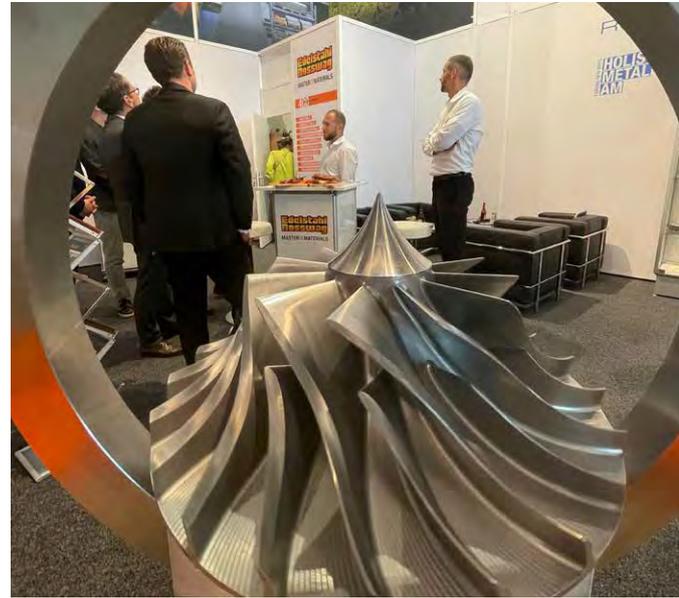
but also losers. Operations whose earnings are currently mainly based on the casting of components for vehicles with a combustion engine are feeling the pressure to change.

Profiting from the transformation

Other companies are profiting from the transformation process because foundries, with their upcycling, are drivers of the green transformation: with products that are used everywhere and make regenerative energy supply or new mobility possible in the first place. GMG GusTec GmbH from Gera in



Topics, Part 1: Caster Hans-Peter Grohmann (left) in conversation with Ministerial Director Michael Kleiner from Baden-Württemberg's State Ministry of Economic Affairs.



Topics, Part 2: Fondium Spokesman Achim Schneider (right) tells Kleiner about the most urgent problems.

Thuringia, for example. Thomas Bunk has been its managing owner for almost a year and has a clear focus. "Pumps have a future," says Bunk, "particularly thanks to the transformation and climate change. Heat pumps and pumps for the water industry that are becoming increasingly important. And,

for us, the future means that we will achieve double-digit growth from 2021 to 2022." Whereby Bunk is also an interesting example of how great the influence of energy prices can be on operational management and the product range. So the works will stop gas-fired bronze casting for small parts at



The Association leads: BDG expert Dr. Ingo Steller shows the way around the trade fair.

the end of the year – customers have already been informed. The reason for this drastic measure: electricity costs of 35,000 euros in 2021 just for extraction in this part of the works. With prices still rising drastically. Happily, Bunk pulled the emergency cord in good time.

Small companies like GMG, with its 40 employees, can profit from the transformation – or sector giants like Siempelkamp with more than 2,000 personnel. “Our capacity will be fully utilized until 2023,” says Managing Director Dirk Howe. Siempelkamp, based in Krefeld in the Lower Rhine region, specializes in heavy structural parts for large machines – as commonly used by specialist machine constructors. “Cement, copper, nickel – these are the raw materials of the transformation. So the market needs machines,” says Howe. Then there are motors for LNG and H2 plants, or parts for giga presses, as supplied by Bühler and other machine constructors. The trend towards e-drives thus sets a cascade in motion that also opens up

opportunities for casters at various points.

Politicians must provide prospects

Howe also comes to the point when the subject of wind energy is raised. In fact, Germany needs more than 2,000 new wind turbines a year according to the BDG’s “Casting 2035” study. In fact, a fantastic potential for the domestic market of Germany’s foundry industry – as long as the prerequisites are right. “What concrete prospects does the body politic offer the foundry industry? What we need is a common understanding between economic policy and our SMEs,” Howe mentions one specific prerequisite for casters’ investment decisions, “I would invest if the investment were commercially safeguarded.” Because there is no question at all for Howe that it must be German foundries that decisively drive forward the transformation. “We must produce the

goods at whatever location they are required.”

It’s hardly surprising that the challenges facing forging are the same as those facing the foundry industry. The transformation is also an important topic here. Oliver Meiser, Key Account Manager Machine Construction at Brück GmbH in Saarbrücken, paints a vivid picture regarding the upcoming expansion of wind energy. “Everyone knows that there will be a race. At the moment, all companies are standing in the pit lane and waiting for the warm-up lap.” Brück supplies, among other things, forged rings for drives.

At least, to maintain the metaphor, all is going well on the racetrack – just not yet in Germany. “We supply Germany’s plant constructors – but for their exports,” says the sales rep.

So CastForge 2022 provides a picture of a sector facing upheavals – with severe and substantial current challenges, but also with constructive glimpses into the future. A trade fair that offered the appeal of compactness and intensive customer dialogs.



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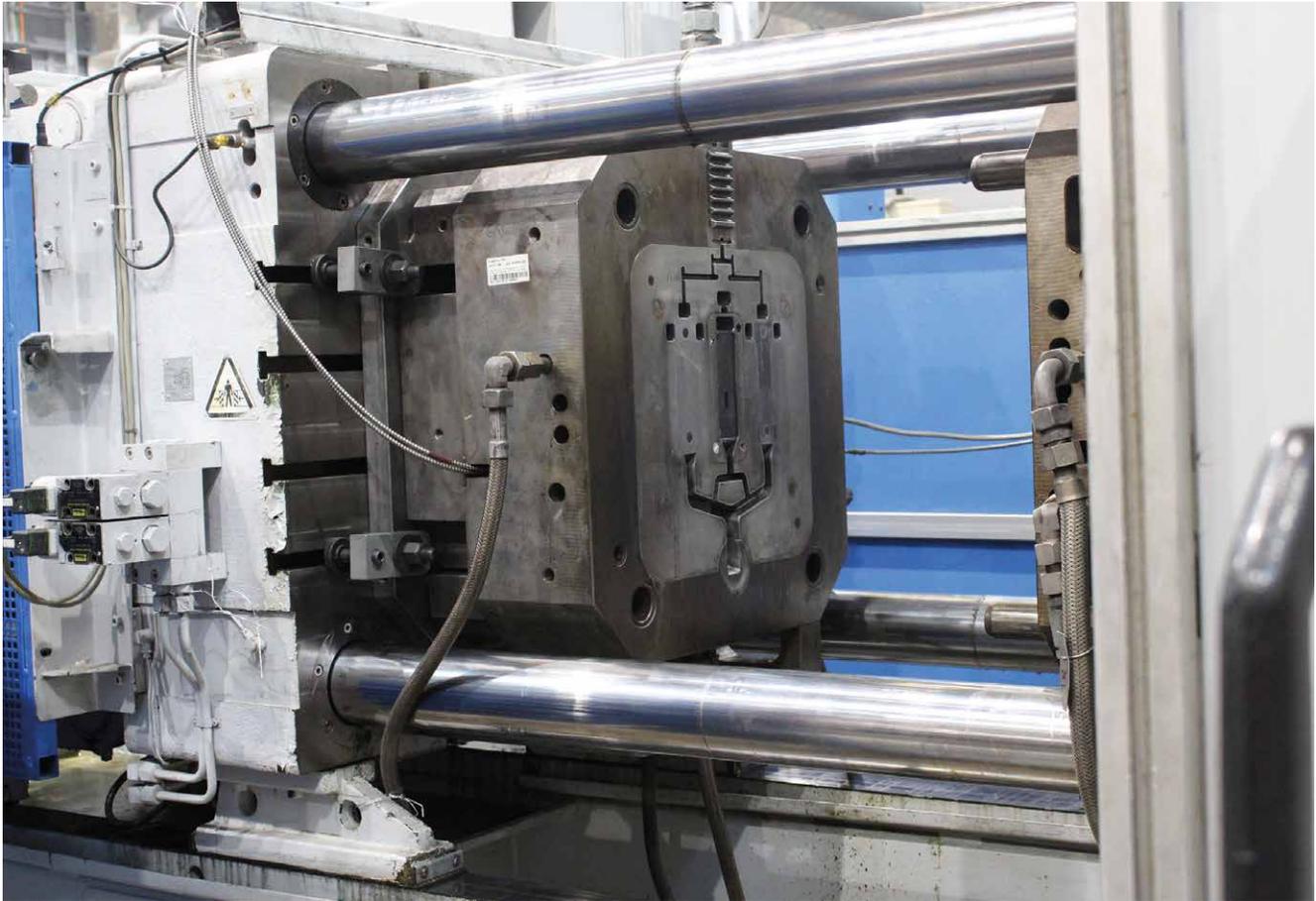
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The efficiency of the die casting process decisively depends on the quality and suitability of the release agent.

Release agents for die casting molds

Increasing efficiency with the Clean Part & Mold concept

Die castings made of aluminum, magnesium and zinc alloys are produced in large series. Even though also highly aggressive cleaning methods are used in the die casting shops, residues of release agents are still quite often the cause of quality issues in downstream processes, such as painting, gluing, etc. Release agent material accumulating in the molds may also lead to interruptions of the casting process because these residues have to be regularly removed by machining to guarantee that the castings are dimensionally accurate.

By Peter Pyka, Marco Haesche, Martin Wiesing, Andreas Stake and Christoph Pille

The Clean Part & Mold (CPM) release concept developed by Keim Additec Surface GmbH (part of the CHT Group) provides the basis for new release agent formulations that help avoid that residues adhere to the mold and casting surfaces. As a result, mold cleaning during production can be

largely dispensed with and adhering release agents are no longer an issue for the quality of the castings and downstream gluing or painting processes.

This fundamentally new concept has been studied in casting trials at Fraunhofer Institute for Manufacturing

Technology and Advanced Materials (IFAM) in Bremen. The release agents were analyzed and evaluated based on examinations of the molds and the surfaces of the castings. Examining adhesion of the coating layer on the casting surfaces was also part of the investigation.

Acqueous release agents

Acqueous release agents for metal die casting often contain additives from the group of modified polysiloxanes (e.g., alkyl-aryl-modified siloxanes). These polymers have been modified to provide good releasing performance, be thermostable and make the casting surface suitable for coating or gluing. However, they usually provide only poor lubrication, leading to elevated wear, particularly on moving elements of the casting mold, as, e.g., in the ejector system. These silicones are also prone to residue formation. Difficult to remove adhering vitreous residues are found particularly in the hotter mold areas. Even specific modifications to release agent recipes have still not been able to solve the problems in downstream processes such as coating and gluing caused by these highly adhesive additives.

Another group of additives frequently used in aqueous release agents are waxes and low molecular polymers. These, usually long-chain, molecules on polyethylene basis owe their excellent releasing capacity to their high melting viscosity. Even at the comparatively high temperatures prevailing in Al and Mg die casting, they provide good releasing properties and generally combust without any residues. However, this type of release agents is very prone to forming continuously growing accumulations of residues (figure 1) when exposed to lower metal temperatures (< 600 °C) in areas of the mold that are more distant from the ingate or do not get in contact with the hot metal. As a result, the molds have to be frequently cleaned during a casting campaign. However, these polyethylene additives (waxes) generally provide good lubrication, a property that has a wear-reducing effect on the moving components of the mold.

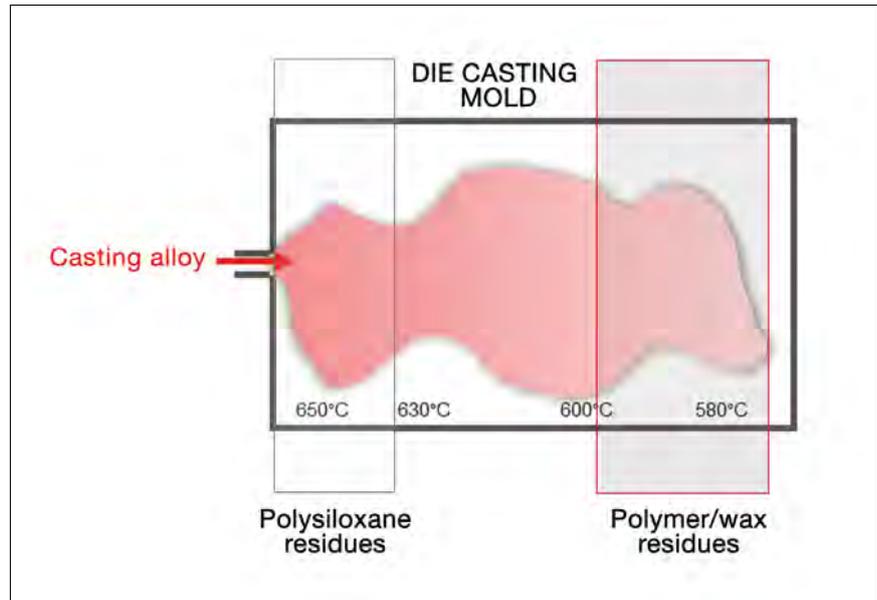


Figure 1: Temperatures of the molten metal in the casting mold.

Common release agents (table 1) generally use a combination of both additive groups (modified silicones and wax polymers) to achieve trouble-free casting. However, these recipes are always a compromise because the negative effects of both additive groups persist both during casting and in the downstream processes.

The Clean Part & Mold concept (CPM concept)

To avoid the negative influences described above and increase the efficiency of die casting, Keim Additec Surface developed novel short-chained, waxy polymers that have an entirely different structure than the additives used until now. These newly developed polymers are highly polar due to the great number of polar centers in the polymer chain. They provide a very high level of adhesion to metal surfaces while possessing very low melting viscosity. This

combination enables them to easily and uniformly disperse on hot surfaces, creating very thin and highly adhesive layers of release agents. The high adhesive strength of these polar additives is due to the interaction between the free electrons in the polar centers and the dipoles of the metal oxides in the die casting mold (Van der Waals interaction) [1]. These ultra-thin, high-adhesion polar films provide very good lubrication, reducing wear and tear on the moving parts of the mold (e.g., in the ejector systems). In addition to this, their release performance during casting is very good. Any residues of release agent remaining in the mold can be easily rinsed off before the mold is being lubricated for the next cast, thus preventing release agent material from accumulating in the cooler areas of the mold. Likewise, minor residues of release agent adhering to the casting surface can be easily removed with a mild alkaline cleaner during subsequent cleaning

Table 1: Comparison of common release agent additives

	Silicone additives	Wax additives
Release properties	good	good
Residual release agent material in the hot zones of the die casting mold	yes	no
Residual release agent material in the cooler zones of the die casting mold	little, no tendency to accumulate	tendency to accumulate (interconnection)
Lubrication effect (moving parts of the mold)	little	good
Paintability	negative effects	less negative effects
Gluing properties	negative effects	less negative effects
Alkaline cleaning of the castings	high-alkaline cleaning of the castings (negative effect on alloy)	alkaline cleaning

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Table 2: Release agent recipes (blue figures indicate difference to reference recipe of release agent 1)

Ingredients	Release agent 1		Release agent 2		Release agent 3	
	Content in %	Solids content in %	Content in %	Solids content in %	Content in %	Solids content in %
Water	72.26	0	70.46	0	56.66	0
Emulsifier (fatty alcohol polyglycol ether)	0.24	0.24	0.24	0.24	0.24	0.24
Triethanolamine (90%)	1.50	1.35	1.50	1.35	1.5	1.35
Alkyl-aryl-modified silicone emulsion 55% solids	15.00	7.95	15.00	7.95	0	0
PE primary dispersion 40% solids	11.00	4.40	5.50	2.30	0	0
Ultralube E-7098-R polarly mod. Wax polymer) 30% solids	–	–	7.30	2.20	20.70	6.21
Ultralube E-660-R (mod. PP dispersion) 35% solids	–	–	–	–	17.90	6.27
	100	13.94	100	14.04	100	14.07

of the casting. Thus, these residues are generally irrelevant for the downstream coating and painting processes.

It is recommended that CPM additives should be combined with a conventional high-molecular additive because these high-adhesion additives (polyethylene or modified polysiloxanes) are needed for mold areas subjected to the very high metal temperatures and high flow rates near the ingate, for example. However, they should be limited in quantity to the absolute minimum required in each case. This effectively prevents release agent residues from remaining and accumulating in the mold. Modified polypropylene dispersions have proved as a very good alternative to polyethylene additives. Due to the molecular structure of polypropylene, its thermal degradation behavior is much better than that of polyethylene, and polypropylene is not prone to form high-polymeric residues.

Comparative investigations

Aluminum die casting tests were performed at Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM) in Bremen to verify the performance of the Clean Part & Mold release concept. Three model recipes (table 2) were used for the tests.

