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WITH SUPPLIERS GUIDE

Juni 2023 | 2

CASTING

PLANT AND TECHNOLOGY INTERNATIONAL

With GIFA Special

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CASTING

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GIFA NEWCAST

Welcome to GIFA

12.–16. Juni 2023

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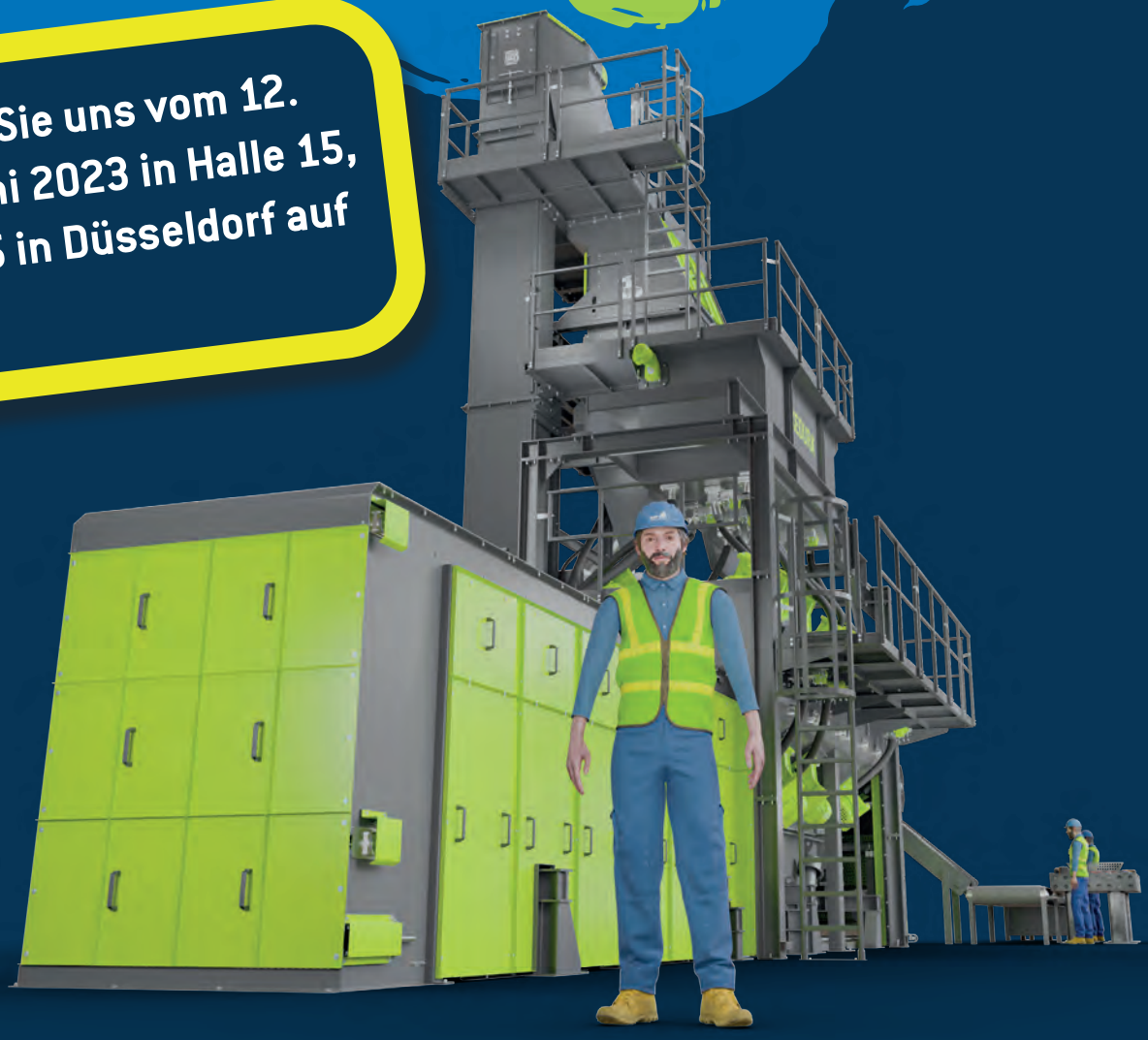
GIFA

Besuchen Sie uns vom 12. bis 16. Juni 2023 in Halle 15, Stand D25 in Düsseldorf auf der GIFA!



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The world's leading trade fair – are you there?

Germany at least is in GIFA and NEWCAST fever, as far as the casting part of our industry is concerned. The industry meeting in the Duesseldorf exhibition halls could also live up to its claim as the leading trade show in 2023 – but what about outside Europe?

Photo: BDG

Martin Vogt
Editor-in-chief
e-mail: martin.vogt@bdguss.de

For many months now, news has been trickling into our editorial office. Product news about GIFA and NEWCAST, the two trade show parts of our foundry industry within the GMTN trade show quadrangle. Even though physical trade fairs may no longer have the overriding importance of earlier times, my impression is that even in 2023 many companies in the industry take the trade fair very seriously, as the mass of information in advance alone shows. A trade show is still a showcase in which people like to present themselves and their products.

Consequently, this issue of CPT reaches you with a trade show focus that begins right after the table of contents. Our articles starting on page 10 and 20 are a commitment to the efficiency of the casting process and our industry as a whole, as well as an assessment from a political and strategic perspective. In the middle is the interview with trade show president Dr. Ioannis Ioannidis. It discusses the special focal points of the trade show and, of course, the challenges facing our industry.

But what is „our" industry anyway? By that, of course, I mean the industry from a German, and possibly even a European, perspective. That is the horizon that we can survey. We know the protagonists, the specific topics, not least through our European association CAEF.

But what about outside Europe, where our CPT is also read? To be honest, I don't know what topics are of particular interest to foundrymen in India or the USA. But I would like to know. As editors, we would prefer a lot of information and technical articles that concern non-European companies. I would consider that exciting for a worldwide foundry community. Maybe we'll get talking in Duesseldorf. And if you have decided against the exhibition or the visit to Duesseldorf, possibly also virtually and digitally. I would then be very interested to know what you think about an action we took in May in a German foundry: A rally for Germany as a business location and for the future – combined with the demand for an industrial electricity price. Does that seem exotic to you? Because you have other issues? Please let me know.

Have a good read!

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SGMT sand mixer


F1 molding machine


Core setter


Core setting line


Closing station and transfer car


Pouring line


SK sand cooler

SAVELLI horizontal flask molding line & main machines for "Green Sand" preparation to produce engine blocks and cylinder heads at SCANIA CV AB cast-iron foundry in Södertälje, Sweden

- Mold's size: 1.500 x 1.100 x 850 mm
- Production rate: 60 molds / hour
- Mold's compaction process: by SAVELLI Formimpress high pressure double squeezing model-side compaction
- Mold's cooling time: 490 minutes
- Drives systems: by El-Mecs horizontal and vertical electro-mechanical units equipped with SIEMENS servomotors
- Typology: heavy-duty, energy saving, fully automatic and integrated, compliant with Industry 4.0

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GIESSEREI CASTING Special

GIFA 2023

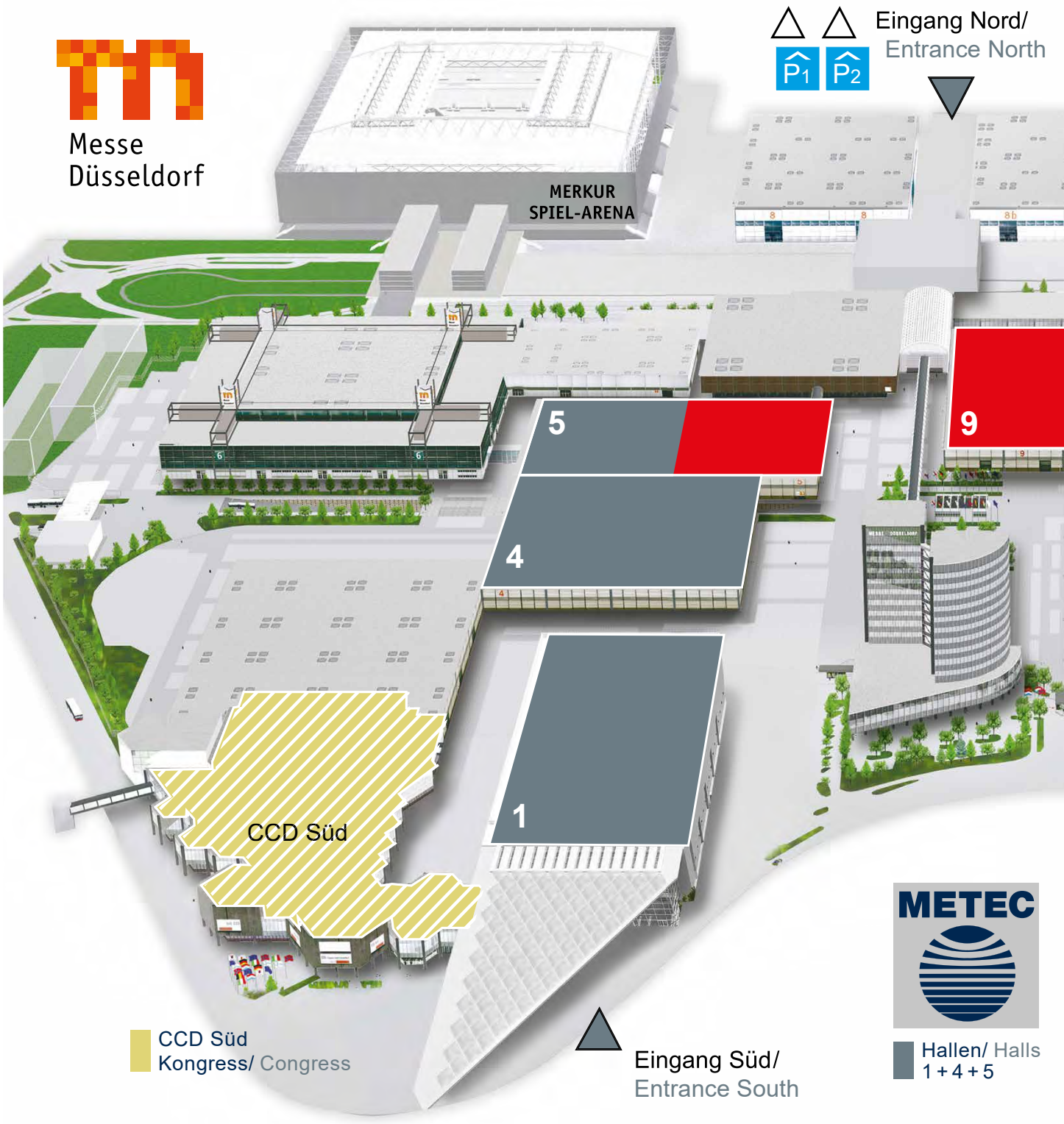
15th International Foundry Trade Fair

FOTO: C. TILLMANN

12–16 June
Düsseldorf
Germany

NEWCAST and GIFA 2023

Ideas for the major transformation



Central meeting point for the industry

From June 12 to 16 it will take place again: the international trade fair quartet GMTN consisting of METEC, THERMPROCESS and the two foundry fairs GIFA and NEWCAST. Buyers, users, experts and decision-makers from the metallurgy, thermal engineering and casting industries will meet in Düsseldorf to learn about decarbonization of the metallurgical industry, ecoMetals, circular economy, digitalization, additive manufacturing processes as well as e-mobility and automotive lightweight construction from around 2000 exhibitors from more than 50 countries. The BDG, as the conceptual sponsor of GIFA – the undisputed world's leading trade fair for the foundry industry for decades – and NEWCAST – the industry's showcase and performance exhibition and the youngest child of the trade fair quartet – will have its presence at the intersection of both trade fairs in Hall 13. In the center of the stand, the Foundry Meeting Point will once again offer all BDG members space for personal exchange. „Since the last GIFA/NEWCAST 2019, the industry has experienced a lot. All the more reason for me to look forward to a trade fair that will show how adaptable and significant the foundry industry is in and for Germany," says a delighted Max Schumacher, General Manager of the German foundry association BDG.