Test recipes

Recipe 1

This recipe represents, in simplified form, the state of the art and was used as reference. Alkyl-aryl-modified polysiloxane and a polyethylene primary dispersion were used as active release additives together with additives to promote the

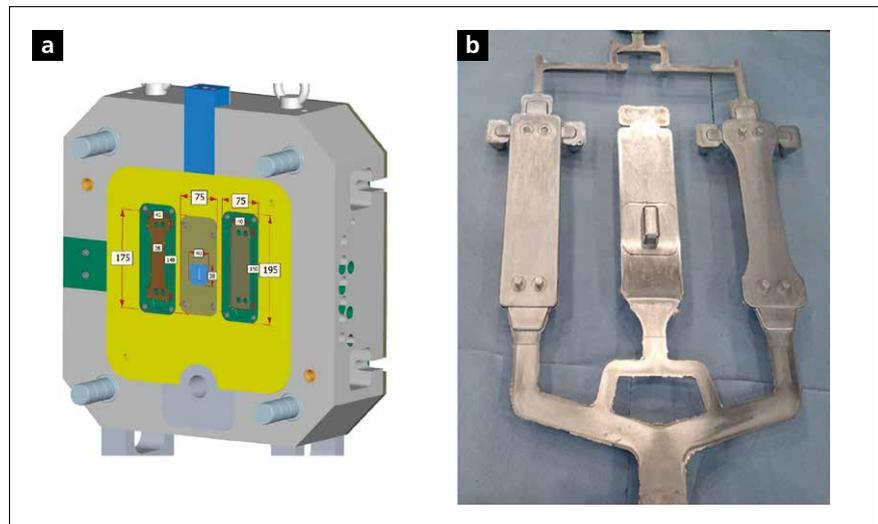


Figure 2: Casting tests to study the performance of different release agent recipes; a) fixed die half with easily removable inserts, b) die casting component.



Figure 3: Light microscopic images of the casting at the overflow; a) cleaned, b) release agent 1, c) release agent 2, d) release agent 3.



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release agent's anti-corrosion, hard water stability and dispersing properties.

Polyethylene primary dispersions are produced by emulsion polymerization of ethylene in water at very high temperatures and pressures. Due to its high melting viscosity, aqueously dispersed polyethylene possesses excellent release properties but has a strong tendency to form residues.

Recipe 2

For this recipe, 50% of the primary dispersion was replaced by new additives from the CPM range (Ultralube E-7098-R). Care was taken that the overall solids content of the release agent would be kept constant. All other ingredients remained unchanged.

Recipe 3

In this case, the primary wax component was completely replaced by the CPM additive Ultralube E-7098 R. To apply the Clean Part & Mold concept to practical casting trials, alkyl-aryl polysiloxane was replaced by a polypropylene dispersion grafted with maleic anhydride (Ultralube E-660-R). This specifically modified PP wax possesses very high melting viscosity, providing it with excellent release properties. Ultralube E-660-R is much less prone to residue formation than PE waxes.

Casting tests

The die casting tests were performed in the foundry lab of Fraunhofer IFAM using a Frech-DAK-250 horizontal cold chamber machine. A special tooling system was used to enable easy removal of the cavity inserts without having to take the complete mold out of the die casting machine. In order to be able to perform the planned analyses on the surfaces of the mold inserts and the castings, planar mold cavities were chosen (figure 2a) to produce casting with planar surfaces (figure 2b). The most important process parameters are given in table 3.

Before starting the test castings, the entire die casting mold was dry-ice cleaned. To document this original state, light microscope images were taken of the surfaces. Subsequently, test castings were performed with the three release agent variants described above. 150 castings were produced with each one of them. Before switching to the next release agent variant, the mold inserts were removed, the surfaces examined and the mold completely dry-ice cleaned again.

Results

Release properties:

As only 150 castings were produced with each release agent variant, the release agent structure was simulated with a very high release agent concentration of 1:30. Before the actual test castings, 10 castings were produced with an effective release agent concentration of 1:100 in each case. All three variants showed good release properties at a concentration of 1:100.

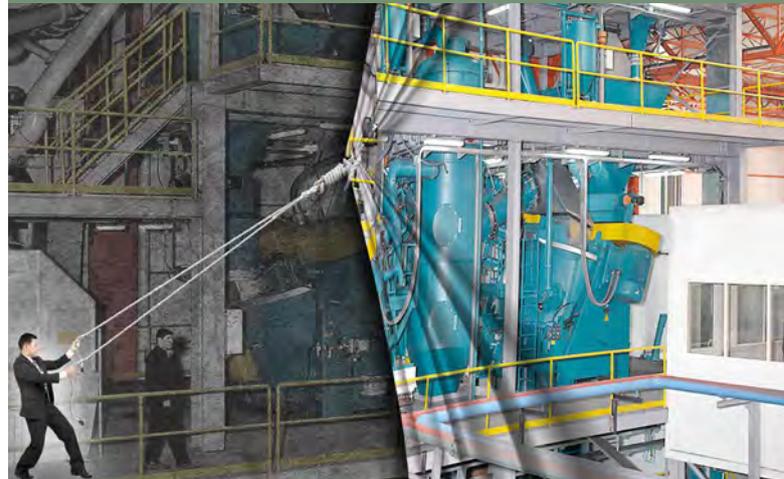
Mold cavity surfaces:

Images of the mold cavity surfaces were taken with a Keyence-VHX-7100 microscope with fully integrated head under confocal illumination, i.e. the light rays passing through microscope lens hit the surface perpendicularly. This results in flat, specular areas being fully illuminated and showing as



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light areas in the microscopic images. Thin, dielectric films usually appear iridescent. Rough or angled areas reflect the light. The mold was not cleaned before the microscopic measurements.

Images taken of mold inserts near the overflow (figure 3) show that release agent residues significantly decrease with an increasing Ultralube E-7098-R content. Especially with variant 3 (figure 3d), the surface is light-colored and the iridescence indicating the presence of release agent residues is minimized.

Surface tension / contact angle on the castings

The contact angle was determined by means of a drop shape analyzer (DSA-100-S) on a dust-free surface (figure 4). For this, the contact angle of a water drop was measured in three positions of the test plate. 5 measurements were taken at each of the following positions: at the ingate (position 1 = the highest temperatures), in the center of the casting (position 2) and near the overflow (position 3 = the lowest temperatures).

The results show that on the castings produced using the CPM release agent (release agent 3) the contact angles are far smaller than on the castings produced with release agents 1 and 2. This provides better surface wettability, e.g., for water-based paints. The surfaces of the castings produced with release agents 1 and 2 are heavily affected by adhering release agent material. The contact angle of release agent 2 is slightly larger than that of release agent 1. Both products contain the same quantity of the modified polysiloxane additive.

Paintability and adhesive strength

The dust-free components were spray-coated with a water-based 2C PU varnish (surface tension 30 mN/m). After hardening for 2 hours at 70 °C, the paintability was evaluated first. After drying, the coating layer was 30 µm

Table 3: Key process parameters for the aluminum die casting tests

Alloy	AlSi9Cu3(Fe)
Heat temperature (furnace) in °C	680
Mold temperature in °C	190 to 200 (measured in mold cavity)
Number of castings	150 castings per release agent
Concentration of release agent	1:30
Die casting machine	Frech DAK-250-34 (locking force 290 t)
Shot weight in g	approx. 600
Max. piston velocity in m/s	approx. 5

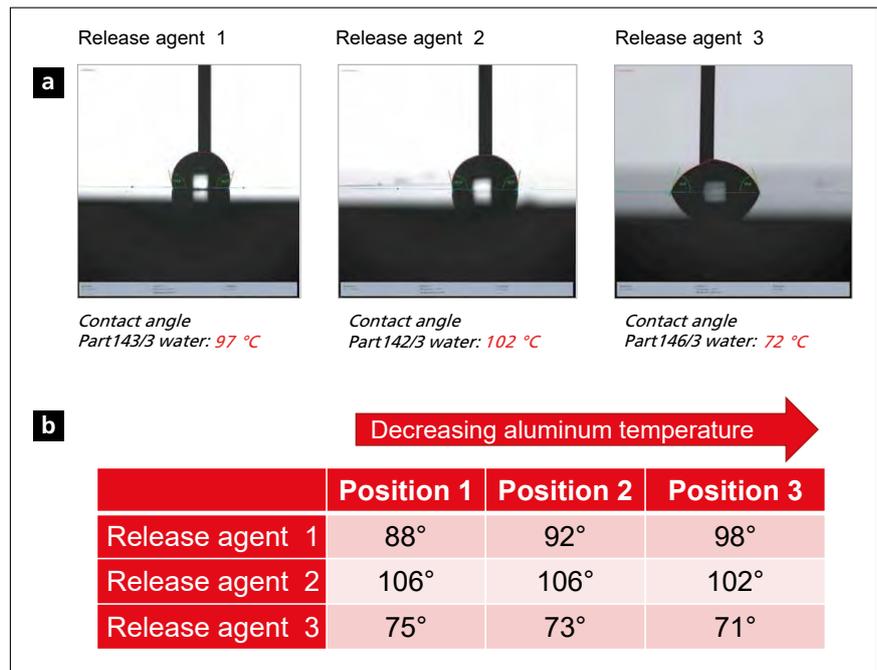


Figure 4: a) Contact angle measurements and b) mean of contact angles measured at three different positions each.

thick. All of the three release agents examined provided good paintability (figure 5).

The adhesive strength of the coating was evaluated by means of cross-cut tests in accordance with DIN EN ISO 2409 standard. This is an easy method to evaluate the bonding strength and elasticity of single and multi-layer coatings. You cut a right-angle lattice into the coating, clean the grid with a brush and apply an adhesive tape

(specified in the standard) over the cut area with gentle pressure. Then smoothly remove the tape from the substrate. The tests are visually evaluated by comparing the cross-cut areas (figure 6). Only release agent 3 (figure 6c) achieves good adhesive strength on the entire casting, whereas with release agents 1 and 2 bonding is rather poor (figures 6a and 6b). This is probably due to the alkyl-aryl-modified polysiloxane.

Table 4: Results of the XPS measurements (all indications in atomic percent)

Castings produced with	Residues from the release agent			Aluminum alloy			
	C in at-%	Si in at-%	O in at-%	Si (metallic) in at-%	Al in at-%	Mg in at-%	Others in at-%
Release agent 1	81.5	5.3	12.6	0	0.46	0.1	
Release agent 2	68.7	6.8	18.0	0.6	4.53	0.3	
Release agent 3	30.4	0	40.0	2.9	15.4	8.6	5.29



Figure 5: Painted castings.

Residues on the casting surface

X-ray photoelectron spectroscopy (XPS)

This is an established method to perform non-destructive qualitative and quantitative analyses of the elemental composition of solids, more specifically, of their surfaces. In this case, the near-surface measurements were performed with a penetration depth from 5 to 10 μm . The measured samples were dust-free, but had not been specifically cleaned. The results are shown in table 4. To further differentiate the Si-containing components, the highly resolved Si2p spectra were analyzed by means of a fit model [2]. The resulting contents of metallic Si in the spectra were used to determine the respective atomic concentration.

> On the surfaces of the samples cast with release agent 1, the elements C, Si and O – which are characteristic of this release agent – are very dominant, accounting for > 99%. They indicate that there are residues of this release agent present on the surface.

> On the samples cast with release agent 2, the characteristic release agent elements C, Si and O combined account for approx. 86%. In addition to these elements, indicators of alloy elements, such as metallic silicon and aluminum

have been found. The decrease in residual release agent material correlates with the use of the CPM additive (Ultralube E-7098-R).

> The lowest concentrations of C-containing residues were observed with the use of release agent variant 3. The concentration of characteristic alloy elements, such as metallic Si, Al and Mg as well as Na, P, Bi, Pb, Sn, Cu and N, increased accordingly. With recipe 3, residual release agent materials determined based on the C-content account for only 30% of the corresponding values measured on the samples produced with recipe 1. This can be attributed to the use of the CPM additives.

TOF-SIMS

The release agent residues on the castings were analyzed with TOF-SIMS (time-of-flight secondary ion mass spectrometry) using an IONTOF-M4 Bi-cluster (Bi+ 25 keV). With this technique, the molecular surface composition can be qualitatively characterized with a surface sensitivity ranging from 1 to 3 nm. The release agents were spread on Al foil and their respective compositions analyzed in comparative examinations (figure 7a).

It was found that the spectra on the surfaces of the castings produced with release agents 1 and 2 are very much the same, and very similar to the spectrum of the release agent component alkyl-aryl polysiloxane (figure 7b). The polysiloxane-typical signals are dominant in the spectra, suggesting the presence of at least one monomolecular layer of polysiloxane. The spectra on the castings produced with release agent 3 show no correspondence with the spectra of the reference materials. Inorganic signals of the (oxidized) alloy components can be observed instead. Longer-chain organic fragments of masses above 400 m/z are negligible. This suggests that the layer of contami-

nants does not form a continuous cover. Moreover, the strong fragmentation observed in the measurements suggests that the remaining organic contaminations are low-molecular (thermal decomposition products) or strongly adsorbed.

Summary and conclusions

Die casting tests with different release agents were used to investigate the properties of the release agent variants in terms of releasing performance, residue formation and paintability of the components produced. The release agents used in the tests were formulated in such a way that it would be possible to relate the effects identified during the examination to the corresponding additives (figure 8). All of the three release agents investigated showed more or less the same good release properties during the first casting tests. However, the microscopic examination of the mold inserts showed that the three release agents started to show very different residue forming behavior as early as after 150 cast parts.

> With release agent 1 (reference), residues were clearly discernible near the overflow.

> With release agent 2, which already contained some Ultralube E-7098-R, there was already less residual material in the mold.

> Release agent 3, consisting of an entirely new combination of additives, left only very little residual material in the mold.

The investigation revealed that the paintability in downstream processes was very different depending on the type of release agent used. The fewer release agent residues on the casting surface, the lower the adhesive strength of the coating would be. While the castings produced with release agents 1 and 2 showed good paintability with the aqueous varnish, due to the specifically modified polysiloxane, this particular additive had significant influence on the adhesive strength. In contrast to this, castings produced with the polysiloxane-free release agent 3, which consisted entirely of CPM additives, showed both good paintability and good adhesive strength of the coating.

Replacing 50% of the original PE primary dispersion in release agent 2 with Ultralube E-7098-R led to a significant decrease in C-containing residues, as revealed by the XPS measurements (see table 4). Consequently, there is a corre-

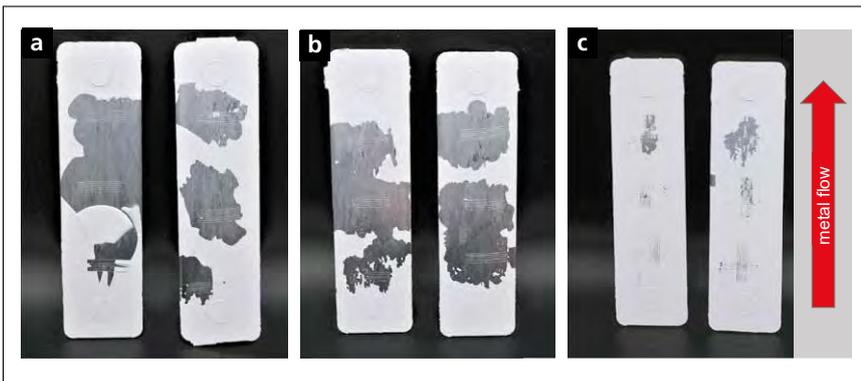


Figure 6: Cross-cut test results; a) release agent 1, b) release agent 2, c) release agent 3.