THERM PROCESS
Hallen/ Halls 5 + 9

GIFA
Hallen/ Halls 10–13 15–17

NEWCAST
Hallen/ Halls 13 + 14

Hallenstruktur (Stand April 2023

"NEWCAST will be a unique platform for our foundry sector," Thomas Laue, Gießerei Heunisch.

Photos: Messe Düsseldorf / ctillmann

International innovations in casting – NEWCAST 2023

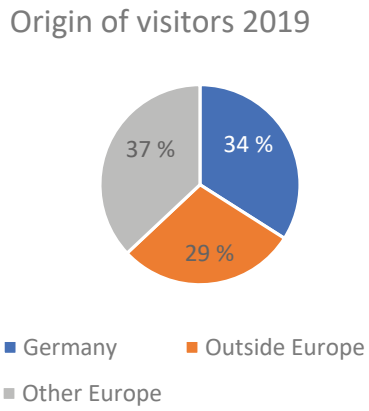
The sector will show what casting can do

At NEWCAST, foundries from all over the world will show the whole diversity of innovative casting procedures and products to decision takers and designers. The significance of NEWCAST as the international performance show of the foundry industry will be reflected, not least, in rising numbers of exhibitors. Already at today's status, NEWCAST 2023 will be larger than in 2019. Thus, NEWCAST will be the ideal counterpart to the GIFA foundry trade fair.

By Gerd Krause

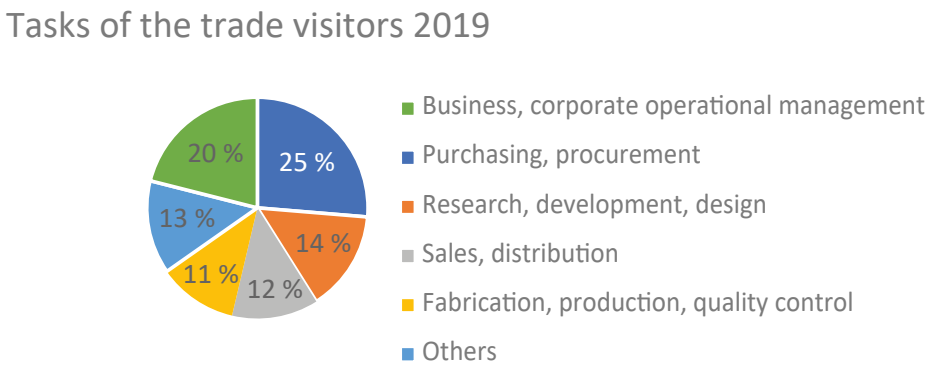
The internationally outstanding position of NEWCAST will also be documented by the high foreign proportion amongst the visitors, e.g., last time, 34 percent came from Germany, 37 percent from Europe and 29 percent from outside Europe. "Thus, NEWCAST will offer a unique opportunity to enter into discussions with potential foreign customers too," was the assurance given by Malte Seifert, Director Portfolio Metals, Energy & Autonomous Technologies at Messe Düsseldorf. Because another striking feature will be the high proportion of decision takers amongst the visitors to NEWCAST. In 2019, one in five visitors originated from business, corporate or divisional management.

Innovations in casting have outstanding significance for the industrial value added in all growth fields. "Like the entire Bright World of Metals, NEWCAST is also always a representation of the current industrial challenges and a constituent of the solutions to them," continued Malte Seifert. "The change to electromobility, the energy turnaround and the decarbonization of industry - without the innovations in the foundry industry, it would not be possible to meet the challenges of the present," this is highlighted by the leading head of the quartet of fairs consisting of GIFA, METEC, THERMPROCESS and NEWCAST. Just like the entire Bright World of Metals, NEWCAST will also reflect the current and new challenges in the metal sectors more strongly than ever before. The great importance of the fair will be highlighted, not least, by the presentation of the NEWCAST Award with which a committee consisting of specialists from



BDG, VDG and Messe Düsseldorf will honor the most outstanding achievements in casting.

NEWCAST will provide foundries with a stage for displaying the system relevance of their products. Castings



constitute key components in practically all industrial fields. While castings for lightweight automobile construction and renewable energies have already been on the agenda at NEWCAST in the past, new subjects and challenges will be added with the challenges of the decarbonisation of industry as well as the change to electromobility and climate-neutral heat technology. "The strength and innovation potential of casting as a forming procedure are shown clearly here. With the material diversity of the metallic casting materials, the large number of classic and new casting procedures with lost moulds and metallic chills and the considered supplementation of complementary new production methods such as additive manufacturing, foundries are creating such a wide range of innovations that I can only urgently recommend that every visitor to GMTN 2023 should visit NEWCAST."

NEWCAST will be a platform for all facets of innovation in casting and will portray the entire spectrum of innovative casting procedures and products. Casting not only for conventional vehicle construction but also for e mobility as well as precision castings for the aerospace industry and for mechanical and plant engineering. Casting components from the filigree die-cast zinc component for medical technology via the lightweight e-motor housing right up to the rotor hub which is made of cast iron with a high load-bearing capacity and weighs tonnes will illustrate the wide range and significance of innovative casting procedures and metallic casting materials for all industrial growth markets.

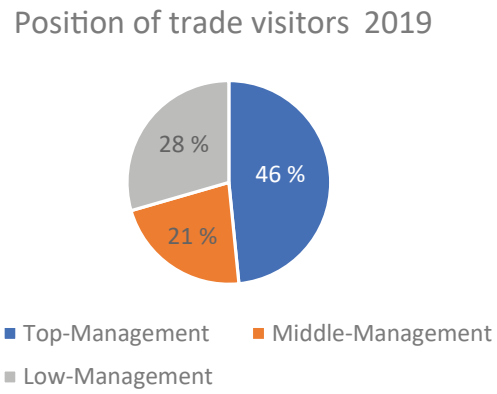
New technologies are opening up new potentials for the foundry sector. For example, indirect additive 3D printing procedures permit maximum geometrical freedom when manufacturing sand molds and cores for metal casting. Plastic investment casting models for precision casting are resulting in the successful integration of new procedures into established fabrication processes.

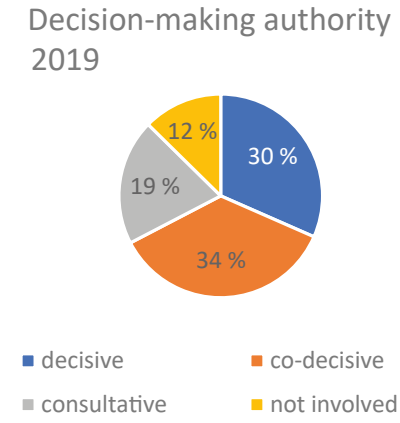
It must be recommended that not only users of castings but also all the visitors interested in casting as a forming procedure should make a tour of the halls at NEWCAST. In particular, designers in all industrial sectors will be able to convince themselves of the potential of the different casting procedures in situ and on the concrete object. Proven industrial procedures from gravity sand casting, via die casting and low-pressure casting right up to precision casting will stand next to new technologies such as additive manufacturing in the prototype and small-scale series fields. On their booths at NEWCAST, international experts from around the world will answer the questions of the visitors. Nowhere else will people unfamiliar with the subject be able to receive better explanations about the strengths of the individual casting procedures and materials than on the concrete object - and simultaneously be made enthusiastic about casting as a fabrication procedure with all its possibilities.

One task for the entire industry and thus also for Messe Düsseldorf and the exhibitors at NEWCAST is the objective of climate neutrality. Of course, this also includes highly topical subjects such as energy and raw material security. Clear plus points of the casting procedures over competing fabrication procedures are the energy efficiency and the advantage of being able to manufacture even complex geometries near the net shapes. Within the framework of the ecoMetalsTrails here, innovative companies will indicate paths to sustainable and low-CO_2 fabrication right up to CO_2-free fabrication. The objective of decarbonization is being supported, not least, by new digital technologies and artificial intelligence. Thus, the products at NEWCAST will also be characterized by pioneering sustainability aspects which will be taken up by the exhibitors and Messe Düsseldorf within the framework of the ecoMetalsInitiative.

With GIFA, NEWCAST and THERMPROCESS, Messe Düsseldorf will offer not only the most comprehensive performance show of the entire foundry sector anywhere in the world but also meeting and discussion forums about the burning questions of the time. "This year, transformation paths to decarbonisation and the circular economy, also in view of the stipulations about climate neutrality, will be at the very top of the agenda," was the assurance given by Seifert. "GIFA and, in particular, NEWCAST will graphically illustrate that the foundry companies are not only affected by the challenges of decarbonisation but, with their innovations, are also making absolutely decisive contributions to converting industry into a climate-neutral economic location." It will be possible to marvel at the wide range of ingenious casting products at NEWCAST from June 12 to 16, 2023 within the framework of the Bright World of Metals in Düsseldorf.

Gerd Krause, Mediakonzept, Düsseldorf





Photos: Martin Vogt

Interview with GIFA/NEWCAST President Dr. Ioannis Ioannidis

„We have the three D's as giant challenges"

Of the trade fair quadrilateral GMTN, the foundry industry is most familiar with the GIFA and NEWCAST trade fairs. In June, exhibitors will present themselves to the global trade audience – for the first time after the years of Corona upheavals. What are the particularly important topics for the industry in the trade show year? And what is the president of GIFA and NEWCAST particularly looking forward to? The following is an interview with Dr. Ioannis Ioannidis, CEO and President of the Frech Group from Schorndorf, Germany, and new President of GIFA and NEWCAST 2023.

Mr. Ioannidis, what is your task as president?
After four years, international meetings without masks can take place again. I want to communicate to the outside world that we have a unique platform here. I see my task as representing the entire project to the outside world with conviction.

What are you convinced of?
I'm convinced that GIFA and NEWCAST, to a certain extent the flagship trade shows of our industry, are unique. At least I don't know of anything comparable. The fact that we have the chance to appear on the world stage and come together is unique. And you also have to see the information character that is offered here, an enormous source of ideas. The opportunities for the future that we find here have a valence to me that I don't find anywhere else.

So let's stick with that valence. What in particular comes to mind when we review the four years since the last show?

We've certainly had four years that have been very, very difficult. And even though we've probably got the immediate Corona phase behind us now, new issues are coming up. For example, we still have very high cost factors – on the energy side, but also in all materials. There are, of course, many in the industry who are well utilized, and perhaps have fewer issues with that. But there are others who are attached to the automotive industry, for example, and are struggling more. This should not be underestimated. We as plant manufacturers, but also our customers in particular, have to cope with this. In order to maintain competitiveness, financial strength must be built up.

What feedback do you have from customers and how do you deal with the issue of energy?

The thing is, in terms of energy requirements, we are constantly working to save energy. This is of course of enormous importance and there are always new ideas to drive this process forward. The individual foundries cannot absorb the increased energy prices, even if there are optimizations. These are quite clearly passed on to the customer. That has to be seen very clearly. As a plant manufacturer, we want to open up the possibility of maintaining competitiveness with new ideas. Because whether the foundries will actually be in a position to pass on the increased prices in full is first of all the question. That's why we need to provide support here. I once suggested that we set up a platform where all companies could contribute ideas on how to save energy. That, in turn, would benefit everyone.

In addition to the purely financial challenges, we also have the ongoing issue of defossilization ...

... Yes, that is of course a very important part of the challenges. We have three D's as giant challenges. Decarbonization, i.e. the reduction of CO_2, is the first of them. And there I think we have a certain fund of experience. To build on this, to continue with it, to consider what possibilities there are, to look for joint solutions with the plant manufacturers, with the associations, e.g. in melting operations, in process control – that is, I believe, what will really take us forward now.

So it's teamwork between different players to tackle these issues. What other D's do you have in mind?

The next major topic for me is digitalization. First of all, it's about getting data. Many people think "I know my process very well" – yes, but maybe there are opportunities to learn, especially when it comes to linking data intelligently. Digitalization and decarbonization are linked. I have to start thinking at the design stage about how I implement the material cycle in mechanics, in electrical engineering, in hydraulics, in process control, in plant design and in data management.

And will we find answers to the topic of digitalization at the trade show as a whole?

From what I can see – definitely yes. I'll stay with our own company for a moment. We have been very far ahead in digitalization for many years. We have invested a lot in innovations over the last four years and are happy to present this to our business partners at the world's leading trade show. After all, you go to GIFA when you have something to show.

We are still missing one D – what is it?

Another extremely important one – demographics. This will play a decisive role in terms of attracting the skilled

„Representing the whole project to the outside world with persuasive power – that's where I see my task."

workforce of tomorrow. Let me elaborate on that briefly: We have a three-shift operation at the foundries and we need qualified employees for this who also have to feel comfortable there. I have to win them over somehow. To do this, I need modern technology, a pleasant environment in general, and assistance systems that the plant engineers have to supply so that people can be supported technologically. Both in the machines and in the graphics, in the presentation at the booth, but also in the communication, we will demonstrate the "green and clean" again and again at the trade show. After all, it's really meant to be a stumbling block that makes you think. We want to use it to express that we need an attractive environment in the foundries to attract talent.

How well do you see GIFA and NEWCAST positioned to carry these core themes of the three D's?
The organizer has done a very good job and the steering committee has also made good suggestions. I think that is what we will see. Of course, you always have to consider what you can take from it and how you can implement it. The fairs show possibilities for the future.

The trade show can do a lot – but it can't really influence the framework conditions in a country very well. Let's talk about that. What demands do you have on politicians in this regard?
I'm glad you brought that up, because I had some politicians here at our site some time ago, and I raised one issue in particular – the regulatory spleen. This regulatory spleen is being implemented by our government in a hands-off way, which means that the smaller companies here in particular are on the verge of being overwhelmed, because how are they supposed to cope? They've been struggling with major challenges for four years. They are looking to the future, want to tackle it now, and are getting new regulations almost every day. Competitiveness is being completely distorted. Politicians should sit down and develop a strategy and say: That's where we want to go, and this is the roadmap.

Would you like to see closer cooperation between industry and politics?
Definitely yes, for example on the subject of energy costs. It starts with the term "lobby" and its pejorative use. The governments should listen to the legitimate interests of the centuries-old foundry industry in order to help here quickly. This has nothing to do with lobbying, but with the preservation of a unique competence that is ecologically and economically indispensable for Europe as a business location.

What would be your idea?
My idea would be this: The core issue of energy is hitting the foundries particularly hard. In order to provide rapid and appropriate assistance here, I sit down with the industry and talk to the experts concerned. We have very experienced people in Germany. We are a region with great institutions. They can offer politicians an intelligent practical reference. Why doesn't politics work even more closely with the associations?

Back to our upcoming industry trade show. What would you like to see, what impetus, what power should emanate from the trade show?
I would really be very pleased if, after the four years – now finally without a mask again – we could come together for a lively exchange. People want to benefit from the trade show, whether they are exhibitors or visitors. They have the most diverse expectations, be they technological or communicative, but also that you simply meet new people you haven't known before. I'm looking forward to that, because I'm convinced that we'll succeed in meeting people's expectations – as the world's leading trade show.

And what are you personally looking forward to in particular?
I am of course delighted to have almost our entire sales team on site. I'm also pleased that a large number of our customers will be there, our business partners. I'm looking forward to the benchmarks to see where we stand after the four years. I'm also looking forward to Düsseldorf and the good events. I am a very positive person, one should go into the future with a positive view and take a positive spirit from the fair that will help us all. The fair should "bring over" motivation. It comes at the right time. We are a strong country and we could move a lot. I wish that people would come together and approach the future positively with motivation.

The interview was conducted by Dr. Kristina Krüger and Martin Vogt

NEWCAST

GIFA METEC THERM PROCESS NEWCAST

The Bright World of Metals

12–16 June
Düsseldorf
Germany

2023 NEWCAST

6th International Trade Fair for Castings with Newcast Forum

N1 worldwide

eco Metals
SUSTAINABLE PROCESS SOLUTIONS

The shape of innovation

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Photo: Apple

Inorganically bound sand cores CO_2 with different graphite contents, which influences the thermal conductivity of the sand binder mixture and thus the hardening times.

Resource Security

Metallic raw materials – the building blocks of the circular economy

Disrupted supply chains during the Covid pandemic and the dependencies on countries such as China have placed the issue of secure raw material supplies on the agenda. The war in Ukraine and the resulting economic sanctions against Russia have additionally fueled the debate about supply security and the circular economy. As the world's leading communication platform, the Bright World of Metals in Düsseldorf from 12 to 16 June 2023 will move these hot topics center stage.

By Gerd Krause

Steel and steel raw materials are also subject to the sanctions imposed against Russia by the EU (fig. 1). Step by step the sanctions were extended to include all steel products, and even imports of Russian steel into the EU via third markets are prohibited. Nevertheless, the results are sobering from the German steel industry's perspective. The Wirtschaftsvereinigung Stahl (German Steel Federation) laments that some EU member states pushed ahead with very long transition periods until October 2024 in the very relevant segment of so-called semi-finished steel products. This means Russian steel imports into the EU will hardly change in the near future. While, after the fourth sanctions package was adopted on 15 March 2022, 52 % of Russian steel supplies were still admissible (compared

Graphic: EU

Fig 1: The EU sanctions affect metallic raw materials only very selectively.

with imports in 2021), this figure is still as high as 47 % even after the by now ninth sanctions package. With the exception of gas and oil the EU sanctions against Russia are hardly perceivable in raw material supplies. Critical raw materials had been largely excluded from the sanctions anyway, and for the German steel industry Russia had only been an important supplier of such raw materials as coal and alloying materials. In the wake of the sanctions companies have re-oriented their raw material purchases to other sources.

Powerful Russian metal suppliers such as aluminum producer Rusal and nickel supplier Norilsk Nickel, Nornickel for short, are not affected by these sanctions anyway, so that Europe continues importing metals such as nickel, copper and aluminum from Russia on a large scale. Lobbyists such as the Federation of Aluminum Consumers in Europe (FACE) have complained about the market power of the major European producers for years and have successfully spoken up against import restrictions on Russian aluminum. Rusal is the largest Russian aluminum producer, ranking third on the world market after the Chinese producers Chalco (number 1) and Hongqiao. Nornickel is the world's largest nickel and palladium producer.

Market power China

The geopolitical relevance of economic interdependencies must be put to the acid test, including against the backdrop of the war in Ukraine and the associated economic sanctions against Russia, demands the Wirtschaftsinstitut IW in Cologne. The Institute is concerned above all about China's market power: the system competitor, they say, is turning into a system rival. In a current study the IW therefore issues a warning about Germany's (and the RoW's) dependency when it comes to critical raw materials (fig. 2). At over 50 % the percentage of Chinese exports into the world and Chinese imports into Germany is highest for magnesium, by IW accounts. China is the world's largest magnesium exporter. Regarding rare earths, indispensable for the expansion of renewable energies, Germany depends on Chinese supplies for 45 % of its demand. "On its way to becoming independent of Russian energy carriers Germany might become newly dependent on China", the Institute warns.

E-mobility increases dependency on raw materials

By banking on e-mobility Germany is increasing its dependency on Chinese raw materials even further. China mines and processes to the tune of 87 % of the world's rare earth deposits and up to 65 % of such metals as cobalt, copper, lithium and nickel, calculates the Federation of SME Mineral Oil Companies (UNITI). These are the raw materials, however, that are needed in large quantities for expanding e-mobility. Depending on their battery size, e-vehicles contain up to 70 kg of cobalt, 13.5 kg of lithium and 80 kg of copper. Add to this large amounts of copper for expanding the charging infrastructure. More than half of all the raw materials required for electric motors hail from China.

Fig. 2: Dependence on China for trade in raw materials.