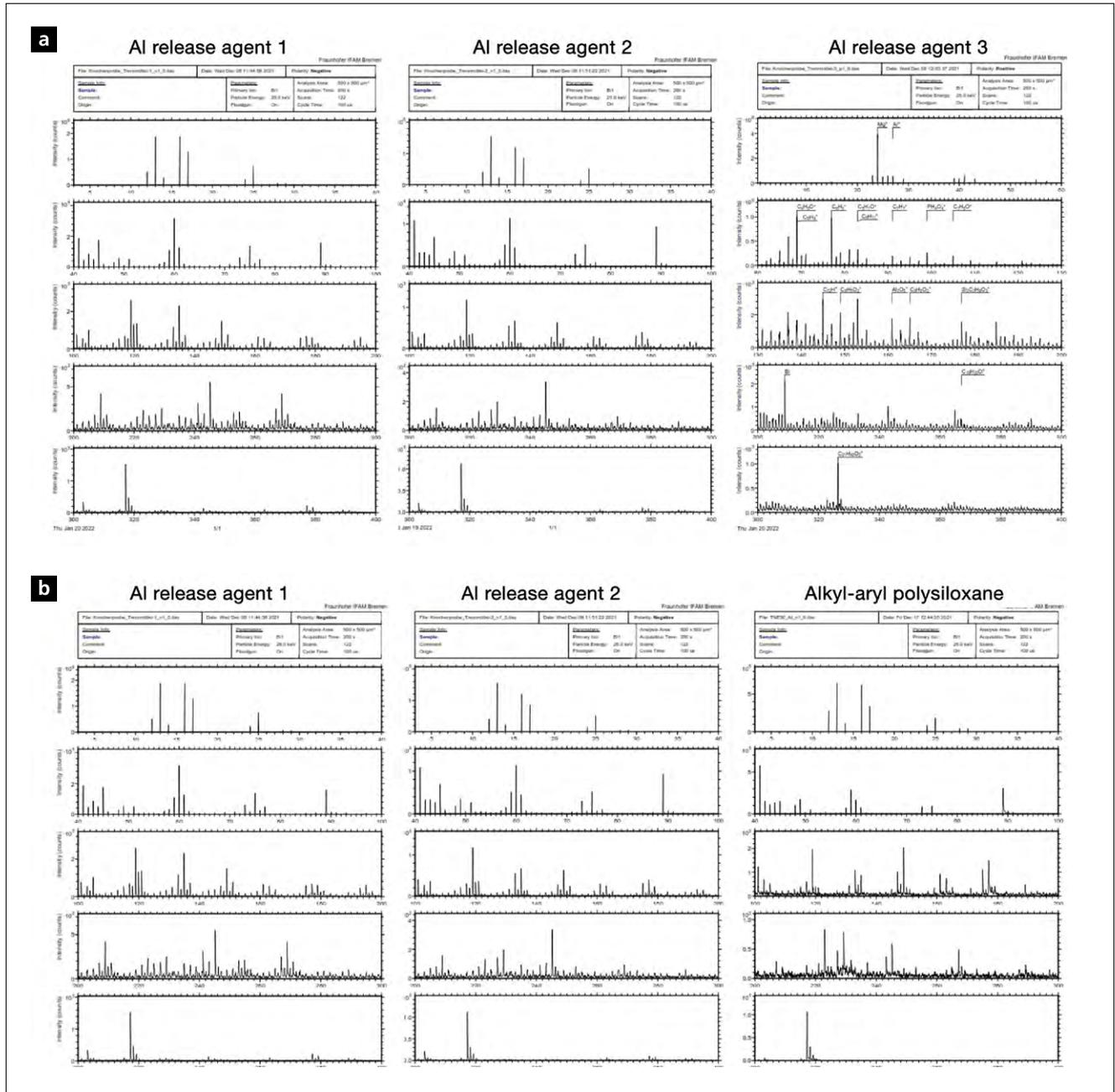


Figure 7: a) TOF-SIMS spectra of release agent residues on the castings, b) TOF-SIMS spectra of the castings produced with release agents 1 and 2 in comparison with alkyl-aryl polysiloxane.

sponding increase in the percentage of polysiloxane on the samples cast with release agent 2. A further indicator of this effect is the larger contact angle (see figure 4b). These findings should be considered in the quantification of polysiloxane in case of formulating a recipe that combines polysiloxane with additives from the CPM concept.

XPS measurements of castings produced with release agent 3 show a distinct decrease in C-containing residues. Residual release agent material on these castings were in general much lower than on the other castings (approx. 30% versus > 99% of the reference). Due to its molecular structure,

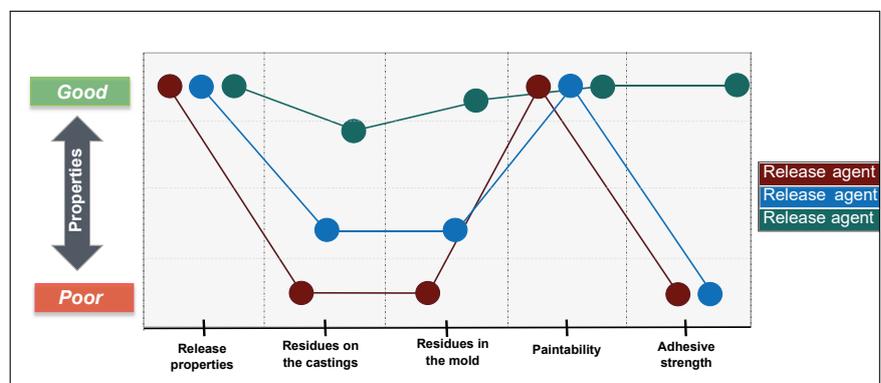


Figure 8: Summary of the test results.

the modified polypropylene used in release agent 3 instead of the PE primary dispersion produces less combus-

tion residues than PE additives and provides good release properties at the same time. Combining CPM additives

(Ultralube E-7098-R) with modified PP waxes (Ultralube E-660 R) leads to a dramatic reduction of residues on the casting surfaces. This suggests that the adhesive properties are significantly better. Moreover, it is most likely that other surface treatments and processes, such as gluing or plating, are also positively influenced by the use of CPM additives.

The TOF-SIMS measurements have shown that the modified polysiloxanes on the castings are highly thermostable. They hardly change their structure during the die casting process. In contrast to this, the high-polar, low-viscosity waxy polymers from the CPM concept, as well as those of the PE primary dispersion, show such heavy degeneration at the high temperatures of the die casting process that the original molecular structure could not be identified any more.

Modifying the release agent recipes by means of the new additives from the CPM concept can dramatically reduce release agent residues on the castings and in the molds. Less residues provide positive effects for the entire process chain, making die casting more efficient in the future.

Outlook

In die casting, release agents have a decisive influence on the die casting process, the castings, the machining processes and the finished components. Release agents are supposed to only serve as a necessary aid in die casting, ideally without influencing the process in any way. This goal has now been reached thanks to the development of the new additives from the CPM concept.

The CPM concept has the potential to positively influence the economic efficiency of die casting along the entire process chain up to the end product. Process interruptions for cleaning and maintenance activities can be minimized as a result of less release agent material remaining in the molds and effective lubrication of the ejector systems. Moreover, surface treatments and processes, such as painting, gluing, plating, etc., are also likely to benefit from the smoother, residue-free surfaces. This is expected to lead to considerably lower waste rates and more efficiently produced die castings. Due to minimized release agent residues, the castings will just need mild alkaline cleaning to comply with the growing surface quality requirements, e.g., for electronic parts. These positive results suggest Ultralube E-7098-R from the CPM concept for the production of high-quality die castings for e-mobility.

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PHOTOS AND GRAPHICS: FOSECO

Robust melt treatment guarantees pure melts for quality castings.

Melt Quality Assessment

Melt control for Al castings with complex property profiles

In the cleaning of aluminum melts, the removal of oxides is becoming increasingly important, especially for components with high mechanical requirements. With the Melt Treatment System (MTS)-1500, Foseco offers a robust process for combined rotor degassing with salt injection. The Melt Quality Assessment (VMET) additionally allows quantification of the quality gain.

Philippe Kientzler, Takehiko Okamoto, Japan, Tenco Xue, China and Pramuk Uhapattanapanich, Thailand

Metal treatment is a critical part of the foundry process, which often has a significant impact on casting quality [1] [2], reject rates and costs. Hydrogen gas porosity is one of the primary concerns in aluminum foundries [3]. But oxide removal also referred to as “melt cleaning” is becoming an increasingly important step which significantly impacts the casting’s mechanical properties.

State of the art

Existing cleaning practice often consists of the manual adding of chemical drossing agents combined with simple rotor degassing, but both have important restrictions or limitations. Hand fluxing can be unreliable since it is operator dependant. Variations in addition rates, treatment times can cause major differences in efficiency and melt quality when cleaning, grain refining or doing sodium

modification. This is especially true in High Pressure Die casting (HPDC) where the number of ladles or furnaces treated can exceed 100 per day.

Flux injection combined with rotary degassing has improved some of these issues by reducing the variability due to the human factor. Unfortunately, the injection of flux through a rotating shaft requires special precautions to prevent blockages. These blockage issues will

Table 1: Model assumptions for volume and price increases during a year.

Alloy A356	Master alloy AlTi5B1	Coveral MTS 1582
Ladle size in kg	700	700
Chemical grain refiner in g	-	310
Master alloy Ti-B rod in g	500	-
Degassing time in min	9	9

Table 2: Comparison of grain refinement.

Legierung A356	Master alloy AlTi5B1	Nucleant-1582	Remarks
Density (80 mbar) in g/cm ³	2.65	2.65	identical
Chemical analysis Titan in %	0.114	0.114	comparable
DAS in spoke section in µm	45.88	47.21	hot area
DAS in rim section in µm	26.09	27.26	cold area

*DAS - Dendrite Arm Spacing

Table 3: Comparison of mechanical properties.

Properties in wheel hub	Master alloy AlTi5B1	Nucleant-1582
Yield strength in N/mm ²	208.1	213.5
Tensile Strength in N/mm ²	276.0	286.7
Elongation in %	6.8	8.0

cause high maintenance and limit the injection rate of the flux thus reducing productivity.

As a solution to these issues, Fosco developed the MTS 1500 [4], a robust blockage-free and reliable system to achieve multiple functions in a aluminum foundry including:

- > Faster degassing using more efficient XSR/FDR rotor designs
- > Cheaper cleaning & drossing especially in high-pressure die casting
- > Constant and repeatable sodium modification [5] [6]
- > Cost efficient Ti-B grain refinement in gravity casting and LPDC
- > Cost saving for drossing in aluminum HPDC
- > Oxide removal in aluminum HPDC, pistons, wheels and chip melting.

Improved grain refining in LPDC wheels

Aluminum wheels are one of the most important automotive castings made (mostly) using the Low-pressure die casting process. They are considered as safety components, it is critical for wheel castings to:

- > be exempt of gas and shrinkage porosity
- > be free of oxides and inclusions
- > have a very fine microstructure to ensure adequate mechanical properties

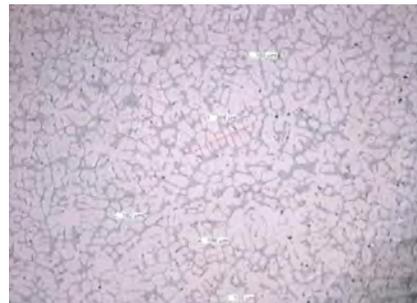


Fig. 1: SEM image of a spoke treated with Nucleant-1582 at 100x magnification. The structure is very fine and homogeneous.

Grain refining [7] is one of the critical steps which most foundries achieve by adding Ti-B rod master alloy. The typical addition rate is usually around 0.1%. **Table 1** details the key process parameters used in an Asian LPDC wheel foundry where A356 alloy is being treated in 700 kg transfer ladles prior to the transfer into the low-pressure furnaces. This wheel foundry is using 500 g of Ti-B rod master alloy in their traditional process in order to achieve the required mechanical properties. The newly introduced Flux Grain refiner (Nucleant-1582) [7] was able to achieve similar quality levels with only 310 g of flux addition. **Table 2** compares the degassing efficiency and titanium levels obtained with Ti-B master alloy and the novel grain refiner, Nucleant-1582.

To compare both grain refining processes, the foundry took samples from wheels in order to measure UTS and Elongation. **Table 3** shows a clear improvement of the mechanical properties despite addition of a smaller amount of the novel Nucleant-1582 grain refiner. **Figure 1** shows some micrography pictures taken from the wheel spoke which was treated with the novel Nucleant-1582 grain refiner [7]. The structure is very fine and homogeneous, which is suitable for modern OEM wheels.

Cost saving in HPDC transport ladles

Drossing is a key part of ladle treatment in Aluminium foundries. Globally, more than 50% of all aluminum castings are now made using the High-Pressure die casting process. Metal treatment is usually carried out in transfer ladles using simple degassers for 3 – 5 min. The purpose is not to degas the melt but to remove unwanted oxides and inclusions which will float up into the dross. These oxide films can lead to defects and casting failures. HPDC creates huge amounts of aluminum dross which can be very rich in metallic Al droplets trapped within the dross.

Figure 2 shows the dross that was collected and sampled in a very large HPDC foundry making automotive castings. The standard dross is wet and heavy with trapped aluminum. While the dross collected after MTS 1500 is much lighter and poor in aluminum. Dross samples were sent to our EN R&D laboratory Enschede (NL) which analysed residual Al metal in the dross using a salt melting technique which is common in the industry.

Table 4 shows the process comparisons between the foundry's current practice and our MTS 1500. It was found that this foundry can save up to 130 Tonnes of aluminum/year which represents an annual saving of at least USD 250 000. This foundry invested into 2 MTS 1500 units type Rotostativ in 2019. Additional units are being considered for the future.

Investigations with the Melt Quality Assessment (VMET)

European wheel foundry

In the last 20 years, aluminum wheels have become the standard for car makers around the world. The preferred manufacturing route for OEM wheels is Low Pressure Die casting (LPDC) using A356 alloy which can



Fig. 2: Dross that was collected and sampled in a very large HPDC foundry making automotive castings; a) after treatment with MTS-1500: dry and light, low in metal, b) without treatment: wet and heavy, much trapped aluminum.

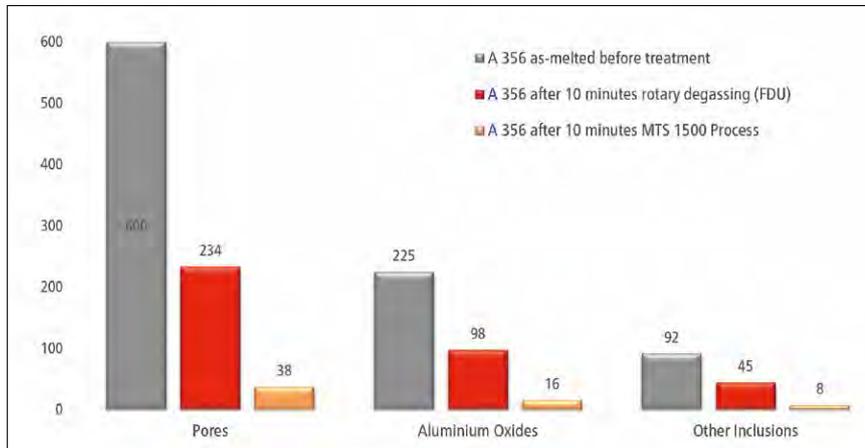


Fig. 3: Melting characteristics in a die casting foundry.



Fig. 4: MTS-1500 treatment in a die casting foundry.



Fig. 5: MTS-1500 treatment in a piston foundry.

meet the required mechanical specifications after T6 heat treatment. But adequate melt quality is a key requirement which can often be tarnished by the excessive presence of porosity, shrinkage, or oxides.

An European wheel foundry asked Fosco to conduct a melt quality audit using VMET to assess the quality of their melts. Samples were taken from their transfer ladles prior to (as melted) and after various treatment processes.

Table 5 summarizes the VMET findings and clearly shows significant quality improvements as:

- > The total number of features is reduced by 93% after MTS 1500 (from 917 to 62).
- > Total aluminum oxides is reduced by 93% after MTS 1500 (from 225 to 16)
- > Other inclusions are reduced by 91% after MTS 1500 (from 92 to 8)
- > More importantly, all the worrying features > 15 microns are reduced by 98% (from 137 to 3).

VMET analysis is showing that MTS 1500 has a significant impact on melt quality in wheel foundries by reducing unwanted defects like porosity, oxides and other nonmetallic inclusions as shown in **Figure 3**. This trend has led to a strong development of MTS 1500 use in wheel foundries around the world.

Intermetallic inclusions during die casting

Metal is usually transferred from the melting to the casting furnaces using transfer ladles with capacities ranging from 300 kg up to 1500 kg. During this melt transfer, some basic metal treatment is performed using rotary degassers for 3 – 5 min. The purpose is not to remove hydrogen but unwanted oxide films and inclusions that can lead to defects and casting failures.

Figure 4 shows a typical transfer ladle undergoing metal treatment using MTS 1500 Rotostativ with following attributes:

- > Casting: Automotive transmission
- > Alloy: ADC12 secondary ingot
- > Ladle capacity: 1400 Kg
- > Flux addition: 0.03% COVERAL Pure 1565
- > Treatment time: 3 min only
- > Rotor XSR 220.70 + DSK 75/800.70

This automotive foundry asked to evaluate their melt treatment practice using VMET on several transfer ladles prior to filling the casting furnace.

Table 6 shows the VMET results before and after MTS 1500 treatment in the transfer ladle. In the case of both ladles, the VMET analysis found that the quality of the melt in die casting is significantly improved:

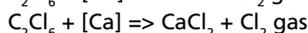
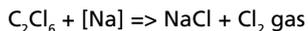
- > an overall reduction of the total number of features, oxides and inclusions.
- > the oxides and inclusions larger than 15 µm were completely eliminated
- > the Fe-linked intermetallic components that can be present in HPDC alloys were reduced significantly.

Magnesium oxides in a piston foundry

Aluminum pistons have become the norm in the automotive industry due to their relative strength vs light weight. But to achieve such performance, pistons must be free of porosity, oxides & inclusions as well as unwanted alkali elements like Na or Ca which at levels > 5 ppm will affect mechanical properties. One additional issue is caused by the magnesium oxides forming in the melt due to the

high Mg content of eutectic piston alloys like ACA8-336-LM13 (Al-Si12CuNiMg).