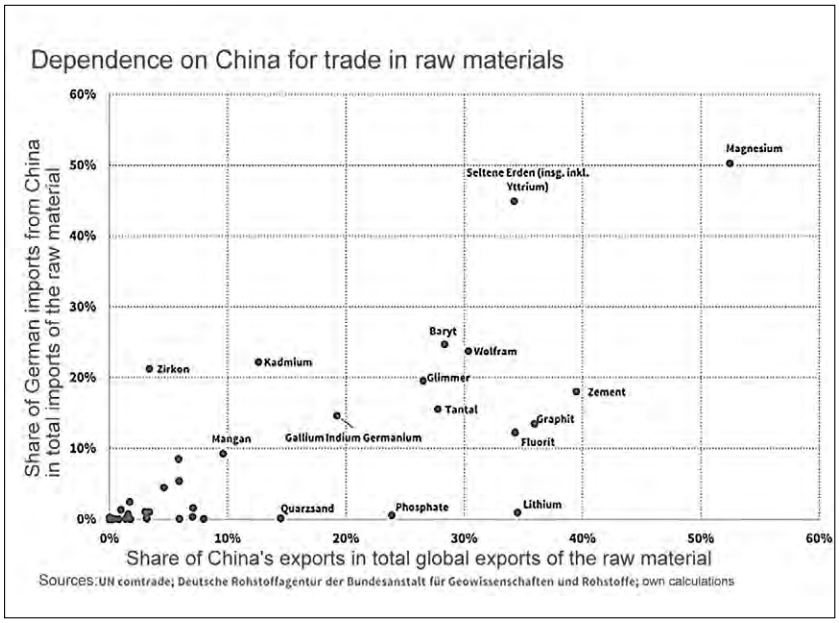


Photo: Fotolia

Fig. 3: The discarded smartphones in German households alone contain enough raw materials to meet the demand for new smartphones for 10 years.

EU Action Plan on Critical Raw Materials

The European Commission has identified this problem and addressed it with an Action Plan. The economically most important raw materials with high supply risk are categorized as critical raw materials, including raw materials needed for green and digital transformation technologies. Featured on the list of 30 raw materials rated as critical by the EU are, next to metals such as magnesium and titanium, the alloying elements vanadium and graphite important for steel production. Recently the list of critical raw materials has also included bauxite, the aluminum ore indispensable to the production of primary aluminum. According to the Deutsche Rohstoffagentur the biggest bauxite producers are Australia, China and Guinea, while the biggest primary aluminum producers are China, Russia, Canada and India. Also mentioned as an alloy for aluminum on the EU list is silicon and scandium, in demand for additive manufacturing of high-performance alloys.

With a new Act on Critical Raw Materials the EU intends to promote strategic projects designed to strengthen supply chains and conserve competition at the same time. The draft law covers the various levels of the supply chain from mining and processing to recycling. Measures include geopolitical raw material partnerships with such countries as Namibia and Kazakhstan. They aim at the sustainable mining of raw materials such as rare earths, polysilicon, lithium and cobalt, especially in Kazakhstan – raw materials required for manufacturing wind turbines, semi-conductors and batteries for e-vehicles. With the planned law the EU Commission also envisages various measures to reduce the dependency on raw material imports from third countries. One objective is to leverage the know-how acquired in European mining regions to tap into domestic raw material deposits.

Focus on the circular economy

A crucial element of the planned law – according to the will of the EU Commission – are incentives for the development of a circular economy with resilient supply chains, a market that offers new business opportunities for steel companies and foundries, metal processors, and metallurgical plant builders. New processes for the mining and reuse of valuable raw materials derived from electronic scrap and batteries complement the classic recycling of metals ranging from aluminum to zinc. It's a market with future potential: according to a new study by IW Cologne (Institute of German Business) the smartphones discarded in German households alone would suffice to cover the raw material demand for new smartphones for ten years (fig. 3).

The leading metallurgical plant manufacturer SMS Group has identified the market potential of urban mining and initiated Primobius, a joint venture with the Australian Neometals company for recycling lithium-ion batteries. The pilot plant at SMS's Hilchenbach site serves to reclaim cobalt, nickel, copper, lithium, iron, aluminum, carbon, plastics and manganese and to convert them into marketable products for use in the battery supply chain. With this pilot plant the plant manufacturer intends to reclaim 96 % of rare raw materials from car batteries hydro-metallurgically for the first time. This process had so far not been possible. Until now battery components had to be disposed of in landfills or processed in high-emission pyrometallurgical reclamation cycles.

Primobius already succeeded in winning over first interested parties for its know-how. Mercedes Benz announced the installation of their own CO_2-neutral recycling factory for e-vehicle batteries by means of their recycling start-up Licular at the Kuppenheim site. The pilot project initiated with technology partner Primobius and research institutes is to go live in 2023. According to Production Manager Jörg Burzer Mercedes-Benz pursues the aim of maximum circularity for all raw materials used, and sustainable battery recycling, he says, plays a crucial part in this.

Automotive industry drives forward the circular economy in the metal industries

From recycling aluminum for e-vehicles and battery reclamation to low-emission steel in car bodies: decarbonisation, sustainability and a circular economy play an ever-greater role in the automotive industry. This means carmakers become the drivers of green technologies for metal sectors from steel mills to foundries.

BMW, for example, has established closed-loop recycling for production scrap from casting processes at its light metal foundry in Landshut in cooperation with local recyclers (fig. 4). A crucial

Fig. 4: At BMW, climate-neutral steel is moving into focus alongside recycled aluminum.

Photo: BMW GROUP

prerequisite for this is the clean-grade sorting of aluminum scrap. To this end the residuals of the various components are collected at each casting line as well as at the various mechanical finishing stations in such a way that the materials with their individual compositions are not mixed. After re-working this aluminum scrap can be used for producing the same components. Almost half of the aluminum used in Landshut stems from closed-loop recycling. This allows BMW to reduce the use of CO_2-intensive primary aluminum for the benefit of a CO_2-optimised recycling.

Volkswagen has sourced its steel from what is called Salzgitter AG today for 60 years now and is one of the first buyers of low-CO_2 steel, which the steel group wants to produce at its Lower Saxony headquarters from late 2025. At the same time, the companies have established a closed loop for their recyclables between their factories in Wolfsburg and Salzgitter: by train the sheet steel coils are supplied to the automotive manufacturing site in Wolfsburg. On the return trip the train takes the production scrap back to Salzgitter, where it is processed into clean-grade products of the same quality and delivered to VW.

The circular economy is not limited to improved recycling rates, as the Fraunhofer Gesellschaft illustrates in its Circonomy research approach. The optimal use of raw materials, they say, comprises an extension of the useful life of components and raw materials plus the lowest possible use of external additives and energy as well as the lowest production waste output possible. The solution is a connected and digitized closed loop, as stressed by Franz-Josef Wöstmann, head of the Department for the Early Detection of Technologies and Their Use at the Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM) in Bremen.

Circular component design as a business model

The product lifecycle should ideally focus on re-use rather than scrapping. The aim should be to keep not only as much raw material but also as many components as possible in the cycle. “If I break down a battery housing of an e-vehicle into its individual components and melt them down I still have to invest a lot of energy”, Wöstmann says, raising a point of concern. If, on the contrary, the battery tray and the housing of the power electronics are re-used for the next generation, this energy is not required to start with. “The basic requirement for this is a cross-generational vehicle design”, the Fraunhofer expert claims.

For a truly circular component design raw materials would have to be standardized. For battery trays, for example, only two instead of 12 different casting and forging alloys should be used, which can later be processed both by casting and forging. The manufacturers of cars or refrigerators, in turn, should know which materials are currently “moving in the cycle“ and when their fridges or cars will come back. This requires both the digitalization of materials flows and components streams and the definition of standards for cross-sectoral raw material circularity, such as for drive train components in e-vehicles. Wöstmann sees quite an opportunity for upstream suppliers here. Components with a lower CO_2 balance which can be re-used in the next product generation would have a USP for buyers. Wöstmann is confident: “This will make the circular economy a profitable business model.”

www.tbwom.com

Gerd Krause, Mediakonzept Düsseldorf

BDG at NEWCAST and GIFA 2023

Appearance at the fair as a lighthouse for the sector

The world's premier fair GMTN with its casters' fairs GIFA and NEWCAST will be more significant than ever – not only economically but also politically. For our sector, it will be the chance to make a multiple appearance. At the intersection between both fairs, BDG and all the trades from the House of the Foundry Industry will make their appearance in Hall 13.

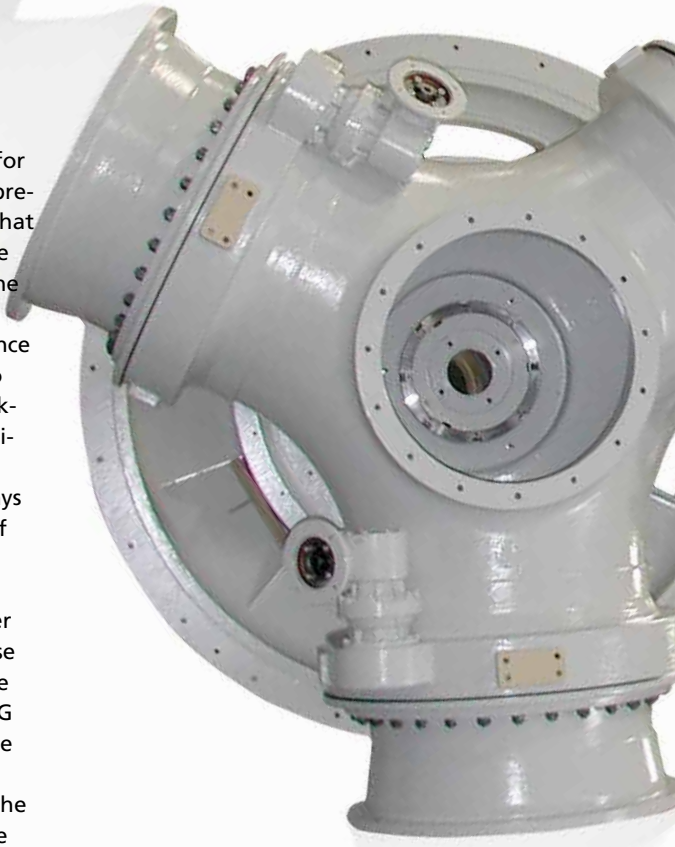
By Martin Vogt

„The show is a must for suppliers, foundrymen and our customers – for designers, developers and buyers".

Max Schumacher

Innovations for the transformation for foundries and of foundries will be presented in an international arena – that will be one side. The other side will be the communication of the sector to the outside, towards politics and society. "The fair will be not only a performance show of the foundry industry but also the optimum opportunity for networking with customers, component suppliers, potential new employees, young people as well as the associations," says Max Schumacher, General Manager of BDG. As the promotional sponsor of GIFA and NEWCAST, BDG will have its booth area together with all the other trades under the auspices of the House of the Foundry Industry in Hall 13, like in 2019 too. The area occupied by BDG will cover by far the largest part of the total area. The geographical center point of the booth and, so to speak, the home for all BDG members will be the Casters' Meeting Place (Gießertreff) as an exclusive place for the face-to-face exchange of ideas. Right next to it: the Castainability special show which will use exhibits in order to show in a graphic and exemplary way that the transformation cannot be successful without casting products. Just like the special show called "Technology in Casting", a performance show of the foundry industry.