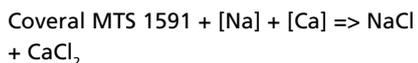
Hence, particular care is given to metal treatment which includes the use of rotary degassers with injection or addition of various fluxes or gases designed to remove such impurities. Chlorine gas (Cl₂) or chlorine releasing fluxes (C₂Cl₆) are still used in some parts of the world, but they are no longer perceived as the most environmentally friendly technology. As can be seen below, there are often strong chlorine emissions linked with the use of such toxic additives.



Due to environmental pressure, a new MTS 1500 technology (figure 5) has developed in aluminum pistons foundries which combines the use of rotary degassing using inert gases (Ar, N₂) and several types of fluxes which have dual functions:

1. remove oxides and especially MgO (spinel) which are a known problem in pistons
2. reduce all alkali elements like Na & Ca below 5 ppm

Coveral Pure 1565 has been proven to effectively remove oxides and particularly MgO spinel inclusions in an environmentally acceptable manner. Coveral MTS 1591 can effectively remove unwanted alkalis according to the following mechanism:



The chlorides formed will float into the dross. A market leading automotive piston foundry has asked us to use VMET to investigate their melt quality follo-

Table 4: Process overview

Automotive HPDC foundry	Standard process	MTS-1500 process
Ladle capacity in kg	1400	1400
Collected dross quantity in kg	4.7	3.5
Aluminum content in %	86,4	43.6
Aluminum lost in kg	4.06	1.53
Savings in Al per treatment in kg	-	2.53
Treatments per day	180	180
Treatments per year	54 000	54 000
Aluminum saved per year in kg	-	136 879
Cost of cleaning granules in US-\$	-	47 250
Savings per year on LME basis in US-\$	-	-
Savings on LME-Basis in US-\$	-	253 884

wing a customer complaint linked to MgO inclusions. This VMET analysis (Table 7) came to the following conclusions:

- > excessive amounts of Na & Ca in the melt before treatment
- > many small oxides and inclusions in the melt prior to rotary degassing treatment
- > 26 MgO spinel inclusions in the sample, smaller than 15 µm
- > MgO spinel were found to be larger than 15 µm, a real problem for pistons

VMET also showed that MTS 1500 process together with Coveral Pure 1565 cleaning flux was able to significantly improve melt quality by removing all oxides and MgO inclusions > 15 µm. This investigation led to the sale of several MTS 1500 units in this piston foundry.

Chip remelting for the ingot production

In recent years, many operations have looked at remelting machining chips in order to produce secondary ingots sui-

table for aluminum casting production. This is particularly true in Asia when very large amounts of A356 chips are coming from LPDC wheel machining. But many such operations encounter quality issues as they underestimate the level of oxides created during the remelting of such finely divided chips which have large specific surfaces. Hence extreme oxidation will create millions of very fine oxide films as shown in figure 6 where VMET found extremely high levels of oxide between 0.5 µm – 15 µm. Such high levels of oxides will create excessive dross during melting but also aggregate to form larger oxide clusters & films which are the cause of reject castings.

Such chip generated melts must undergo intense metal treatment in order to reduce the level of oxides significantly. Strong cleaning fluxes should be applied to de-wet the oxide films and make sure they can be floated into the dross. One secondary ingot maker asked Foseco to implement such a metal treatment and use VMET to quantify the level of oxides and the impro-

Table 5: VMET analysis in a wheel foundry.

Foundry	Alloy	European aluminum wheel foundry		
		Al-Si7%-Mg0,3% (A356)		
Sample description		A356 alloy as melted	After 10 min degassing	After 10 min MTS 1500 and COVERAL-1524 treatment
		Total features	Total number of defects	917
Features by cause and chemical composition				
Pore	Gas and shrinkage porosity	600	234	38
Aluminium Oxides (Al ₂ O ₃)	Aluminum and Magnesium oxides	225	98	16
Other inclusions	Carbides, refractory, ...	92	45	8
Features by size				
0.50 – 15.0 µm	Defects with little influence on quality	780	368	59
Σ all features > 15,0 µm	Defects with a significant impact on quality	137	9	3

Table 6: VMET analysis in a wheel foundry.

Ladle Sample	Ladle #1		Ladle #2		Remarks
	before	after	before	after	
Density (80 mbar) in g/cm ³	2.27	2.62	2.25	2.61	sufficient quality
Total features	1973	296	243	70	reduction of total features
Aluminum Oxide Al ₂ O ₃	1683	253	205	63	reduction of oxides
0.5 – 0.15 µm	1682	253	205	63	little influence on quality
> 15 µm	1	0	0	0	complete removal of oxides
andere Einschlüsse	290	43	184	7	reduction of inclusions
0.5 – 0.15 µm	285	43	183	7	little influence on quality
> 15 µm	5	0	1	0	complete removal of inclusions

Table 7: VMET analysis in a piston foundry.

Piston foundry		MTS-1500 process with Coveral-PURE-1565/1591		
Trial Sample	before	after	500 kg Crucible Remarks	
Na in ppm	4	0.1	excellent Na removal	
Ca in ppm	7.9	2.6	excellent Ca removal	
Density-Index in %	7.5	0.1	excellent degassing	
Gesamt-Al ₂ O ₃ -Oxide	64	200		
0.5 – 0.15 µm	64	200	Oxide nests were broken up, no negative effect	
> 0.15 µm	0	0	no oxides found	
Other inclusions	69	74		
0.5 – 0.15 µm	66	74	Oxide nests were broken up, no negative effect	
> 0.15 µm	3	0	no inclusions found	
MgO and spinels	29	5		
0.5 – 0.15 µm	26	5	reduction of spinels	
> 0.15 µm	3	0	no spinels found	

Table 8: VMET analysis of melting chips.

Chip melting Probe	Furnace #1		Furnace #2	
	melted	after 15 min MTS-1500	melted	after 15 min MTS-1500
Total features	7116	73	4307	53
Pores	3804	63	3791	29
Al ₂ O ₃	2958	3	329	19
Other inclusion	354	7	187	5
0.5 – 2.5 µm	1312	9	1246	17
2.5 – 5.0 µm	3239	21	1980	18
5.0 – 15 µm	2216	21	1008	11
15 – 30 µm	251	19	62	3
30 – 75 µm	64	2	11	4
> 75 µm	4	1	0	0

vement observed. The installation of the plant was carried out on fuel-fired crucible furnaces, which are used for remelting the of the batches of A356 chips. The metal temperature exceeds 780 °C. The specially developed MTS-1500 plant of the Mark 10 type is capable of safely handling such chip melting furnaces.

VMET Samples were taken from one chip melting furnace before and after a 10 min MTS 1500 treatment. It shows (figure 7) the melt "as melted" has

many defects which are a mixtures of porosity and oxide films. Whereas after the 10 min MTS 1500 treatment, the sample is clean without any visible traces of oxides. This is a visual confirmation that MTS 1500 process is able to achieve good melt quality even with 100% pure melted chips.

Experiment:

Two furnaces 1 & 2 with similar capacity were loaded with the same amount of chips. After a melting time of around 1

hour, the MTS 1500 unit was applied respectively to furnace 1 for 15 min and furnace 2 for 10 min. All other working parameters were kept identical including:

- > Furnace capacity: 750 kg chips
- > Gas flow: 20 l/min
- > Flux addition: 1.2 kg (0.16%)
- > Rotor Size: XSR 220 mm
- > Shaft length: 900 mm
- > Treatment temperature: 720°C

The VMET data in [table 8](#), clearly shows that the MTS 1500 treatment was able to significantly reduce most defects and to remove more than 98% of all defects from aluminum melt:

- > Total of features were reduced by 99% after a 10 min MTS 1500 treatment (4307 to 53)
- > Total of pores were reduced by 99% after a 10 min MTS 1500 treatment (3791 to 29)
- > Total of oxides were reduced by 94% after a 10 min MTS 1500 treatment (329 to 19)
- > Total of inclusions were reduced by 97% after a 10 min MTS 1500 treatment (187 to 5)

Conclusions

Metal treatment is one of the critical parts of the foundry process, which often has a significant impact on casting quality, reject rates and costs. Existing practice may have limitations in terms of quality, efficiency or automation. The MTS 1500 process clearly demonstrated higher degassing performance and better grain refining efficiency in low-pressure die casting wheels. In high pressure die casting, MTS 1500 showed significant cost savings in terms of reduced dross generation.

MTS 1500 combined with VMET (Melt Quality Assessment) has proven that this assembly can obviously improve the melt quality of Aluminium pistons, wheels, and chip melting, by significantly reducing detrimental oxides and inclusions.

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Remark

Foseco renamed many chemical products in September 2021. All tests in this publication have been conducted under the old product names. This article uses the new names; however, the composition of the products is identical:

Coveral-MTS-1582 = Nucleant-1582

Coveral-MTS-1565 = Coveral-PURE-1565

Coveral-MTS-1524 = Coveral-1524

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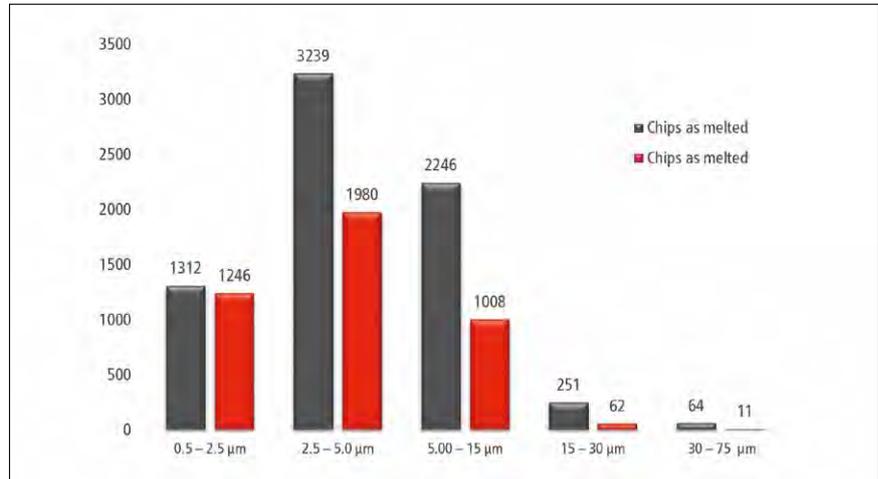


Fig 6: Melting characteristics during chip melting.

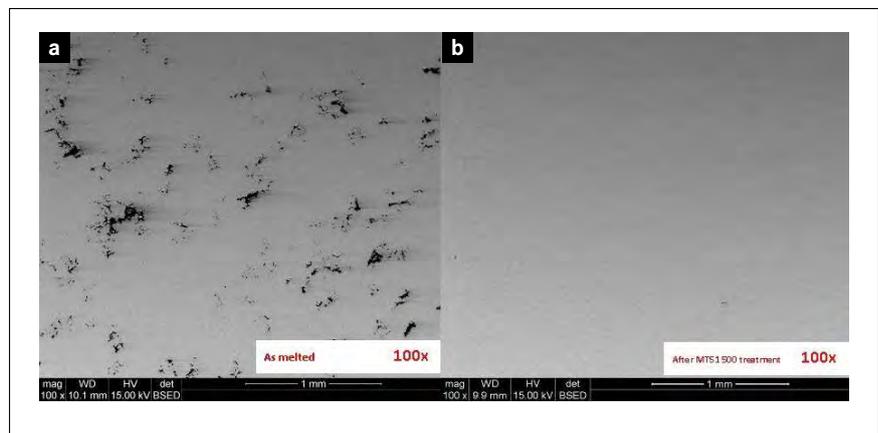


Fig. 7: SEM pictures with 100x magnification; a) before treatment, b) after treatment.

Well at Littlestown Foundry, 2019 AFS Proceedings of the 123rd Metalcasting Congress, Atlanta, Georgia, USA, Paper 19- 015.

[8] Wenwu Shi, *Vmet Analysis of Cast Aluminum Alloys, Fundamental, Application, and Statistic Analysis, AFS Conference on high integrity aluminum castings, October 5-7, 2015 Nashville, TN*



Photo: baier & michels / Rüdiger Dunker

Closing and sealing systems

Pressure-resistant closure and sealing: the b&m-KL Plug, here the steel variant for drilled hole diameters of 12 mm.

The somewhat different plugs

If one wants economical injection molding and die casting one must keep unit numbers and process reliability high and cycle times as low as possible. The correct temperature of tools and plants plays an important role here. A new solution significantly reduces the risk of leaks in drilled holes and flow channels, and transforms installation and disassembly processes that have hitherto been time-, waste- and cost-intensive.

By Andreas Wollny

What is a closing and sealing system that was originally developed for vehicle components doing in tools, as well as plants in the die casting and injection molding industries? The short answer is that it is doing its job. In more detail, it is establishing itself as an intelligent alternative to conventional solutions – with a reliable sealing function up to 30 bars of operating pressure, with simpler installation without creating any waste, and a non-destructive disassembly process.

The history of the b&m-KL Plug began in the late 2010s in an application laboratory at baier & michels, in Ober-Ramstadt. Inspired by customer queries, the developers worked on a sealer that was intended to significantly improve the interplay between quality, cost efficiency and environmental footprint, particularly in cooling and lubricant circuits. “Our aspiration was to create a completely new system that would convince in direct comparisons with, say, expanders, screw caps or

press-in spheres,” recalls Constantin Egold, Technical Product Manager.

A variety of materials

This goal was to be achieved with a variety of materials, particularly steel, stainless steel and aluminum. A radical idea ultimately paved the way: the designers took the technology of a blind rivet and integrated it in a closed blind rivet nut (Fig. 1). The result is an one-piece weight-optimized (due to its structure) closing and sealing element



Fig. 1: b&m integrated the technology of a blind rivet in a closed blind rivet nut (left: before assembly, middle: predetermined breaking point tears – spreading element is pulled into the sealing body, right: assembly process completed).

that is suitable for hole dimensions of from 8 to 24 mm and can handle temperatures of from -40°C to +200°C. Whereby correct material pairing is important here: the component and the b&m-KL Plug should come together with linear thermal expansion coefficients that match one another.

When setting with a standard assembly device, the b&m-KL Plug is in two parts and then consists of a sleeve and a threaded internal cone. Its full expansion only requires a residual component wall thickness of 2 mm. "There was a thorough validation phase before we put it on the market," says Product Manager Constantin Egold. This included leakage tests by the TÜV Süd in Garching, and vibration tests overlaid with temperature and pressure tests at the IMA Material Research and Application Technology test center in Dresden (Fig. 2).

Having been put through its paces, the b&m-KL Plug started operation at OEMs and suppliers in automotive construction. It is used wherever flows must be controlled and regulated. The element prevents, for example, the escape of oil in compressor housings, or closes and seals bearing housing covers in turbochargers. "What's interesting about the b&m-KL Plug is its variety," according to Constantin Egold (Fig. 3). Thanks to its properties the system is also suitable, for example, for regulating throughflow in channels carrying media such as a water/glycol mix or oil. And equipped with a temperature sensor

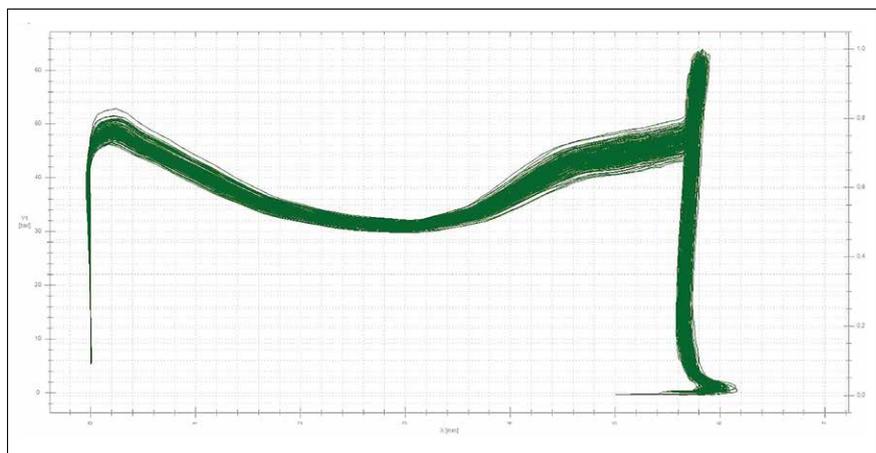


Fig. 2: Installed process reliability: the setting curve diagram illustrates the pressure and setting path values of about 50 tests. Whereby b&m-KL Plugs made of steel were used for drilled holes with a diameter of 12 mm.

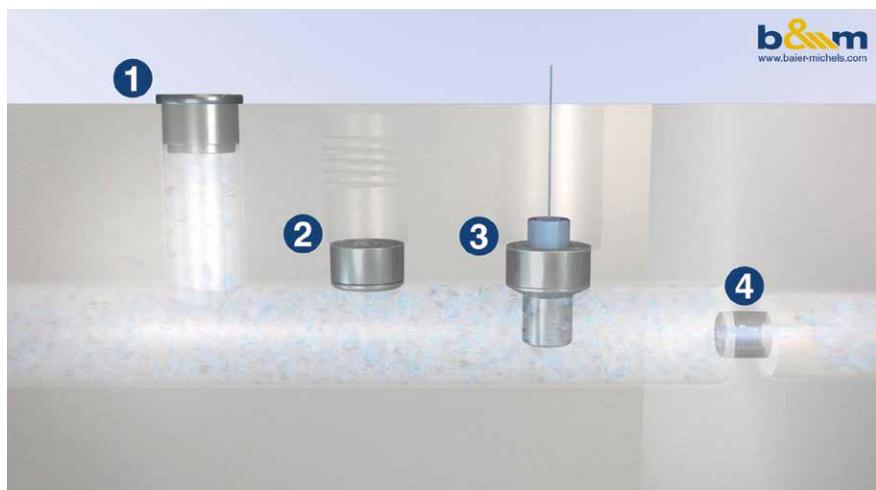


Fig. 3: Versatile use, suitable for fluids and gaseous media. 1: Closes directly at the surface of a drilled hole, 2: Set lower to reduce the dead space, 3: With a thermowell and sensor in a tempering channel, 4: As a flow regulator between two channels.



Fig. 4: Constantin Egold (left) in conversation with Mark Joos, Manager Tool Construction at Haller Kunststofftechnik.

and a thermowell this new type of plug can also act as a control unit for optimizing tempering processes, for example – whether for the power electronics of e-cars or in injection molding and die casting tools.

Successful in practical use

One customer that uses the b&m-KL Plug, among others, is Haller Kunststofftechnik GmbH, in Rodgau. The company uses injection molding to produce technical components made of thermoplastic polymers. These are mainly used in the automotive, electrical and energy sectors in brackets for control devices, cable carriers for electrical wires, and parts for refrigeration units. “The b&m-KL Plug not only increases tightness values, but also considerably reduces closing element installation time and costs compared to what we previously used in the tempering channels of the tools that we also manufacture for our customers,” says Mark Joos, Manager Tool Construction (Fig. 4).”

What this means in practice can be seen when one observes the production of a cable bracket ordered by a carmaker. The tool consists of two mold halves – a cube weighing a total of 900

kg with dimensions of 1000 x 500 x 500 mm³ (length x width x depth) (Fig. 5). “It is principally made of tool steel,” explains Mark Joos. “Whereby the shape-forming area, in particular, that comes into contact with the polymer, is made of hardened tool steel. And because we also process glass-fiber reinforced plastics, the mold contours must be hardened, and even partly coated – soft steels would wear too quickly.”

In the past, the Heller team regularly used expander solutions to close and seal the cooling circuit in the tool, but also used plugs or screw fittings made of

brass, frequently wrapped in Teflon tape to improve the sealing effect (Fig. 6). “Such systems are effective, but require comparatively complicated preparation of the drilled hole,” says Mark Joos. “This involved several steps, for example changing the drill and countersinking, but also cutting and cleaning the thread and, in the case of sealing screws, milling of the heads is also important.”

One must also take into account that many closing and sealing elements, such as expanders, generate a waste product (mandrel) on setting that must be removed from the assembly plant separately. And with the b&m-KL Plug? “It allows us to act without dirt or waste, and we save about five minutes per drilled hole,” confirms Mark Joos.

BAIER & MICHELS

Founded in 1932 as a local dealer of screws and fittings, the company now has a global orientation as a member of the Würth Group and employs about 500 personnel. baier & michels (b&m), based in Ober-Ramstadt, supplies the production industry with connection, closing and sealing solutions for cold forming – developed and produced in-house. Customers include OEMs and suppliers to the automotive, electrical and medical technology industries, as well as tool and plant constructors. In addition to application-related technical consulting, the company also offers training courses and, with its b&m-PORT, an online portal that supports industrial companies in the standardization of their C-parts.

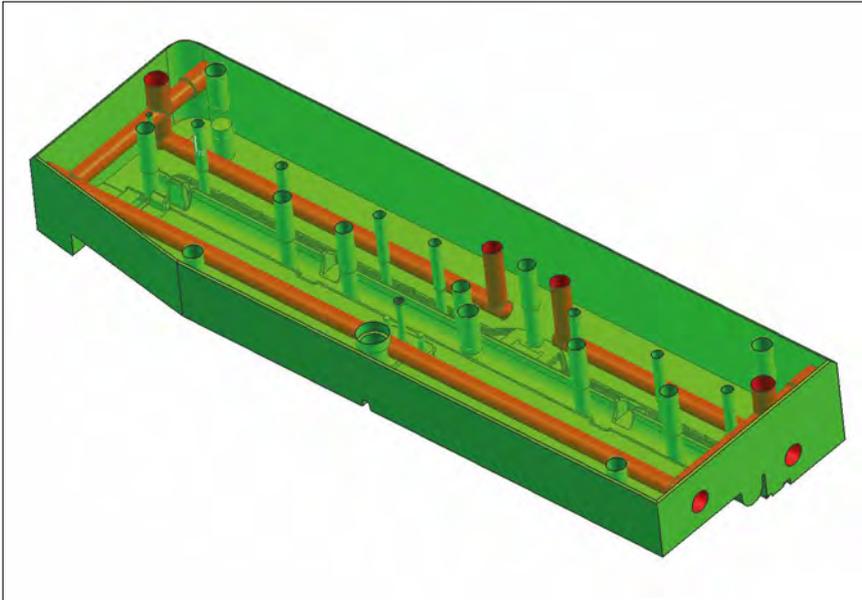


Fig. 5: 3D view: The cooling channels, including the drilled holes in which b&m-KL Plugs are installed, are in red. In a concrete case, there are a total of eight contour inserts in the tool, which weighs 900 kg.

“We generally work with diameters of from 10 to 14 mm.” According to Joos, the channels of the two tool molds in which the cable brackets are made contain a total of about 80 b&m-KL Plugs, “which overall makes us considerably more efficient.”

Efficiency is also essential when designing tempering circuits. Depending on whether the flowing medium is, for example, a water/glycol mix or oil, many years’ use of the tool, which sometimes involves lengthy storage periods, cause the gradual formation of rust or even contaminants. So Constantin Egold recommends keeping the volume of medium in the channels to the minimum necessary. The b&m-KL Plug can help reduce the so-called dead space: “With a lengthened mouthpiece it can be rapidly placed in the desired depth of the drilled hole – and unlike other closing and sealing solutions, if necessary the drilled hole can be re-used without renewed preparation.”

Use in die casting

The topic of non-destructive disassembly is especially relevant in the field of die casting, more precisely in cold-chamber processes. During each casting cycle, the required quantity of melt is newly fed into a receptacle, the so-called shot chamber, and transported into the intended mold via a movable piston at high speed. “To ensure that the liquid hot metal (at about 700°C) does not change its physical state while in the shot chamber, it is heated by the tempering circuit (mostly filled with oil) from outside the chamber walls,” explains Constantin Egold.

When it is necessary to remove closing and sealing elements, for example for maintenance work, conventional closing screws must generally be removed (which is cost-intensive) or, if other solutions are used, there may be metal shavings. Then the borehole must be drilled out to the next-largest diameter required for the new element – which often poses problems for personnel due to lack of space. “The b&m-KL Plug is disassembled without destruction and thus helps save time,” says Constantin Egold and adds: “By making complex things seem easy, this somewhat different sealing plug supports our customers in their desire for process stability and a high level of automation.”

www.baier-michels.com

Andreas Wollny, Manager Product Communication, baier & michels GmbH & Co. KG

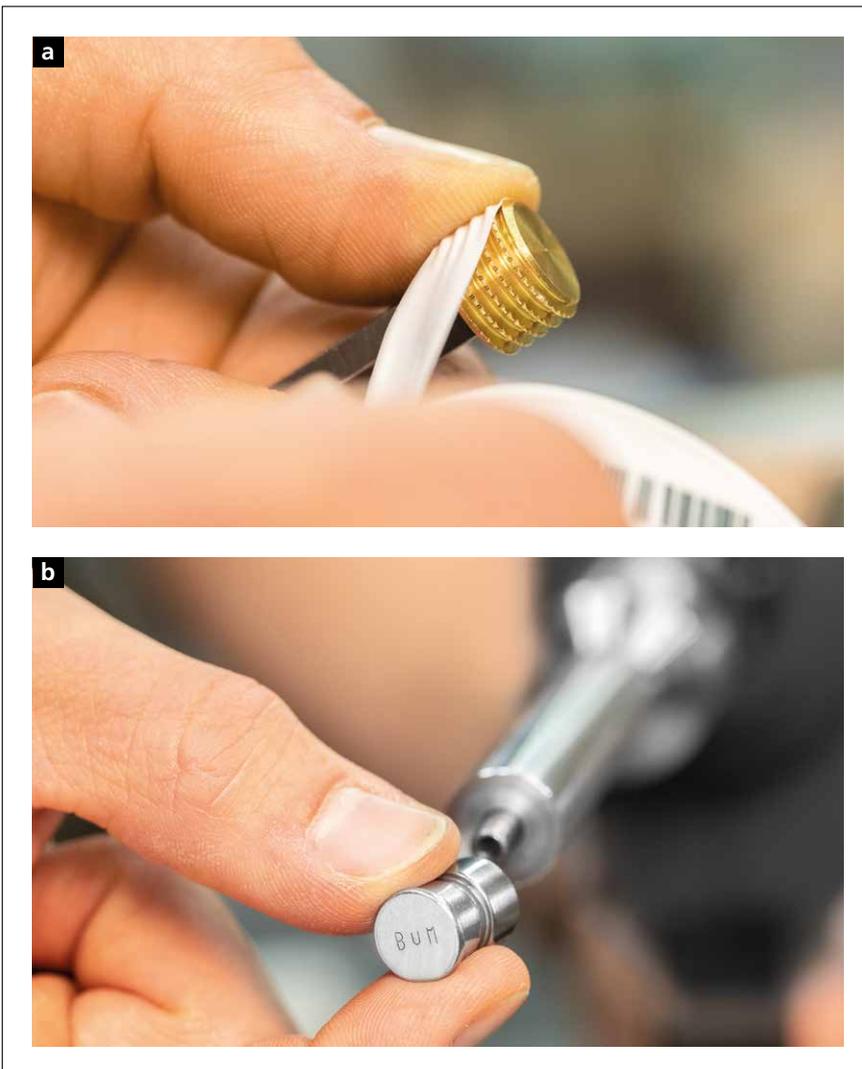


Fig. 6: Fewer work steps: Unlike the setting of a conventional closing plug, which requires several actions, sometimes including wrapping with Teflon tape (a), the b&m-KL Plug (b) is rapidly installed.



Photo: Reichle Technologiezentrum

Repairing castings is an economic alternative to re-melting.

Repair with laser welding

Retaining value creation of defective castings

Reichle Technologiezentrum GmbH offers European foundries, mechanical processors and OEMs a substantial reduction of their reject costs by repairing castings using laser welding. Whereby up to 95% of all rejects – caused by cavities, blowholes, pores, pore clusters and cracks – can be repaired

By Sophia Weiß

The increasingly complex component geometries of castings, together with rising quality demands by end-customers, are causing greater difficulties with cavities, blowholes, pores, pore clusters, cracks, etc. at many foundries. These features are a negative qualitative criterion, particularly on mechanically worked surfaces, leading to remelting and thus the loss of one's own, or externally provided, value creation. It is not rare for this to

lead to high reject costs, delivery bottlenecks or even, if the worst comes to the worst, production downtimes and financial penalties for the foundries themselves, as well as for mechanical processors or OEMs.

Repair as an alternative

Reichle Technologiezentrum GmbH specializes in precisely such cases to considerably reduce reject costs in the casting sector and proactively prevent delivery

bottlenecks. This concept has made the Swabian family-owned company one of Europe's largest service providers in the field of casting repair using laser welding (Fig. 1): The company's workforce repairs more than 300,000 castings on an area of about 2,500 m² in multi-shift operation.

Whereby the Swabian company processes all types of castings regardless of the alloy involved, ranging from smaller connectors and chassis parts, through



Fig. 1: Repair is carried out using laser welding.

cylinder crankcases weighing tonnes, to e-mobility components such as battery housings or stator supports. Regardless of the component or process, the focus is always on economic efficiency. The production cost of each repaired component is generally substantially higher than the processing cost involved in repairing it.

“We repair some car cylinder crankcases whose processing costs only amount to 6% of the production costs. To achieve this, however, requires special laser welding techniques and rational serial processes,” reports Managing Director Marco Reichle. “Customers throughout Europe appreciate the high cost savings and the long-term high quality of the repaired castings.” No mechanical reprocessing is necessary after repair – the castings are almost identical to good parts and can be directly delivered to the customer as in-order parts. For this purpose, the company employs specially trained surface technicians who can maintain almost all dimensional requirements.

The repair process

After the damaged castings have been delivered to the company a flexible range of internal processes are carried out, adapted to the particular customer’s needs. These include sorting and picking, inspection of cracks, flaw analysis, specialist grinding of the defective areas followed by welding of the defective areas, blowholes, pores, cracks, etc. by means of particular laser welding techniques and special filler metals (some of which were developed by the company itself), as well as machining of the laser-welded areas within dimensional tolerances, and finally storage and logistics. The laser welding of castings does not lead to any tech-

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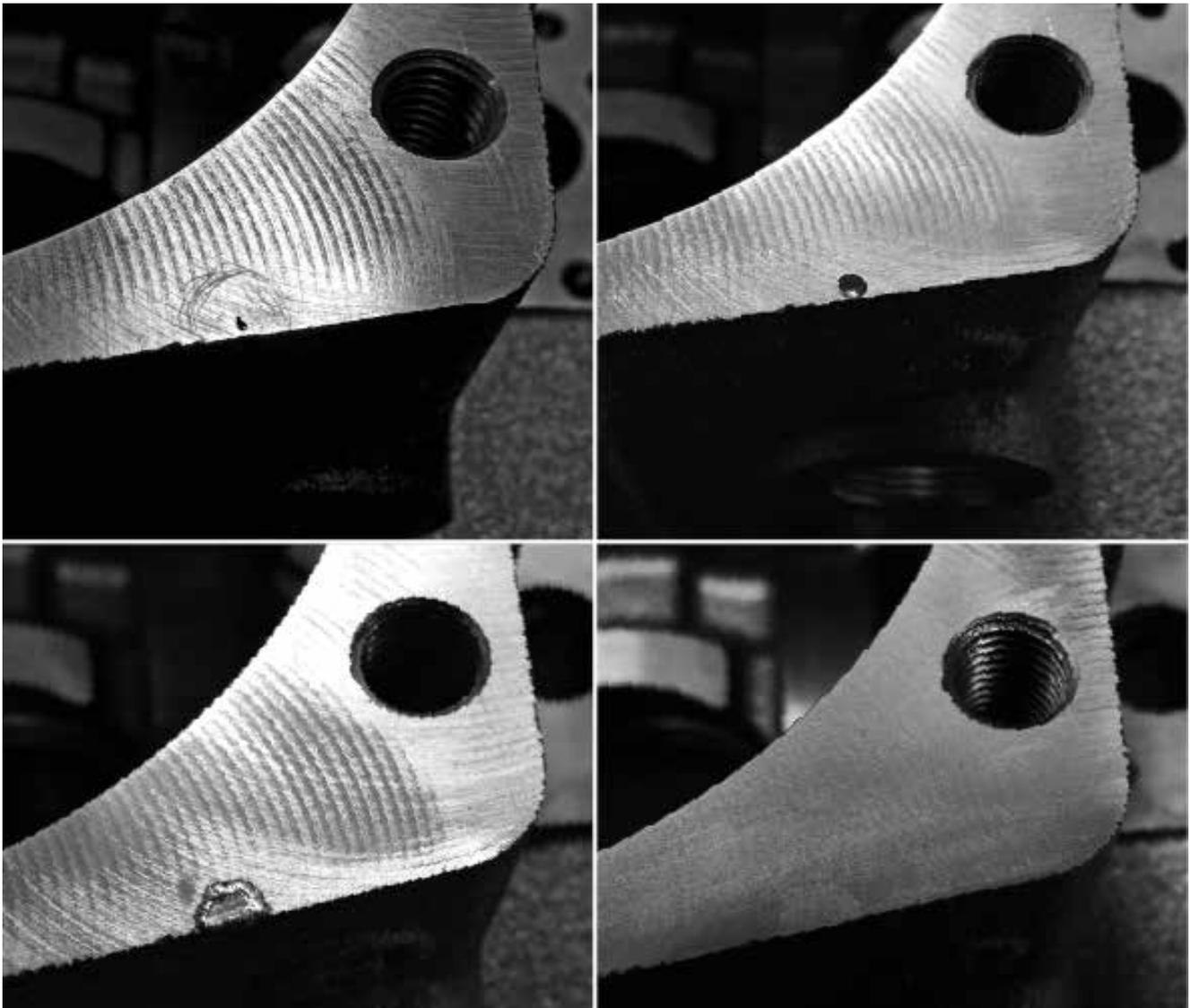


Fig. 2: Before/after state of a processed casting.

nical or optical disadvantages compared to good parts that have not been welded (Fig. 2). This procedure is particularly suitable for mechanically processed surfaces, but can also be used for raw contours or cracked walls. No further heat treatment of the casting is required – due to the special laser welding system used and a vanishingly small heat-affected zone, which can be ignored.