Compared with 2019, individual areas of the appearance at the fair have been refined considerably. One of the main focal points: recruiting young people.



Here, an application with VR glasses will permit a virtual tour of a foundry and will thus make young visitors to the fair more familiar with the working world of a modern sector, including interactive process stations such as simulation, quality assurance or 3D printing. The Demonstration Foundry will be at the starting line once again – here, it will be possible to cast various models. The Metals for You program will recruit the potential young people in coordination with fairs and schools.

Photo: Grohmann Aluworks

Further constituents of the appearance of the House of the Foundry Industry at GIFA and NEWCAST (amongst others): the GIFA Forums, the Institutes Show, the NEWCAST Forum, the NEWCAST Award, the CAEF Forum, the Foundry History Colloquium and the presentation of the Innovation Prize of the German Foundry Industry.

Performance show for "green casting" – the Castainability special show

Right next to the Casters' Meeting Place, the Castainability special show will demonstrate how important casting components will be for the forthcoming transformation of the economy and society – simply, climate neutrality will not be feasible without casting.

Largest casting product

The largest casting product at Castainability will definitely be a highlight which will certainly not be overlooked by anybody. The wind turbine hub weighing 34 tons will show that the energy turnaround needs installations which do not function without casting products.

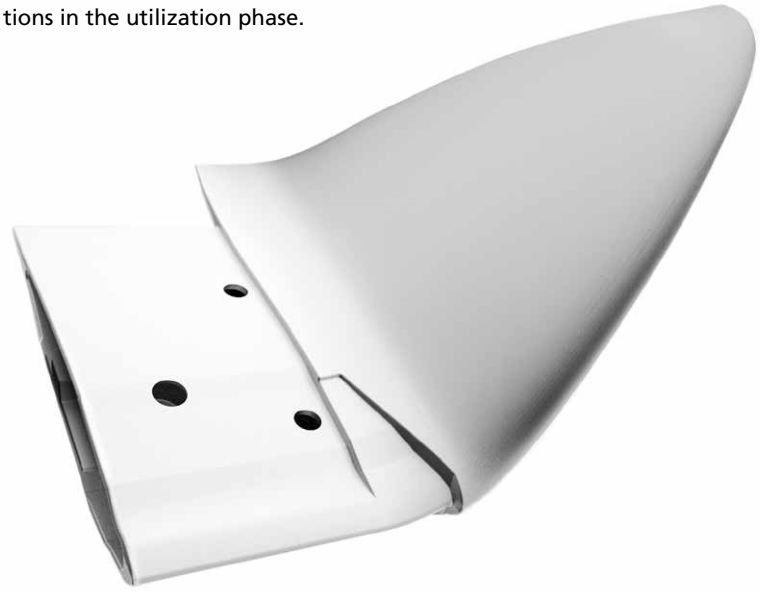
Moreover, a casting product which will serve as an example of what casting can achieve as a fabrication technology. Already impressive because of its size, the dimensions not only result in particular requirements on casting dimensions, the need for molding materials and logistics. The hub must also withstand high loads which set stringent requirements, for example, on the material properties. And in view of the planned expansion of renewable energies, one thing is clear: Wind turbine hubs must be produced in series. Besides, hubs are not the only castings in a wind turbine. Casting exploits its advantages to the full also in the case of machine carriers, base frames, axle journals, housings, planetary webs and torque supports for certain constituents of the turbine installation (and similar components).

Although the "Transformation" motto at Castainability can serve to portray just a fraction of the castings and casting process technologies with the aid of which it will be possible to restructure industry, power generation, the construction trade, agriculture and transport. In addition to wind and hydroelectric power installations, these will also be future vehicles in road and rail transport which will require the lightest and most material-efficient castings possible. Nevertheless, the exhibition will be a performance show for the entire sector and will demonstrate graphically how casting as a fabrication procedure fits into the ecological system of the circular economy:

> Near-net-shape fabrication without any waste-intensive reworking.
> In the case of lightweight construction: Consumption of the least material and energy possible during the fabrication phase as well as lower energy consumptions in the utilization phase.

„The trade show is the foundry cloud on Earth – everyone in there has the same DNA".

Clemens Küpper



One component which is less well-known and not quite as large is located on the wingtips of the wind turbines: the blade tip. The innovative casting product reduces the friction losses when the flow stalls and conducts lightning strikes. It is manufactured in gravity chill casting with a sand core and sets stringent requirements on the tests on the casting and the surface quality. It will also be possible to see a blade tip at Castainability.

CASTAINABILITY
E-MOBILITY, CIRCULAR ECONOMY AND RENEWABLE ENERGY

Art in casting: The "Big Rooster" bronze sculpture created by the artist Arie van Selm in 2013 will also be an eye catcher on BDG's booth at GIFA. Already because of its dimensions of 189 x 165 x 53 cm.

Photo: Werkstatt Galerie Hermann Noack/Roman März

Photo: Christian Thieme

> Design for recycling: Already in the concept phase of a product, think of the possibilities of repairing and dismantling it for the subsequent recycling of raw materials.

And there will be no way to past the other exhibition items either. Because within this attractive setup, there will be seating possibilities which can be used for smaller presentations – e.g., for the guests on the Bank Day. The pictures stand for the concept of the exhibition. Surprises reserved.

Bundled casting competence – BDG's joint booth called "Technology in Casting"

Around 350 m² on which the German foundry industry will present its products – BDG's joint booth called "Technology in Casting" will encompass iron casting, hand-molded and machine casting, chill casting, sand casting, gunmetal, precision casting or die casting as well as additive manufacturing procedures and will thus be the counterpart to NEWCAST on BDG's booth at the fair. What do the exhibitors expect from Technology in Casting? First of all, the successful presentation of their products and companies as well as contacts to potential customers and suppliers. However, a fair is not a one-way street. The information flows in the other direction too. Information about the innovations in the sector is just as important to the exhibitors.

Martin Vogt, BDG

Photo: bub-Druckguss

Ralf Ahnert, bub-Druckguss, will present the company's hybrid die castings at the fair. However, even he himself wants to obtain information about innovations in relation to energy efficiency and energy saving potentials.

Photo: Foseco

Steel metal treatment with the new Rotoclene process.

FOSECO

New products for iron foundries

Hall 12, Stand A01 + A02 The Foseco stand will feature many of our recent innovations for iron and steel foundries, including feeding systems, solutions for improve casting cleanliness, coatings, binders, new products for the melting shop, flow control furnace refractory linings.

A number of recent coating developments will be on show at GIFA, e.g., the Semco family. Its fast dry (FD), color change (CC) and formaldehyde free (FF) water-based coatings takes aim at some of the most pressing challenges facing foundries today by reducing energy consumption, optimising drying times, improving core/casting performance, and reducing emissions to create a more sustainable working environment in foundries. Meanwhile, Semco IC coatings help to reduce the risk of wear to new lead-free bearings from coating particles that are left over in engine components from the casting process. The coatings are designed to significantly reduce the amount such coating residues, while any coating particles that do remain are softer than the bearings.

Controlling the preparation and application of coatings is the most important prerequisite for eliminating coating-related defects. Our new continuous Intelligent Coating Unit (ICU) is designed to eliminate such defects from the outset. Real-time coating density measurement ensures consistent application for shorter drying times and reduced coating consumption – while enabling significant productivity gains. And, in a world first, we will showcase the first handheld density meter that can instantly display the current density or coating in use.

Acticote 3D is a range of refractory coatings designed to overcome the limitations of molds and cores produced by additive manufacturing (3D printing), including lower sand compaction and surface finish. To address these issues, the Acticote 3D range provides excellent surface coverage, smoothing out the step-like surface inherent to 3D-printed cores and molds, and so ensuring casting surfaces are smooth and free from discontinuities and improves the interface between the molten metal and the sand surface, preventing metal penetration and sand burn-on defects associated with lower sand compaction. The range of Acticote 3D coatings support varied application methods, with rheological properties adapted for both dipping and flow coat applications. The selection of refractory filler combinations is also optimized to casting application. Finally, Acticote TS is an insulating coating that provides better control of solidification at lower castings weights, while maintaining excellent surface finish, free of common defects. It thus allows foundries to improve the metallurgical properties of current castings, while also developing designs that minimize casting wall thickness to further reduce total weight – improving yield and reducing energy consumption.

Rotoclene is a new process for producing the highest quality, inclusion-free steel for casting. We will display the whole process at our stand, with an hourly presentation to introduce the theory, practice, and benefits. The process uses rotary action to stir the metal and disperse fine argon bubbles through the melt. These bubbles are highly effective at catching any inclusions and bi-films, floating them to the melt surface, where they are trapped in the slag layer. The rotary action also homogenizes melt temperature and eliminates cold spots. This allows the steel to be poured at lower temperatures, reducing shrinkage and promoting finer microstructures. This is all possible in a standard bottom pour ladle.

www.foseco.com

lpm group

GIFA
Hall 16
Stand G26

Low Pressure and Gravity Die Casting **Machines** for aluminium and magnesium Tooling and Sand Regeneration Systems

LPDC
Machines

Molds
Development,
Simulations,
Construction and
Casting Trials

Gravity
Machines

Sand Regeneration Process
Organic & Inorganic
Sand Regeneration
System

Melting
Furnaces
Metal treatment

Gravity & LPDC
Machines

Automation
Robotic System
& Tooling

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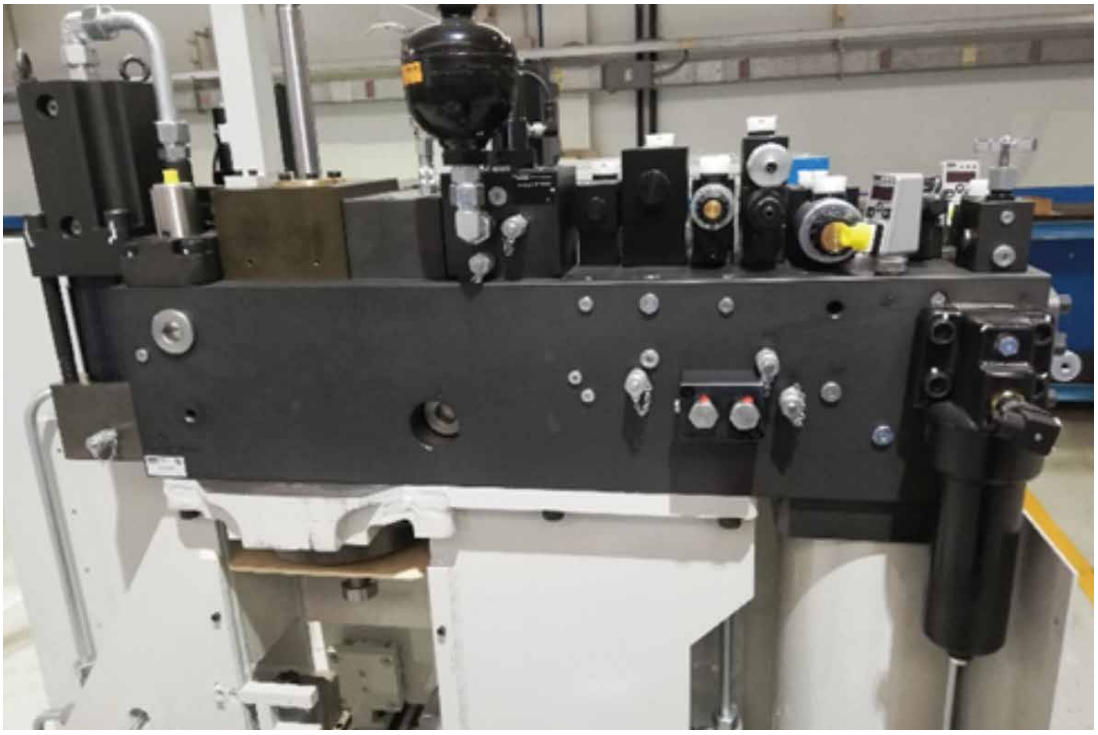

Photo: Agrati

The EcoDrive system.

AGRATI AEE

EcoDrive System applied to Agrati AEE die-casting machines

Hall 11, Stand D40

Agrati AEE srl is one of the most prestigious Italian manufacturers of die casting machines in Europe. Its production site is located in Bergamo, a few kilometers from Milan. It draws on almost 90 years of know-how, partnerships with the world's best technical partners in the fields of electronics and hydraulics, and its own technologies.

In recent years, in collaboration with the world leader in hydraulic technology Parker Hannifin, it has developed the innovative Eco Drive injection technology, a solution for optimizing the die-casting process that improves both productivity and product quality. In order to better understand the EcoDrive System, we drew on the experience of Alessandro Betti, Sales Director of Agrati AEE, who knows the dynamics and the needs of customers. "The EcoDrive System works with the 2-way high response valves series TDP in combination with a Compax3F controller, enabling dynamics and accuracies that had not previously been achieved. This contributes to greater productivity since rejects are reduced to an absolute minimum".

The solution keeps system pressure constant and provides protection from pressure peaks and cavitation thanks to an accumulator on rod side and a check valve. This system also extends the lifetime of all hydraulic components of the die casting machine. Up to 20 % of energy is saved as a result of energy recovery during injection cycle.

We can summarize all the advantages of the EcoDrive System, continues Alessandro Betti, by outlining them as follows: response times of the cylinder movements are greatly reduced; injection speed need is achieved with smaller valve openings; absence of pressure peaks is guaranteed: the maximum pressure in the circuit is now that of the accumulator (130 bar); previously, with the intervention of the outlet brake, values of 230 bar were also reached; increase of the mold front surface is guaranteed due to the absence of pressure peaks; TDP lifetime is longer due to the benefits of the smaller opening; guaranteed better braking and control of the injection cylinder; reduced accumulator charging time due to oil recovery after first injection phase; in the machine tank, there is now a reduction in emulsions because the injection unit discharges very few and at low pressure; reduction in the size of the injection unit drainage pipe; increased pump life due to reduced emulsions in the tank and energy saving due to reduced loading times.

The injection cycle consists of two phases. All phases of the injection cylinder are performed under accumulator and controlled by the TDP valve. In the first phase, at the exit of the injection cylinder, after the controlled safety cartridge, the oil is no longer discharged into the tank, but returns to the accumulator pressure line. In the second phase, when the TDA valve (TDP in case of closed loop options) is opened, the oil accumulates in a pressure transformer which keeps the pressure on the discharge line constant, thus avoiding pressure peaks and water hammer. A small amount of oil is discharged at low pressure into the tank. With the additional closed-loop option, 8 speed ranges with corresponding ramps and 5 pressure setting ranges can be defined.

www.agrati.it

FOSECO

New products for non-ferrous foundries

Hall 12, Stand A01 + A02 The Foseco stand will feature many of our recent innovations for non-ferrous foundries, including melt treatment, crucibles and refractories, aluminum melt shop, innovative sand core binder solution for HPDC and methoding and coatings for aluminum foundries.

A key limitation of the high pressure die casting process (HPDC) is the inability to produce complex, hollow castings, at high volume, and in a cost-effective and sustainable way. This is due to the difficulty in producing suitable cores. Standard sand cores cannot be used, as they are difficult to remove after casting and do not provide adequate surface finish. Salt cores are more suitable but are expensive to produce and present other operational limitations.

In response to this challenge, we have developed the Wasco water-soluble binder and coating, which we will showcase at GIFA 2023. This innovative binder system demonstrates high bending strength and has been used successfully in both liquid and semi-solid HPDC processes, even in severe conditions. With the use of an appropriate coating, Wasco-based sand cores can exceed 1000 N/cm² and are thermally resistant up to 750 °C. Post-casting removal is achieved simply by flushing with water, preventing any risk of damage or crack initiation.

The methoding area at GIFA 2023 will highlight the optimal use of foam filters, die coating, and feeding systems in sand and gravity die casting applications. Applications will be shown for aluminum and copper base castings, demonstrating excellent yield combined with improved casting quality. We will also highlight the Feedex NF1 range of exothermic feeders designed for both aluminum and copper applications. This sleeve material is highly exothermic, provides quick ignition, and has high strength. Due to its excellent feeding performance, manual application of exothermic powders is also avoided, reducing emissions.

The new range of Dycote Safeguard products will also be highlighted. These long lasting, nano-ceramic coatings are designed to achieve significantly longer service life compared to traditional die coatings, leading to reduced interruptions for touch-up – and therefore increased productivity. This new die coating requires only a single spray, resulting in significant time savings and ease of operation. Multiple mixers and spray guns as in the past are no longer necessary.

Finally, new case studies that describe a filter and sleeve combination with conventional running and gating systems used in high quality, technically demanding applications will be displayed. All relevant exhibits will also feature simulations using the most recent version of the Foseco Pro Module for Magmasoft.

www.foseco.com

Photo: Foseco

Anti-explosion electrical device housing produced by HPDC using sand cores made with the Wasco binder.

Photo: Walther Trowal

A THM 400 shot blast machine in the TTC test and training center in Grand Rapids/USA is loaded with aluminum die-castings for the automotive industry.

WALTHER-TROWAL

„Smart Abrasive System“ lowers energy consumption, blast media usage and equipment wear

Hall 15, Stand D15

At GIFA 2023 Walther Trowal. Haan, Germany, introduces the “Smart Abrasive” option in its THM troughed belt continuous flow shot blast machines. The “intelligent” control of the media flow drastically reduces the energy consumption and significantly extends the usable life of the blast media as well as of the entire shot blast machine.

To ensure perfect blast cleaning results on all work pieces large continuous flow shot blast machines normally work with a surplus of blast media. This results in higher energy consumption. To eliminate this waste of energy, Walther Trowal developed the “Smart Abrasives” option for its THM 700 and 900 shot blast machines, which are equipped with up to four turbines. It adjusts the media flow rate in the entire media recycling system to the blast cleaning requirements as well as the shape and size of the work pieces. If a particular blast cleaning process requires a lower blast performance, the system reduces the media flow through the turbines and the RPM of the augers.

This innovative control system saves not only energy. Since less media is passing through the shot blast machine, it also reduces the media consumption. In addition, the overall uptime of the shot blast machine is increased, and the amount of required work for maintenance is decreased.

With suitable processing trials the optimal shot blasting parameters, such as turbine RPM, media flow rate, etc., are defined for each individual work piece type. Based on these data processing programs are created, which are then stored in the PLC of the machine controls.

Typical applications for the THM machines are automotive components, for example, chassis parts made from aluminum like transverse links, swivel bearings or steering knuckles. For the surface refinement of these lightweight work pieces the manufacturers are increasingly using aluminum blast media. It allows to make the entire blast cleaning process particularly gentle.

Meik Seidler, sales manager for mass finishing and shot blasting at Walther Trowal, expects a growing demand for shot blast machinery that can handle the high work piece volumes typical for the automotive industry: „With the increased production of hybrid and electrical cars more high-strength chassis components will be required. Since such vehicles have a higher weight and require a higher torque in their drivetrain, the components must be more resistant against tensile and bending stress. For these applications the THM shot blast machines with the “Smart Abrasives” control system represent a highly economical solution”.

www.walther-trowal.com/en

JOEST

Joest presents its extensive product portfolio

Hall 17, Stand A20

As a leading supplier in the production of vibration technology, Joest will present its comprehensive solutions for foundry technology at the GIFA in Duesseldorf from June 12-16. In addition to the proven vibration technology, the areas of Goessling conveyor technology and Joest lifting and tipping technology will also be presented.

For more than 100 years, Joest machines have proven themselves through continuous development, experience and quality. Together with the customer, individual complete system solutions are developed for every application. Joest offers the entire project management from a single source, from design to production to commissioning. Its automation technology also offers in-house controls and individual software solutions, in line with Industry 4.0. A holistic monitoring of the machine and plant parameters as well as a connection to higher-level control systems is also possible.

Photo: Joest

Joest Charging Feeder for the high demands of the foundry industry.