Regardless of the casting process, the components most often repaired by Reichle in terms of volume include cylinder crankcases, heads and head covers; gearbox, clutch and pump housings; and oil sumps for cars, commercial vehicles and trucks, as well as for mechanical engineering, the marine sector and the aerospace industry. Whereby about 60% involve castings made using aluminum or magnesium, and 40% are parts made with lamellar graphite (GJL), cast iron with vermicular graphite (GJV), and other alloys.

Buffer concept prevents delivery shortfalls

The company has almost 20 welding plants for processing activities, so it can react and re-equip for special requirements at short notice to avert delivery bottlenecks or impending conveyor standstills on the customer side. This ensures a high level of flexible capacity, and the company's semi-automatic processes mean that even small castings can be repaired economically.

The company's buffer concept allows foundries and mechanical processors to do without special shifts resulting from excess or general defect rates. One-off advance production is sufficient: Reichle Technologiezentrum GmbH repairs defective products and stores the resultant good parts. Repaired castings are sent back to the producer as soon as there is another

delivery of defective parts, whereby the customer rapidly obtains stocks of good parts. This reduces direct reject costs and, often, indirect production and logistics costs.

Analysis and optimization

Reichle also carries out a cavity analysis, with whose help changes and optimizations of molds can be undertaken in close collaboration with end-customers – thus, for example, contour changes or material damage in the casting molds are welded and ground or milled. The company also offers compaction beaming for casting molds to lengthen their service lives.

www.reichle.de

Sophia Weiß, Marketing, Reichle Technologiezentrum GmbH, Bissingen



Photos and Graphics: Feinguss Blank

Wax blank for investment casting from the 3D printer.

Hybrid investment casting

3D printing for greater efficiency and an expanded portfolio

No other metal-forming process can produce as complex and as cost-effective geometries as the lost wax investment casting process. With its hybrid casting system, Feinguss Blank GmbH integrates 3D printing into the process – enabling even greater design freedom and more rapid implementation.

By Manuela Schmid and Dominik Roth

Hybrid concepts are the current trend, whether in everyday work, in mobility, or at congresses and trade fairs. The core definition is always the same: a mix of several types of work, drive or events to achieve increased efficiency. The development department at Feinguss Blank GmbH is constantly looking for optimization potentials in the investment casting process. This has also resulted in the development of Blank hybrid casting, which similarly conforms to this core definition: a symbiosis between two dif-

ferent production methods to become quicker and more accurate, depending on the particular application.

The investment casting process

“Our approach becomes understandable if you first look at the regular manufacturing process (Fig. 1),” explains Rainer Bühler, Head of Business Development at Blank:

- > Firstly, one needs a tool that is used to produce the wax parts. The wax parts are almost identical to the subsequent casting regarding its dimen-

sions. Minor deviations can be caused by differing amounts of shrinkage of industrial wax and the metal alloy to be used.

- > Then the wax parts are glued together to form trees so that from now on several individual parts can be produced in a single manufacturing step.
- > The casting shell is then formed by dipping the wax trees in ceramic mass and then sprinkling them with sands of different grain sizes.
- > After drying, the wax is evaporated

INVESTMENT CASTING

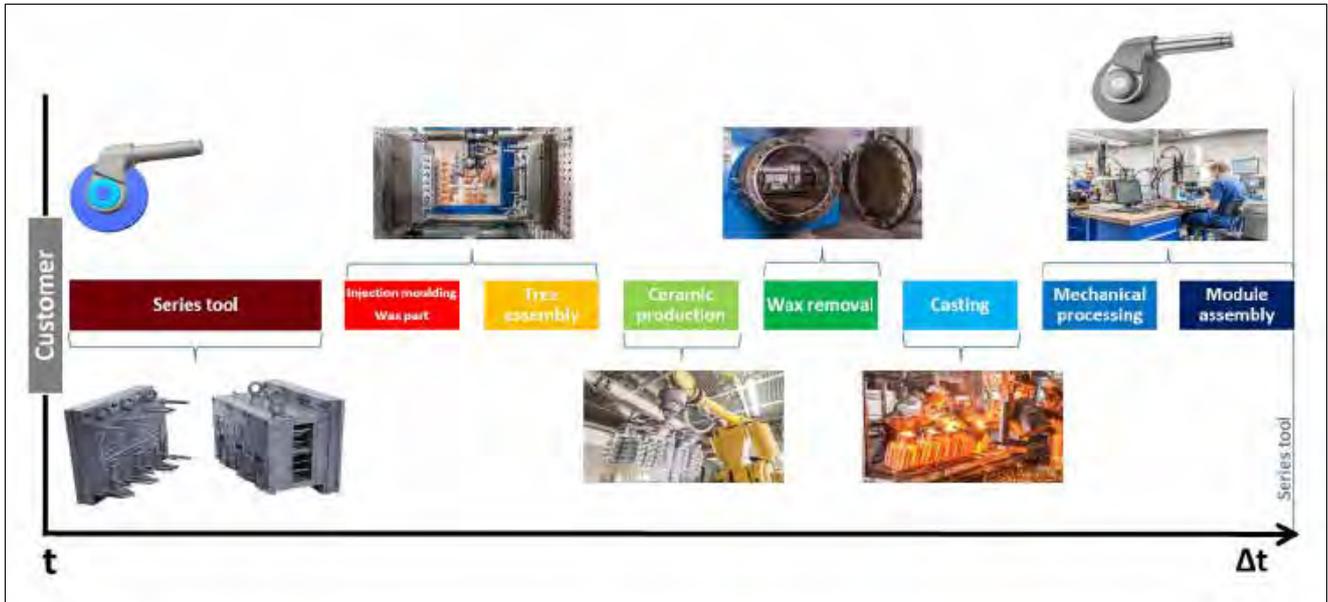


Fig. 1: Serial tool – examination of time required for regular production of an investment casting.



Fig. 2: Blank hybrid casting for acetabular cups; the fine tripods can be seen in the enlargement.

out and the resultant shell is burnt at more than 1,000°C.

- > Then the mold is filled with metal melt: the investment casting step.
- > The shell, when it has cooled completely, is knocked off.
- > Finally, the parts are separated from the casting tree, cleaned and further processed.

Blank hybrid casting

The idea behind Blank hybrid casting is to replace production of the wax part using an injection molding tool and instead employ wax 3D printing. This considerably shortens the production time, and part geometries can be achieved that were previously impossi-

ble or could only be produced with great difficulty.

The wax used in the 3D printer is comparable to conventional investment casting waxes regarding its parameters, e.g. wetting capacity and ash content. It does, however, need special flow characteristics to enable it to be passed through the cartridges and nozzles. Moreover, the printed wax surface has a typical texture and roughness that must be levelled using a special process to prevent ceramic inclusions.

Example: prosthetics

The production of acetabular cups (Fig. 2) is one example of a very efficient use of the new process. The casting part

consists of a solid shell-shaped head on whose surface there are hundreds of small so-called tripods (see Fig. 2, detail). These fine cross-shaped anchors are the connective links between the implant and bone. Up to now, they have been manually glued to the wax part on the ladle, which was extremely time-consuming and very very filigree manual work that made every implant unique. Within the project, thanks to the hybrid casting system, implementation could be achieved using wax 3D printing, allowing accurate positioning of the tripods to within one tenth of a millimeter – which would be impossible manually. This ensures a more reliable mechanical connection between the tri-

Pods and the femoral head, gives the process continuity, and enables a reduction of throughput and personnel costs.

Example: bionics

Another potential application here can be found in racing, where weight reduction plays a decisive role regarding speed and agility. A bionic wheel carrier design (Fig. 3) that withstood the stresses of the end-use despite being considerably lighter was developed as part of a production collaboration. The weight was reduced by more than 40 percent compared to the original milled part. This bionic part can only be produced in this form using Blank's hybrid investment casting process.

Flexible and smart

The shorter production time thanks to 3D printing (Fig. 4) is particularly economical for small unit numbers, for example prototypes and small series, as well as for producing replacement parts. "The investment casting process consists of between 20 and 60 individual work steps, depending on the customer's requirements. This may involve a higher throughput time and sacrifice flexibility. In such cases, hybrid casting can offer an interesting alternative to the regular production process," according to Bühler. In general, however, he considers wax 3D printing as a supplement to classic wax injection – something that expands the product range and not a substitute process.

Feinguss Blank has integrated an online 3D printing calculator on its homepage to provide a comprehensive smart concept. A service has thus been established with which one can order



prototype investment castings, "like one would order from the big online retailers." The rapid availability of investment casting solutions within 23 working days enables customers to react rapidly to the dynamic market and produce a prototype, for example. In addition to 13 technologies, it is also possible to select from 100 different materials in the calculator, including heat-resistant and stainless steels suitable for hot gas zones. Non-metals such as gypsum, plastic (also fiber-reinforced), quartz sand and silicon are also available via the sup-

plier network. The link below leads to further information and the online 3D printing calculator itself.

www.feinguss-blank.de

Manuela Schmid (Press Contact) and Dominik Roth (Head of the Technology Center / Global Production) at Feinguss Blank GmbH, Riedlingen



Link to online 3D printing calculator:

<https://bit.ly/3dDNDt8>

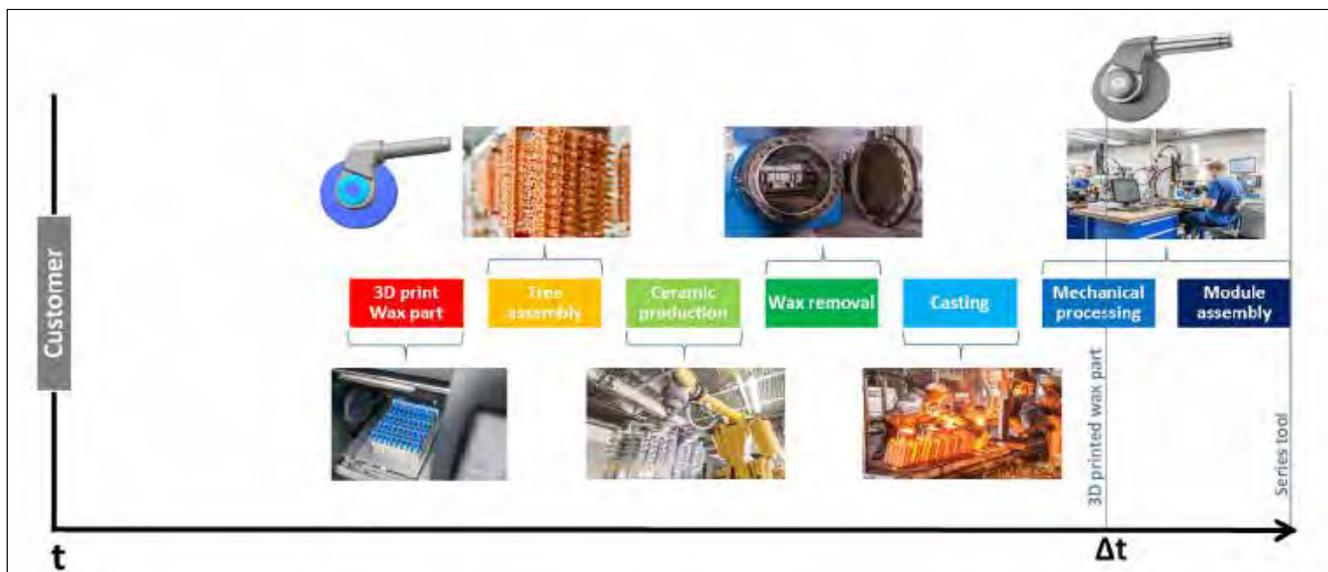


Fig. 4: Examination of time required for production of an investment casting using Blank hybrid casting.



Photos: Waygate Technologies

Automotive foundries profit from quality data acquisition and preparation.

Digitalization

Data from inline CT increase quality and efficiency

Comprehensive data acquisition and preparation from development to production enables considerable increases in production efficiency and quality, as well as shorter development and production start-up times. 3D data from the inline computer tomography of castings or molds can be an important element in this.

By Ferdinand Hansen and Michael Ulbricht

Data are the new gold. This motto is nowadays often quoted when describing the advantages of digitalization in production. Benefits here can be obtained by, among other things, comparing CAD and real measurement data as well as through the statistical evaluation and interpretation of 100% testing.

The collection of data has been standard practice in automotive foundries

for decades, for example in the production of cylinder heads and e-motor housings. Up to now these data have often only been used to compare actual measurement values with a defined target. Whereby a tolerance is assigned to each value to determine whether the part is classified as 'in order' or 'not in order'. No further data analyses, which could lead to additional advantages, are carried out. This is now changing, as

the first examples of the evaluation of intelligent 3D data from inline computer tomography (CT) show.

Automated CT scan and intelligent evaluation

A computer tomography system developed by Waygate Technologies (formerly GE Inspection Technologies) provides the prerequisites for rapid, and thus very numerous, 3D analyses of light-metal

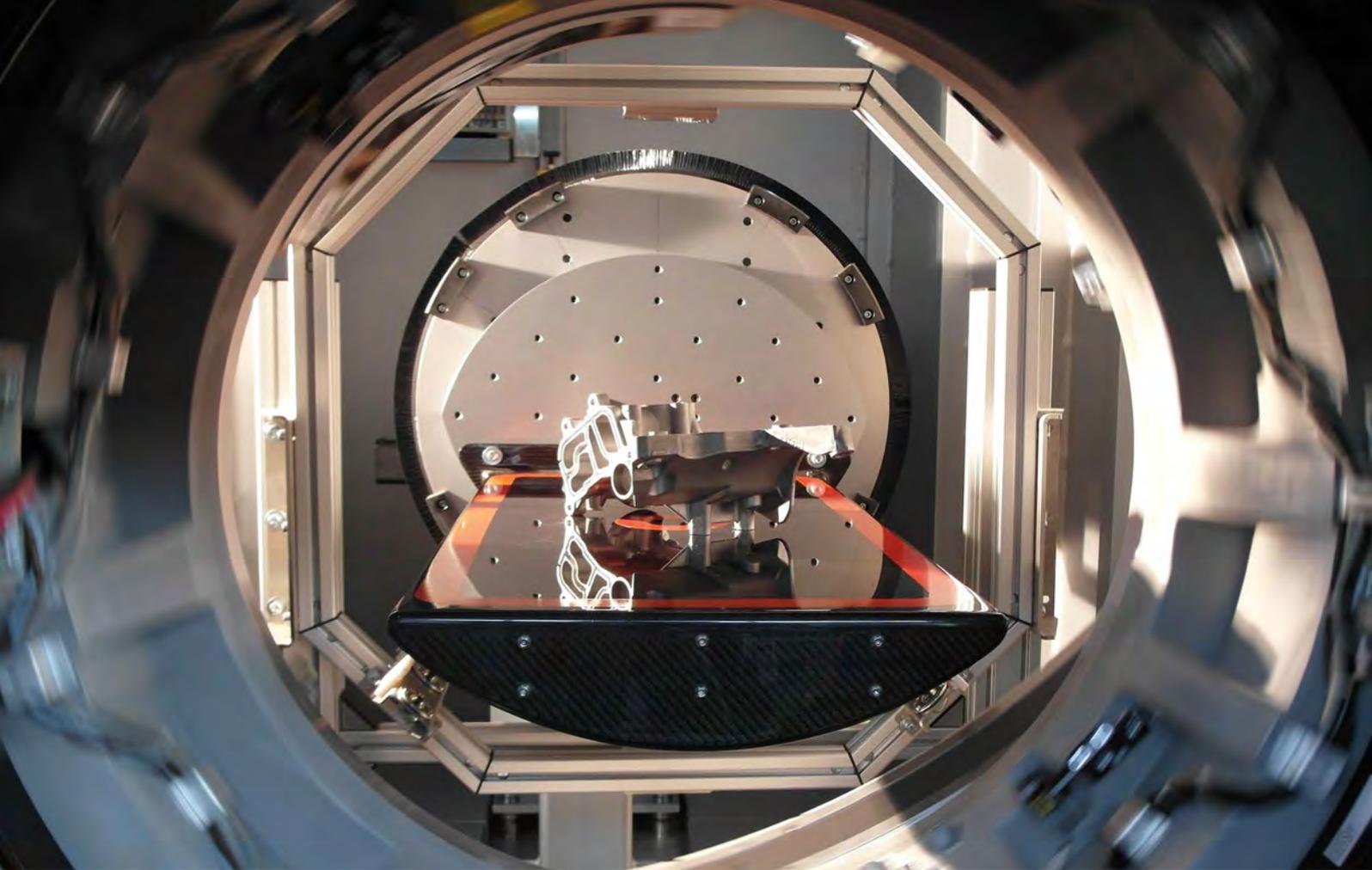


Fig. 1: As with medical tomography, the CT gantry of the Phoenix Speed Scan CT 64 rotates around a test-piece on the inspection table.

castings. CT testing is nothing new in foundry technology, but the Phoenix Speed Scan CT 64 System (Fig. 1) offers three special features that fundamentally open up other opportunities for data use:

> The device works exactly like a CT system in human medicine – with a rotating CT gantry. This enables rapid inspection processes with extraordinarily high cycle times: scanning a cylinder head only takes about 15 - 30 seconds and is thus much faster than conventional industrial CT processes with area or line detectors.

> The scanner can be automatically loaded and unloaded (Fig. 2). Whereby the table upon which the test-piece is lying moves out of the plant without the test-piece having to be fixed for a rotation. These two factors provide the prerequisites for inline use in 100% testing – and thus for the generation of large quantities of data. The reconstruction and evaluation of the data are already taking place while the next light-metal casting is being scanned. It can also be used for at-line testing in the immediate proximity of several production lines.

> The Speed ADR and Inspection-Works software platforms for automatic defect detection and intelligent data evaluation not only enable highly differentiated 3D examinations within the casting, but also permit further analyses – and can thus considerably increase productivity in the foundry and the quality of the light-metal castings.

Quality assessment as a basic task

The Speed Scan CT 64 can completely digitalize every light-metal casting produced (or representative samples or prototype parts) up to a size of about 600 mm diameter x 900 mm length and create a digital twin of it. Whereby not only are the dimensions detected, but also the casting's inner structures. So numerous potential casting defects, such as inclusions, blowholes, flaking or sand core residues – including those in invisible or inaccessible locations deep within the test-piece – can be reliably detected and measured from a diameter of 0.5 mm upwards.

The quality of the component can therefore be much more reliably evaluated than with the hitherto usual

destructive or surface test methods, or 2D radiographic inspection. In addition, the scan also enables an assessment of component porosity in the course of pre-machining tests (Fig. 3), i.e. not just whether there are problematic porosities due to their size, but also whether a problem could arise after further processing.



Fig. 2: Test objects can easily be placed on the deployed loading table of the Phoenix Speed Scan CT 64 scanner.

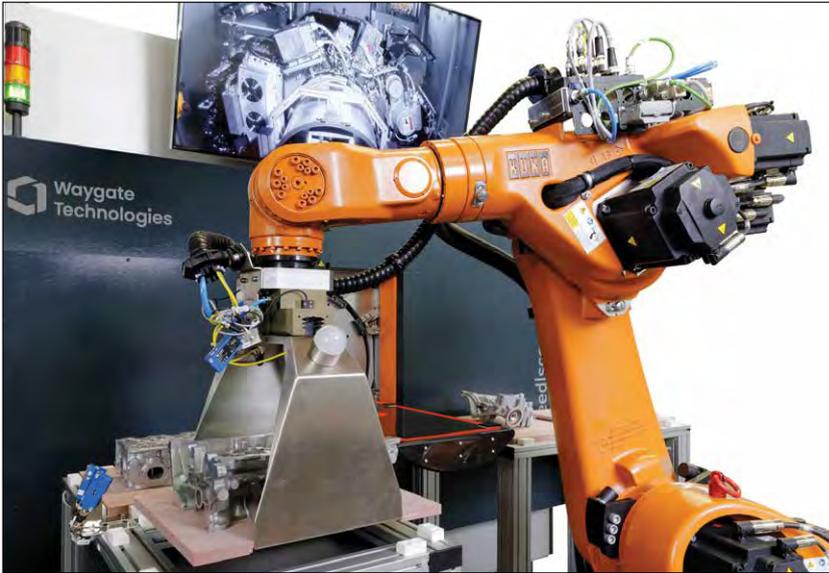


Fig. 5: Speed Scan CT 64 system with robot loading for fully automated testing.

made on when the deviation will reach a value that is no longer acceptable – in the sense of predictive maintenance, in other words before rejects are produced. The user can then take advance action, for example, by making corrections to the core and casting tools. In this way, the number of rejects can be so considerably reduced in practice that the investment in an inline CT plant can be amortized within a reasonable period of time.

Efficient tried-and-tested technology

In summary, it can be said that the presence of 3D data sets of scanned light-metal castings can be used multiple times in the overall production process to save time and effort. The user of the Phoenix Speed Scan CT 64 is free to choose which of the use-cases presented here to start with. Several car-makers and suppliers already use this technology in their foundries, both inline for meaningful 100% quality assurance (Fig. 5) with a minimized reject rate, as well as at-line in development and prototype production, and for statistical monitoring and optimization of processes at several parallel production lines.

The first plant of the new type, the Speed San CT 16 based on a medical CT gantry, was the predecessor to the even faster CT 64 model. Suitability of the technology for continuous industrial use is attested by almost a decade of unbroken activity since its installation in the Volkswagen component foundry in Hanover and the scanning of about 150,000 large aluminum castings.

Another example: a well-known Asian carmaker bought a Speed Scan CT 64 system three years ago and initially used it offline in a laboratory to learn how to employ it optimally in serial production. The plant was then equipped with a robot loading system to gain experience with fully automated operation before integrating more inline CT systems in serial production.

Summary: driving digitalization forward

A data structure with the most important process data can gradually be created by linking the individual sub-pro-

Fig. 6: Endurance test passed: about 150,000 large castings have been scanned and analyzed with the Speed Scan CT 16 system at the Volkswagen foundry in Hanover in eight years.



Graphik: Volkswagen AG

cesses. This digitalization step clearly leads to economic benefits resulting, above all, from the acceleration of processes. The implementation of Foundry 4.0 can be substantially driven forward with the above-described approach, at least in two fields of activity:

- > In prototype production as a comparison between simulation and real components, and
- > in inline or at-line testing during serial production.

Those interested can test the Phoenix Speed Scan CT 64 at the Waygate Technologies Customer Solutions Center in Ahrensburg (in Schleswig-Holstein), among other places, with their own test-pieces.

www.bakerhughesds.com/waygate-technologies

*Dr. Ferdinand Hansen, Ing. Beratung F. Hansen, Hanover.
Michael Ulbricht, Global CT Product Management Leader, Waygate Technologies, Wunstorf.*

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OTTO JUNKER

Order from Nordenham Metall

Otto Junker, Simmerath, Germany, has received an order from Nordenham Metall GmbH for a medium-frequency coreless induction furnace with IGBT frequency converter for melting and distilling of zinc.

Nordenham Metall (a member of the Glencore Group) is one of the oldest lead works in Europe and has been one of the most productive to date – thus being among the most important lead recyclers. Annual production is above 100,000 tons of primary and secondary lead. In the next few years Nordenham Metall will be transformed into a modern polymetallic works. In addition to the recycling of lead-containing products from spent lead batteries, processing capabilities will be extended to include residues with lower lead levels from zinc ore processing, as well as substances of more complex compositions.

The vacuum-type coreless induction melting furnace has a capacity of 3000 kg and a nominal frequency converter rating of 600 kW. It will offer a melting



Photo: Otto Junker

Vacuum-type coreless induction melting furnace.

rate of 1000 kg/h. The vacuum-type induction furnaces with the coil outside the vacuum are designed and suited for melting of Zn-Ag-Pb alloys and the subsequent condensation of zinc from this alloy. Only the actual melting crucible is under vacuum. This design ensures a reliable protection against glow discharge

effects that may occur under vacuum. It also ensures protection of the induction coil lining against zinc infiltrations. Multi-frequency technology is implemented to permit melting at optimum frequency (80 Hz) and to create more intensive bath agitation for vacuum treatment (40 Hz). www.otto-junker.com

AMB TRADE SHOW IN SEPTEMBER

Shot blast machinery for the first time at the show

At the AMB trade show Walther Trowal, Haan, Germany, displays not only mass finishing but also shot blasting equipment for blast cleaning of castings and stampings. The new troughed belt shot blast machine is characterized by its small footprint, and the TT high-energy mass finishing system requires 20% less energy.

The company introduces the compact continuous flow troughed belt shot blast machine, model THM 300/1. This machine was specifically developed for treating high volumes of small, delicate work pieces with thin walls. It can handle aluminum and zinc diecastings with diagonal measurements between 20 and 150 mm. For example, this includes toy cars, components for consumer electronics or fittings for the furniture industry.

For the first time a continuous flow shot blast machine is now available for treating small work pieces. With a footprint of only 1.4 x 2.7 meters it can be easily integrated into existing manufacturing lines. With the troughed belt trans-



Photo: Walther Trowal

Up to 40 t clamping force can be generated manually.

port system the work pieces are gently passing through the machine in a spiral movement. Since the work pieces are continuously tumbling over each other, they are evenly blasted on all sides.

Potential customers who see the displayed machines at the exhibition, can

conduct processing trials with their work pieces at the new test and training centers in Haan, Germany, and in Grand Rapids/Michigan, USA.

www.walther-trowal.de

MECHANICAL CLAMPING NUTS

High clamping forces without any tools

Completely tool-free clamping is possible with the two power clamping nuts ESBS and ESBT from Enemac, Kleinwallstadt, Germany.

The power clamping nuts of the ESBS and ESBT series with their integrated planetary gear can be driven easily and with little effort by turning the hand grip. The internal thread is drawn in a little and the counterpart is tightened when turning the handle. Up to 40 t clamping force can be generated manually.

And this is how it works: Manually screw the power clamping nut onto the existing bolt until the nut lies flat on the part to be clamped. Then turn the handle clockwise until the workpiece is firmly clamped. The nuts are self-locking and guarantee a high level of security. The ESBS and ESBT series are designed for workpieces or tools of the same size. Both types are available as standard for thread sizes from M10 to M20 and can be used at temperatures between -243 K and 363 K.

www.enemac.de



Photo: Enemac

Up to 40 t clamping force can be generated manually.

IMPROVE CASTING QUALITY BY COOLING & PRECONDITIONING YOUR SAND



If you have a hot sand problem and your foundry is experiencing casting defects, the Simpson Multi-Cooler is the solution!

The Simpson patented back-blending design of the cooler allows for homogenization and precondition of the bentonite and water—improving process control and reducing variations in sand qualities at the muller.

Engineered for:

- Durability and ease of maintenance
- Integrates easily into existing sand systems
- Advanced moisture control and continuous monitoring



FULL CASTING TRACEABILITY

The missing link for foundry scrap reduction

DISA has released Trace and Guidance (TAG), an innovative casting-level tracking system. It creates the missing link between process and quality data, allowing green sand foundries to achieve full casting traceability.

For the first time, foundries can trace every single casting they produce instead of relying on less accurate batch data. With DISA TAG, they can create an individual-casting-level view of their whole process. "Finding the root cause of scrap can be extremely difficult, making it hard to reduce quality-related costs," said Per Larsen, Innovation Manager at DISA. "DISA TAG adds a unique ID to each casting which operators simply scan to link the casting to a specific defect cause or to look up the process parameters used to make it. DISA TAG promises to be a game changer, helping to reduce quality costs to previously unseen levels."

It works in three steps: First, foundries install marking units in their pattern plates to give each casting a unique TAG ID. After casting sorting, a hand scanner is used to read the codes of scrapped castings and link them to specific defect types. That quality data is automatically stored in the TAG database. In the final

step, each casting's unique code and specific defect are linked to that casting's process data. Engineers can then correlate specific defects with the process data to find hidden insights and the root causes of defects.

DISA TAG is also a perfect match for automated analytics that leverage Artificial Intelligence (AI). The casting-level data helps the AI self-learn much more quickly, improves optimization accuracy and so maximizes scrap reduction. It's an essential part of the journey to zero defect manufacturing and a more sustainable future.

"Granular, casting-level data makes it much easier to decide exactly which combination of process parameters created a bad casting," explained Per. "DISA TAG helps to solve complex quality problems, reveals hidden insights and enhances AI-driven process quality optimization."

DISA TAG cuts wasted material, energy and time in more than one way. For example, operators can classify a set of castings as "bad", use hand scanners to quickly identify them after shot blasting – ensuring that good castings aren't scrapped and re-melted too. If a customer enquires about an issue with a casting months later, the foundry can



Photo: DISA

Any casting can also be scanned to look exactly when it was produced.

simply scan the casting's TAG ID to locate its process data and investigate.

"For foundries that collect and analyse data on their process – or are planning to – DISA TAG takes them to the next level of traceability and accuracy," said Per. "It helps guide them to the correct actions that improve quality, reduce reworking and scrap, cut costs and increase sustainability."

www.disagroup.com/en-gb/disa-tag

TRADE FAIR METAL EXPO

Foundry Goes Green

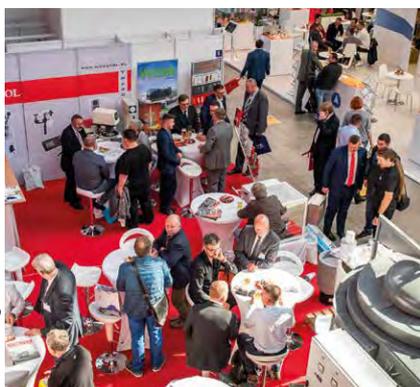


Photo: Targi Kielce

In the fall, foundrymen will meet again at Metal Expo in Kielce, Poland.

The foundry industry dominates Targi Kielce's events calendar in its summer-end section, i.e. 20 to 22 September. This strong accord is owed to the Metal expo and its accompanying exhibitions: Heat Treatment, Aluminium & Nonfermet, Control-TECH & Recycling.

In the previous years, the pandemic slightly distorted the calendar of expo, however, this year Metal has returned to its traditional date. The convention, which brings together companies professionally involved in the foundry market, still welcomes exhibitors.

The Foundry Goes Green – the expo accompanying a two-day seminar (on September 20 and 21 from 11:00 to 13:00 each day) is deemed to be an excellent opportunity to present modern solutions designed for the

industry. The sessions offer an immense dose of practical knowledge. The meeting is divided into two thematic blocks; the seminar is a vital complement to the event's offer and agenda. The forum offers an insight into clean air, modern industry technologies, heat treatment of metals and many other topics of pivotal importance. Digitization has become ubiquitous in every area of life and various industry sectors. Thus the Foundry Goes Green seminar features digitisation. Another topic is the energy transformation of the foundry industry.

www.targikielce.pl/en/metal

Intelligent control for smart performance management and high energy efficiency

Vacuum specialist Leybold, Cologne, Germany, has developed the Varodry VDi vacuum system with integrated VAControl CAB control. The pump systems of the new series consist of the air-cooled, oil-free Varodry screw pumps, the dry-compressing roots pumps of the RUVAC series as well as the VAControl CAB control for smart management of all pump processes.

„In concrete terms, users today expect dry, flexible vacuum solutions with a high pumping speed. Therefore, quick and uncomplicated adjustment possibilities of the vacuum performance to the respective process conditions are necessary,“ says the responsible Product Manager, Dennis Schröder, outlining the requirement profile. He adds that, especially with rising energy prices, customers do not want to worry about unplanned process and maintenance costs. To meet their profitability and sustainability goals, the energy and resource consumption should therefore be as low as possible and calculable.

To achieve this, the VDi system can be configured by the operator according to the process requirements: This allows users to set their own vacuum capacities as needed to match the pump-down process and the pumping speed. Another advantage: To protect against critical gases and particles, the Varodry VDi vacuum system can be equipped with gas ballast and purge gas. This increases the service life and system availability. In some application environments where steam or dust is present, additional filter options ensure an uninterrupted vacuum supply. Additional energy savings and even wear are ensured by the Energy Saver Kit.

More intelligence in the applications is provided by the heart of the system – the integrated VAControl CAB control system specially programmed by Leybold. With its smart software functions, the processes can be controlled and optimized in a user-friendly way. Users can choose between local, remote or cloud connectivity. Different authorisation levels can be created for the individual user accounts.

During the vacuum processes, all pump data is recorded and stored. The operating logs, which can be viewed at

any time, provide maximum transparency for users and ultimately ensure high production and product quality. The powerful computer generates maintenance and service recommendations depending on use – some of the maintenance, such as changing the belt on the Varodry, can be carried out by the operator himself. „The software updates are available for download from Leybold. Many additional software options are planned for the future“, assures Schröder.

www.leybold.com

Varodry VDi vacuum system.



Photo: Leybold



Modernization
Maintenance
Retrofit



info@rump.de www.rump.de +49 5258 508 0



Photo: Quaker Houghton

LARGE DIE CASTING MACHINES

Die Lubricant solutions

In the automotive industry production processes are evolving to create lighter vehicles from larger and more complex die cast parts. Lubricant solutions from Quaker Houghton, USA, are supporting the introduction of the latest generation of large, >4,500T die casting machines to deliver on these challenges.

One direct result of a desire to reduce emissions is the automotive industries' focus on 'lightweighting' new vehicles. To achieve a reduction in overall vehicle weight, engineers are increasingly adopting a range of materials and production techniques to create lighter components. For die casting in particular, engineers must consider how to deliver improved quality and productivity for large and complex parts. Alongside this, production costs need to fall, the total cost of ownership needs to reduce, and the environmental impact of the diecasting process must be lowered.