In Duesseldorf, Joest presents not only the entire product portfolio but also a model of a functional charging vehicle specially designed for the trade fair with an exemplary aggregate dosing feature to illustrate the versatile application possibilities. The sales team will be available throughout the entire trade fair with its expertise in foundry technology and is looking forward to numerous discussions. Whether it is the replacement of proven machine technology or new robust special solutions – Joest has the complete product range for your individual solution – wether separating, cooling, crushing, dosing, conveying, drying, screening, sifting, lifting, tipping or thermal processing.

www.joest.com/gifa-2023

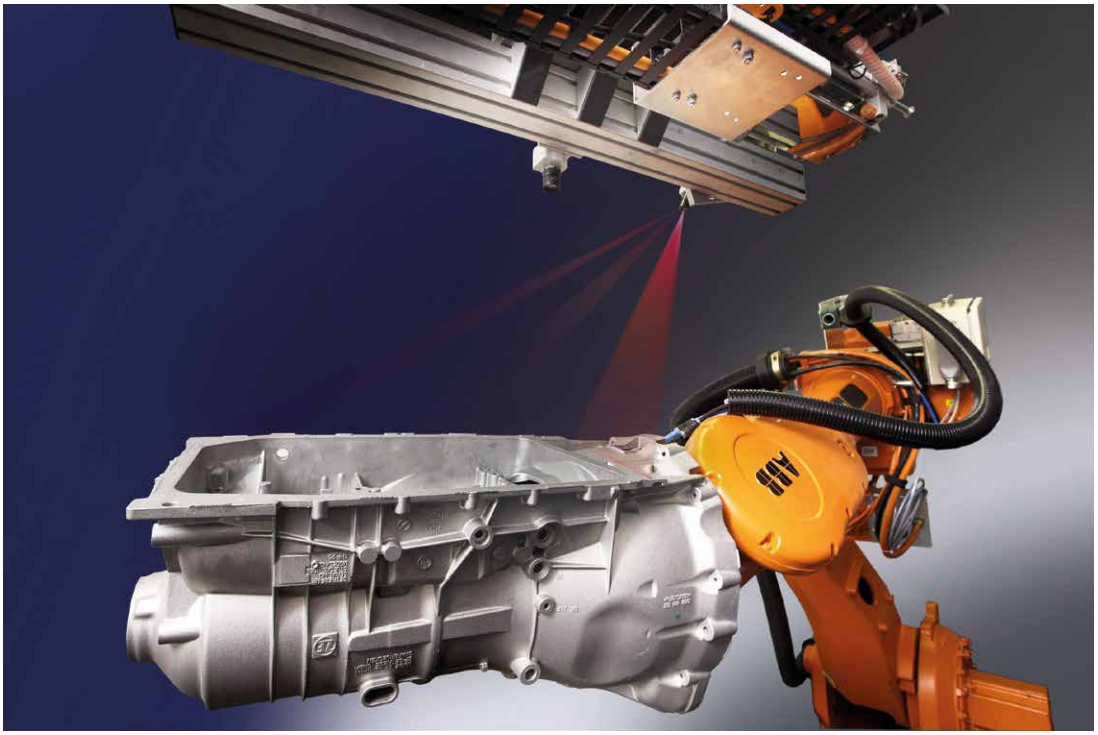

Photo: Laempe Mössner Sinto

The Flexinspector in action on a casting.

LAEMPE MÖSSNER SINTO

Image processing: automatic inspection of sand cores and castings

Hall 17, Stand D23

In 2018, Laempe acquired and integrated inspectomation, a company that specializes in automated image processing. With the help of its self-developed core products Core-Vision, Disc-Inspector and Flexinspector, defects, damage and other faults on sand cores and castings can be detected automatically using camera technology. This reduces or completely eliminates the need for manual inspection during production. The products and solutions in the field of image processing can be perfectly integrated into the automation solutions of Laempe Mössner Sinto – this is exactly what the leading company in core production technology will be demonstrating at GIFA. The solutions in image processing develop their full effect when they are integrated holistically into the overall process. For this reason, customers, which primarily include foundries, not only receive a pure image processing solution, but a holistic complete solution from a single source. This includes image processing, mechanics, programming, commissioning and service. In addition to the complete solutions for traditional foundries, inline monitoring and core measurement for 3D printing processes are currently in preparation.

Core-Vision is an image-based camera system for the automatic detection of defects on sand cores as well as sand molds and is used for the fully automatic detection of break-offs, gaping cracks, missing cores and other visible larger defects (> 2 x 2 x 2 mm). In contrast to traditional methods, which often only work with a single image under diffuse illumination, the Core-Vision system takes a series of images with differently directed illumination. The resulting series of images provides comprehensive 3D information about the shape of the object being inspected.

The Disc-Inspector system is primarily aimed at manufacturers of brake discs. The product uses a mixture of 2- and 3-dimensional imaging processes to inspect the ventilation channels and all visible surfaces of a brake disc for casting defects or damage. Holes, break-offs, burrs in channels as well as full and partial occlusions in channels can thus be detected automatically. With the Disc-Inspector system, 100 percent of the brake discs produced can be inspected in a cycle-retaining manner. The changeover effort is minimal and all available types can be inspected. The Disc-Inspector solution is a future-oriented modular system including a system configurator. This means that customers can adapt the system to their individual needs, depending on what is to be inspected on the brake disc. The Disc-Inspector is currently used by many well-known manufacturers of brake discs and in foundries worldwide.

The Flexinspector system can check all visible surfaces of a casting for casting defects or damage using a 3-dimensional imaging process. If the system is calibrated accordingly, the dimensional accuracy of parts can also be verified. The inspection is carried out in a tactile manner and covers any number of part types. Customers, especially foundries, can create, update and adjust inspection programs themselves. The Flexinspector system – like the Disc-Inspector and the Core-Vision – is delivered and commissioned as a turnkey system. The Flexinspector is 100 percent cycle-retaining, reduces waste, increases efficiency and can be used flexibly. Since, strictly speaking, it is a similarly designed system to the Disc-Inspector, the Flexinspector combines the same advantages. It is used, among other things, to inspect gearbox housings and cylinder heads at world market leaders.

www.laempe.com

FRECH

Always challenge the status quo!

Hall 11, Stand D22

Sustainability, effectiveness, specialists, new applications – the die casting industry is transforming. The established from all phases of the product life cycle must be scrutinized and collaboratively solved; an extract follows.

With industrialization or „the best path from product concept to the cast part“ the following questions arise: are all components and assemblies manufactured with the most appropriate materials and methods? Is there sufficient die casting process expertise in the early product and system development phase? Should die casting – if it is the target process – be used to produce the first development sample parts? From which minimum small batch quantities can die casting be the most cost-effective and sensible alternative? How can up to 50 % more output (part/time) be achieved by using modern technologies – in comparison to conventional die concepts?

With scaling or „the right machine technology for series production“: why is technology openness with respect to die casting process required in order to find the best solution? Can the melt always be held close to the die surface in the hot chamber process and thereby the best cycle time and casting quality be achieved? How can assistance systems further increase operating comfort and effectiveness? Machine technology must also make a significant contribution to additional energy savings through new concepts – but how? How can the machine concept contribute to even more cleanliness in the foundry and thus to a longer service life of the machine?

With finalization or „with coordinated peripherals to a cell for the most effective serial production“: can cast weights beyond 100 kg be handled with maximum dosing accuracy, melt quality and safety? How can as many individual temperature zones as possible be implemented with as few temperature control devices as possible in order to achieve significant space and energy savings? Is it possible to shift the limits of conventional die casting with the latest vacuum technology? How can the casting producer be enabled to have the circular economy of their various materials completely under their control? Can the sum when realizing and operating a casting cell result in lower costs than the total of the individual parts?

With digitalization or „software for more transparency, but particularly as an instrument for solutions“: how is it possible to obtain very high transparency with respect to the effectiveness of one‘s own production without investments & workload? Don‘t data processing and reporting have to be automated, thereby using the capacity previously dedicated to problem solving? Cooperation with respect to spare & consumable parts must be as lean and error-free as possible – how can this be done? The process and technology knowledge of foundry employees must be held at a consistently high level or retrievable when required – but how? „Taking temperatures“ is not enough; „treatment“ is required – how can modern tools support increasing effectiveness?

With optimization or „how special units can increase foundry effectiveness with modern tools“: is it possible to start problem solving only a few minutes after an error, thereby increasing effectiveness in the foundry? Is it possible to pro-actively prevent more failures than to reactively resolve them? How can the delivery time for spare and consumable parts be significantly accelerated? Where is the „circular economy“ approach found in die casting technology? Is it possible to get the human production factor to a comparable level of knowledge with respect to die casting technology internationally?

Find the first solution approaches in the next edition of CPT and visit us between June 12-16, 2023 at GIFA in Duesseldorf to learn about the innovations inspired by them.

www.frech.com

OTTO JUNKER

Focus topic energy efficiency

Hall 10, Stand F57
Furnace specialists Otto Junker and its subsidiary Induga will be presenting their solutions in the induction melting and thermoprocessing equipment fields in Duesseldorf. The focus topic of energy efficiency is also accompanied by further developments in plant availability and safety: A new learning module from the Otto Junker Academy will be presented that incorporates virtual reality. VR goggles can be used to simulate critical operating situations such as a ground fault message in a foundry environment. This allows both operating and maintenance personnel to be realistically trained for critical situations in an understandable and descriptive manner. The virtual environment enables tangible learning of correct behavior at the melting furnace.

Photo: Induga

The 20 MW IGBT converter.

Another advantage for optimized loss-free operating processes is demonstrated with IGBT converter technology (Insulated Gate Bipolar Transistor). On the one hand, transistors enable maximum operating safety due to components that can be switched off; on the other hand, the plant can continue to operate with slightly reduced power even if an IGBT module fails. At Otto Junker, medium-frequency crucible furnaces with capacities of up to 60 t and outputs of up to 28 MW are supplied with the operationally reliable IGBT technology. The furnaces are used, for example, for steel applications, DRI melting and as a CO_2-free replacement for cupola furnaces.

Otto Junker has also further developed the patented laser-optical measuring system for monitoring crucible wear and the thermal load on the induction coil. At the trade show, comprehensive information will be provided on the proven OCP+ (Optical Coil Protection) system, which has now been made even more user-friendly.

www.otto-junker.com

AUMUND

Innovative conveying system for cleaning and sorting in foundries

Hall 16, Stand C17 + Hall 4, Stand F18
Customer-specific conveying technology solutions from Aumund, Rheinberg, Germany, play an important role in linking the individual steps in foundry processes. Careful handling is often a decisive factor in assuring the quality of the castings, which is why it is important to select the right conveyor for the application. Aumund offers conveying technology for the complete foundry process chain which uses wet method production techniques.

Aumund Flat Plate Conveyors for heavy-duty mechanical and static loads stand out with their great resistance to the impact loads of the degating tools, such as the hammers, hydraulic separating wedges and manipulators, used by foundry workers. The extreme pressure caused by these tools on the conveyor is absorbed by the closely overlapping plates of the Aumund Conveyor. Other systems on the market only have minimal or no overlapping at all between plates. Steel cord belt conveyors or slat conveyors are not stable enough mechanically for this application. All of these systems are therefore more prone to requiring repair. The smooth, level surface of the Aumund Flat Plate Conveyor, which can be supplied in widths from 600 to 2,400 mm, guarantees careful transportation and discharge of material.

Being compact, these Aumund Conveyors are also suitable for confined spaces, which is often a requirement in foundries. The new design was developed by working closely with customers in order to do as much justice as possible to prevailing conditions specific to foundries. Aumund can design the conveyors horizontally, slightly

inclined or in a combination of horizontal and inclined, in order to fit them in to existing plant geometry.

Aumund has developed innovative conveyors for the transportation and cooling of very hot bulk materials in the steel industry. This know-how has now been creatively adapted to the requirements of foundries. The essence of the innovative application is the Aumund concept of spray mist cooling with which the castings are cooled in a controlled and protective way, and prepared for demolding, degating, shotblasting and sorting. These specialized conveyors are able to cool a foundry's entire daily production in one single cooling run. Each Aumund Cooling Conveyor is designed for its individual application. Cooling connections can be supplied as an option.