Die casting is now being used to cast one-piece structural parts such as shock towers and torque bars, aiding the ultimate goals of weight reduction. This requires use of large die casting machines able to produce such a large one-piece casting. The casting of larger parts

brings complexity to the die casting process. This is where innovative lubricants that are paired with the right equipment are required.

To avoid compromising quality and increasing costs in the manufacture of large, complex components, specifying the correct die lubricant technology is essential to ensure an adequate release lubricant film is formed over the die surface. As die tools increase in size and complexity, they become increasingly difficult to lubricate using conventional water based lubricant systems. Ensuring lubricant reaches all parts of the complex tool to prevent casting failure is a significant challenge not easily overcome.

For an industry looking to cast larger components and also meet the challenges of maintaining product quality, improving productivity and reducing costs, water-free electrostatic lubricant systems, like Lubrolene from Quaker Houghton, provide the best solution. Such systems combine a high-power release agent, free from the drawback of conventional lubricants, coupled with a compact low weight spray system.

When Lubrolene WFR-EC is applied through a unique electrostatic spray gun, the lubricant spray droplets carry

Lubrolene is applied by electrostatic spray.

an electrostatic charge which, when coupled with a grounded die leads to unsurpassed lubricant deposition in all areas of the die. This includes deep ribs and other recessed features, which are very difficult to reach with other die lubricant technologies. The low weight and small footprint of the spray head coupled with the control features of the application system mean that lubricant application can be readily adjusted across the die face to give an optimized lubricating film.

As the lubricant product is also water free, any Leidenfrost effect, which is a significant problem with water based lubricants, is all but eliminated leading to unmatched lubricant deposition and adhesion on the die surface. The very high adhesion performance offered by electrostatic spray reduces the amount of release agents required by up to 99.9% per cycle. As well as reducing ongoing running costs, the volumes of lubricant is significantly lowered, which combined with wax free lubricant formulations result in much reduced build-up on equipment. In turn, the need for cleaning of both spray head nozzles and dies is significantly lowered.

<https://diecastiq.quakerhoughton.com/>

SPECTROSCOPY

OES Analyzer for Next-Generation Material Control Analysis



Photo: Spectro

The new Spectromaxx LMX10 ARC/SPARK OES analyzer.

SPECTRO Analytical Instruments, Kleve, Germany, has introduced the Spectromaxx LMX10 ARC/SPARK OES analyzer for fast, accurate, advanced elemental analysis in metal producing and fabricating plants, and iron and non-ferrous foundries.

The LMX10 is the newest version and promises outstanding repeatability, reproducibility, and reliability in material control analyses from incoming materials to in-process testing to final quality inspections — adding certainty to critical supply chains. Users obtain ultrafast information on changing process conditions while achieving drastically reduced cost of ownership with lower consumables. Advanced diagnostics and easy maintenance prevent expensive downtime. In addition, the analyzer features Spectro's proprietary iCAL 2.0 calibration logic, which requires only 5 minutes and a single sample per day — and automatically compensates for most changes in environmental temperature or pressure. Conventional analyzers may need 30 or more minutes for standardization, plus reruns whenever site conditions change.

As further advantages the manufacturer mentions completely new factory calibrations; extended calibration ranges and element selections; optimized source excitation parameters; improved limits of detection (LODs); a total shutdown of argon flow for periods configurable by the operator; trouble-free analysis of 10 matrices, 65 methods, and 59 elements

via convenient controls for operation; enhanced software features such as quick-check programs, virtual type standards, spectrum scans; special software even for less experienced personnel.

The new analyzer is available in two models: The basic features a single air optic, with state-of-the-art CMOS sensors. It extends the relevant and applicable elemental wavelength range from 233 nanometers (nm) to 670 nm. In addition, a new option analyzes relevant wavelengths to 766 nm, covering potassium (K). The advanced utilizes the same high-resolution CMOS technology, with the air optic covering the same wavelengths as the basic model, from 233 nm to 670 nm. But an added UV optic handles a lower spectral range, from 120 nm to 235 nm. This includes a new capability to analyze oxygen (O) in copper (Cu). In addition, a new option analyzes relevant wavelengths to 766 nm, covering potassium (K).

Amecare Performance Services maximize the uptime of all Spectromaxx analyzers. Hundreds of experienced service engineers in 50 countries provide high-value, customized support designed to ensure optimum performance plus the most extended possible equipment life. Additional support includes Spectro Pro-tek secure global remote monitoring, proactive performance maintenance, performance upgrades, applications solutions, consultation, targeted training, and ongoing support.

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03 Melting Plants and Equipment for NFM

03.02 Melting and Holding Furnaces, Electrically Heated

Aluminium Melting Furnaces 630



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Remelting Furnaces 700



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04 Refractories Technology

04.01 Plants, Equipment and Tools for Lining in Melting and Casting

Mixers and Chargers for Refractory Mixes 930



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Gunning for Relining of Cupolas 950



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04.02 Refractory Materials (Shaped and Non Shaped)

Refractories, in general 1040



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Insulating Products 1130



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Micro Porous Insulating Materials 1220



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Ladle Refractory Mixes 1240



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04.04 Refractory Building

Maintenance of Refractory Linings 1462



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08 Plants and Machines for Moulding and Coremaking Processes

08.02 Moulding and Coremaking Machines

Multi-Stage Vacuum Process 3223



Pfeiffer Vacuum GmbH
35614 Asslar, Germany
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Internet: www.pfeiffer-vacuum.de

09 Moulding Sands

09.01 Basic Moulding Sands

Chromite Sands 3630



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Ceramic Sands/Chamotte Sands 3645



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Internet: www.gtp-schaefer.com

09.06 Moulding Sands Testing

Moisture Testing Equipment for Moulding Sand 4410



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

Moulding Sand Testing Equipment, in general 4420



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

10 Sand Conditioning and Reclamation

10.01 Moulding Sand Conditioning

Aerators for Moulding Sand Ready-to-Use 4470



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

Sand Preparation Plants and Machines 4480



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

Mixers 4520



Maschinenfabrik Gustav Eirich GmbH & Co KG
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Internet: www.eirich.de

SUPPLIERS GUIDE

▼ Sand Mixers 4550



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

▼ Aerators 4560



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

▼ Scales and Weighing Control 4590



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

10.04 Sand Reconditioning

▼ Sand Coolers 4720



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürmer Str. 50, 74736 Hardheim, Germany
Internet: www.eirich.de

12 Gating and Feeding

▼ Breaker Cores 5340



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▼ Exothermic Products 5360



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▼ Insulating Sleeves 5375



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▼ Exothermic Mini-Feeders 5400



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▼ Exothermic Feeder Sleeves 5420



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▼ Exothermic Feeding Compounds 5430



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13 Casting Machines and Equipment

13.02 Die Casting and Accessories

▼ Multi-Stage Vacuum Process 5876



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17 Surface Treatment and Drying

▼ Heat Treatment and Drying 7398



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Mühlenseifen 2, 57271 Hilchenbach, Germany
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Internet: www.loecher-glueherei.de

17.01 Plants and Furnaces

▼ Tempering Furnaces 7400



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▼ Ageing Furnaces 7401



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▼ Annealing and Hardening Furnaces 7430



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▼ Solution Annealing Furnaces 7455



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▼ Annealing Furnaces 7490



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▼ Quenching and Tempering Furnaces 7510



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▼ Heat Treating Furnaces 7520



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▼ Hearth Bogie Type Furnaces 7525



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18 Plant, Transport, Stock, and Handling Engineering

18.01 Continuous Conveyors and Accessories

▼ Vibratory Motors 7980



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20 Control Systems and Automation

20.01 Control and Adjustment Systems

▼ Automation and Control for Sand Preparation 9030



Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürner Str. 50, 74736 Hardheim, Germany
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20.02 Measuring and Control Instruments

▼ Immersion Thermo Couples 9230



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▼ Laser Measurement Techniques 9310



POLYTEC GmbH
76337 Waldbronn, Germany
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▼ Positioning Control 9345



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▼ Temperature Measurement 9380



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▼ Thermal Analysis Equipment 9400



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▼ Thermo Couples 9410



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22 Analysis Technique and Laboratory Equipment

▼ Sampling Systems 9970



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Internet: www.minkon.de

24 Environmental Protection and Disposal

▼ Waste Disposal, Repreparation, and Utilization 24.03



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☎ +49 2306 106 8831
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Internet: www.legran.de

26 Other Products for Casting Industry

26.02 Industrial Commodities

▼ Joints, Asbestos-free 11120



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▼ Sealing and Insulating Products up to 1260 °C 11125



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27 Consulting and Service

▼ Heat Treatment 11345



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28 Castings

▼ Aluminium Pressure Diecasting 11390



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Internet: www.schoett-druckguss.de

Index to Companies

Company	Product
Maschinenfabrik Gustav Eirich GmbH u. Co KG	4410, 4420, 4470, 4480, 4520, 4550, 4560, 4590, 4720, 9030
Friedrich Schwingtechnik GmbH	7980
GTP Schäfer Giesstechnische Produkte GmbH	3630, 3645, 5340, 5360, 5375, 5400, 5420, 5430
EIKA, S.COOP	1040, 1130, 1220
REMONDIS Production GmbH	24
Gebr. Löcher Glüherei GmbH	7398, 11345
LOI Thermprocess GmbH	630, 700, 7400, 7401, 7430, 7455, 7490, 7510, 7520, 7525

Company	Product
MINKON GmbH Geschäftsleitung	9230, 9380, 9400, 9410, 9970, 11120, 11125
Pfeiffer Vacuum GmbH	3223, 5876
Polytec GmbH	9310, 9345
Schött-Druckguß GmbH	11390
Uelzener Maschinen GmbH	930, 950, 1240, 1462

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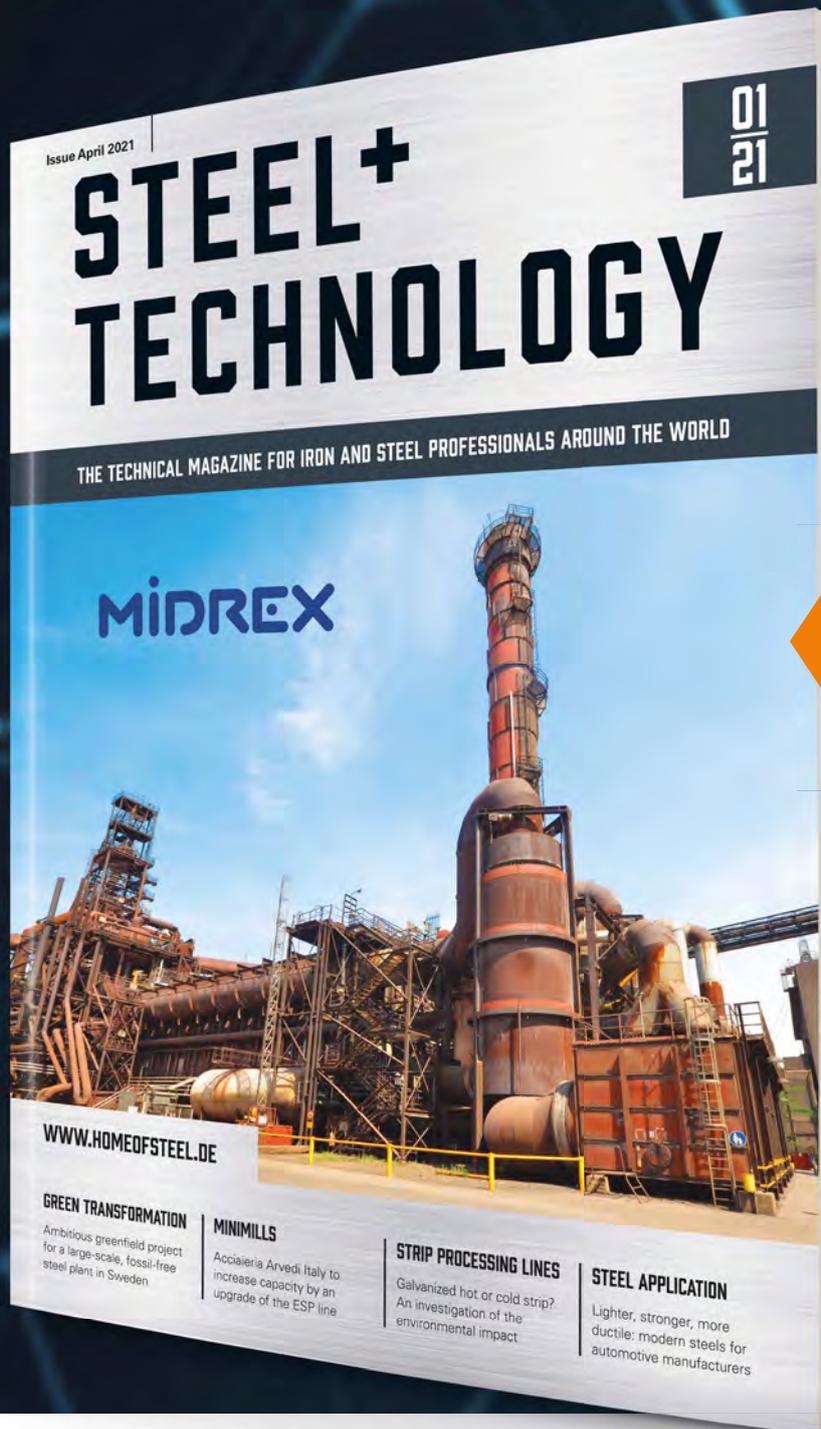
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If there are many possible solutions, the casting process simulation software not only helps to automatically determine these variations, but also to evaluate them.

Preview of the next issue

Selection of topics:

Reduce porosity with geometry optimization

As a rule, manufacturing companies try to optimize costs by reducing material quantities. In foundries, too, more molten metal initially means higher costs and more production effort. Who wants that? However, a minimized minimized use of metal in casting processes does not always guarantee the best component quality.

New furnace technology for vacuum metallurgy

Prevents oxidation in the manufacturing of copper-titanium alloys: Furnace allows efficient production of high-purity melts by using vacuum induction technology on an industrial scale.

3D printing alternatively to HPDC of Zinc

Up to now, the prototyping of zinc components consumed a lot of money as well as time. Using the technique of Additive Manufacturing, this problem can be solved. The company of PROTIQ has developed a specialized process to print components from the alloy Zamak 5.

Imprint

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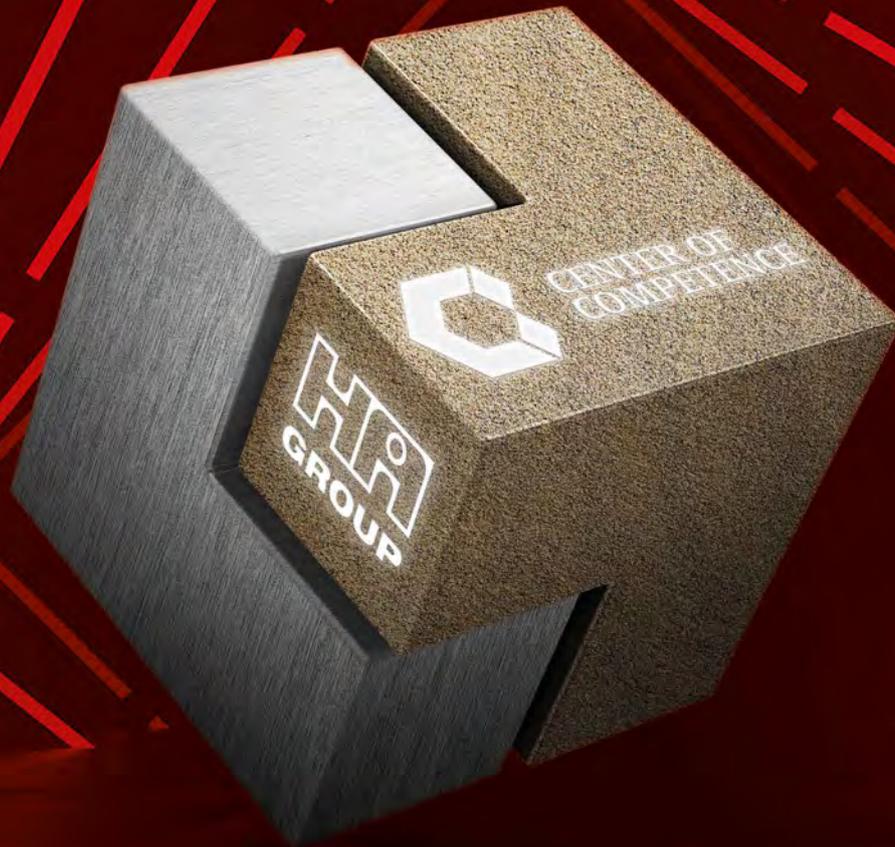
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