Photo: Aumund

Flat plate conveyor in operation.

Further solutions in the Aumund portfolio are: Bucket Elevators for vertical conveying are used for abrasive bulk materials such as foundry sand. Pan Conveyors with their patented pan overlapping system for ascending and descending transportation can be used for feeding scrap to the furnace.

www.aumund.com

JUTEC

Safety with optimized PPE

Hall 10, Stand H40

Workplaces exposed to heat, as frequently found in the steel and aluminum industries, in foundries and at heat treatment plants, call for individual solutions because every working environment has different requirements on the Personal Protective Equipment (PPE). Safety officers have to make sure that they comply with the wide and varied range of complex rules and regulations applicable in this field.

To facilitate this challenging task, Jutec provides its customers the "Heat Protection compact" toolkit, a hands-on approach to helping safety officers select the best possible equipment for the job at hand. It contains an action plan for all steps from analyzing the situation at the respective workplace up to certifications required by the PPE regulation.

Jutec experts support their customers through a five-stage selection process: 1. analysis of the current situation at the workplace; 2. risk and hazard assessment – mandatory for every project; 3. recommendations for the selection of the most suitable, approved fabric and the entire protective clothing, considering safety and wearing comfort aspects; 4. proof of safety, e.g., by means of a spill test with molten metal and 5. Certification – the Jutec label certifies that the heat protection solution employed complies with all applicable rules and regulations.

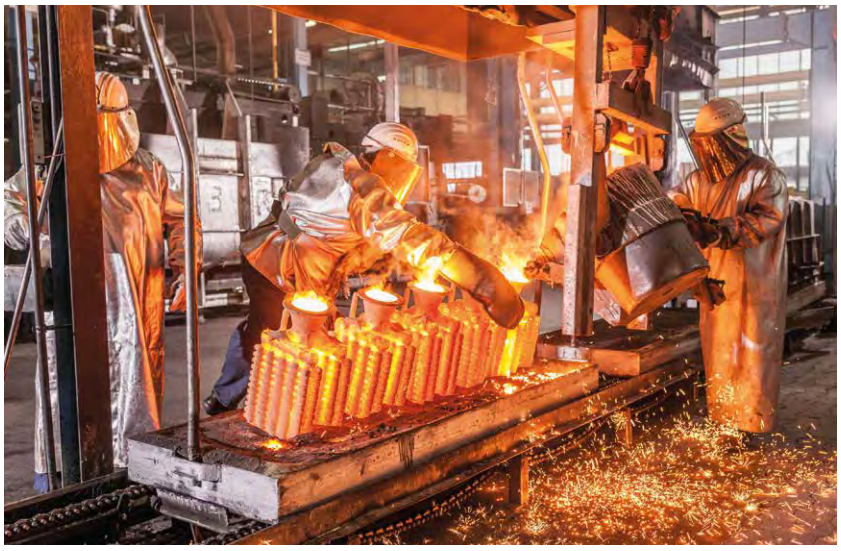

Photo: Jutec

Even castings of 1000 °C and more can be safely touched with Jutec protective gloves.

Stephan Muscheites, Sales Director at Jutec, is familiar with the situation on the shop floor: "The safety officers in the companies are constantly confronted with ever new rules and regulations affecting all kinds of safety aspects. In this context, heat-exposed workplaces play only a minor role. To support the safety offers, we have developed "Heat Protection compact": With this, we take our customers through a well-structured selection process culminating in the certification of the solution chosen. Thus, our customers can rest assured that they comply with all requirements of the PPE regulation on workplaces exposed to heat and protect their employees as best as absolutely possible".

www.jutec.com

Photo: Klein Anlagenbau

The company building corresponds to the energy standard KfW55.

KEIN ANLAGENBAU

Resource-efficient – environmentally-beneficial – economical

Hall 16, Stand C11

Klein Anlagenbau AG is the experienced and competent partner in pneumatic conveying systems for bulk material, core sand preparation systems, sand reclamation and foundry equipment. The company's portfolio includes development, consulting, project planning, engineering, manufacture, start-ups, training and after sales services. In accordance with the growing market requirements, Klein develops resource efficient and environmentally beneficial processes and systems which are economical at the same time.

The pneumatic conveyor SP-HL was especially designed for the gentle and energy-saving transport of foundry sands. Thanks to its quasi-continuous conveying principle, energy savings reach up to 50 % compared to conventional conveyors. At the same time, wear of conveying pipes is minimized, and the grain structure of the silica sand is preserved.

Owing to the double-chamber mixing principle of the core sand mixer Statormix excellent mixing results in very short mixing cycles are achieved compared to conventional core sand mixers. Thus, the energy input into the mixed core sand batch is kept minimal.

By means of the innovative reclamation process Clustreg, inorganically bonded used sand is reclaimed without employing cost-intensive thermal processes. The limited resource of sand is preserved, polluting transports are not necessary, and the bonded sand is regenerated energy-efficiently.

For the cleaning of castings Klein offers the shock wave technology Cerabite by means of which sand and ceramic cores, coatings and chips are removed out of complex castings such as motor blocks and cylinder heads. With this process up to 140 castings per hour can be cleaned by consuming 6 kW of energy only.

Klein stands for environment protection and energy efficiency: Our company building corresponds to the energy standard KfW55 and stands out for its high level of energy efficiency. In 2022 we were awarded the Ökoprofit Siegerland certificate proving our corporate commitment to environmental issues such as climate protection, resource management, sustainability, and CO2 footprint. In 2023 our quality management will be certified in accordance with ISO14001 standards for environment.

During the international trade exhibition GIFA, Klein Anlagenbau AG and its subsidiary Klein Stoßwellentechnik GmbH will present themselves in hall 16, stand C11. Looking forward to meeting you in Duesseldorf!

www.klein-ag.de

HYDRO ALUMINIUM METAL

AlSi7_Mg^{++}, the smart master-alloy

Hall 13, Stand B35

Hydro Aluminium Metal, supplier of primary foundry alloys with a yearly production capacity of 300,000 t would like to present a new and smart type of master-alloy: AlSi7_Mg^{++}. The master alloy is based on AlSi7, but with an increased Mg content, so that its addition to a AlSi7Mg melt is just increasing the Mg-level in a defined way, while leaving all other element concentrations unchanged.

In aluminum foundry alloys the following typical issues regarding Magnesium can be addressed: 1. burn-off due to melting or long holding times, 2. need to adjust Mg-levels to reach required mechanical properties after heat-treatment and 3. need of several AlSi7Mg variants due to different customer specifications. The normal practice of increasing the Mg-level by adding pure Magnesium or AlMg-master-alloys has some disadvantages such as poor yield, increased oxide formation, diluting effects, and additional handling.

AlSi7_Mg^{++} overcomes most of these inconveniences. Delivered as continuous cast ingots with a Mg-content of 2 % and finely distributed Mg-phases it dissolves quickly, avoiding unnecessary oxide formation without showing significant diluting effect. Operations are facilitated since the master-alloy in shape of classical ingots can be handled in the same way as the base alloys. In the standard version of the master-alloy, the Mg-concentration is designed in such a way, that the addition of one ingot to 1000 kg of AlSi7Mg will increase the Mg-level by exact 0,01 % without changing the overall remaining composition.

Photo: Hydro

AlSi7_Mg^{++} is supplied as a continuous casting ingot with a Mg content of 2 % and finely divided Mg phases.

Magnesium burn-off can easily be compensated by adding an appropriate number of ingots to the melting furnace or into the transport crucible. AlSi7_Mg^{++} opens up for fine-tuning of mechanical properties of T6-treated castings and allows to manage different variants of AlSi7Mg with just one base alloy. For further information you are welcome to visit us during GIFA, our CTS team is awaiting you.

www.hydro.com

VULKAN INOX

Sustainable abrasives for surface finishing

Hall 16, Stand G09

At GIFA 2023, Vulkan Inox, Hattingen, Germany, will showcase Chronital and Grittal blasting abrasives, which the company has been producing exclusively with renewable energy since 2022. This improves the eco-balance of its customers, because the blasting media they purchase brings a significantly smaller CO_2 footprint. In addition, the reusable stainless steel blasting abrasives reduce consumption to just a few percent compared with mineral-based ones. Thus, when blasting metal workpieces, they make a significant contribution to the sustainability of production.

The stainless steel blasting abrasives are made from melted steel scrap and are completely recycled back into the metal cycle – a prime example of functioning recycling management. When used by customers it significantly improves the eco-balance, because they wear very slowly on impact with the workpieces and cycle again and again in a closed circuit. Vulkan's blasting media reduces the amount of abrasives used to just a few percent of the quantities previously required compared with mineral materials.

The high dimensional stability of the individual stainless steel grains prevents the formation of dust and noticeably improves working and visibility conditions. In addition, their use reduces the amount of waste and the cost of disposal.

Christian Hoffmann, Sales Manager at Vulkan Inox, knows that his customers are making great efforts to reduce their own footprint. Once again, he sees his company as a pioneer in its industry: „We have made many adjustments: As a starting material, we deliberately buy secondary input materials with a low CO_2 footprint . Since 2022, we have been operating our induction furnaces with electricity generated from renewable sources and implementing waste heat recovery to power the drying process. Overall, we have reduced CO_2 emissions from our own and third-party energy sources (Scope 1 and 2) by 87 percent since 2018. This means we are conserving valuable resources. Our goal is to convert the entire process so that gas will no longer be required."

www.vulkan-inox.de/en

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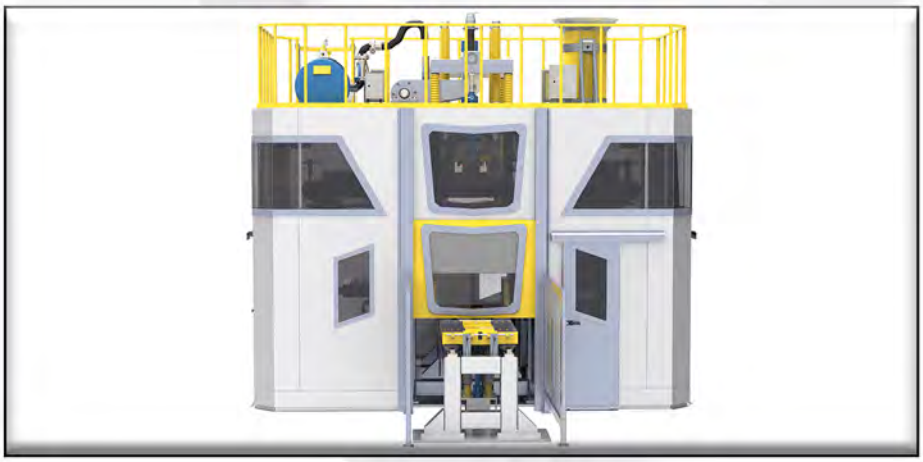

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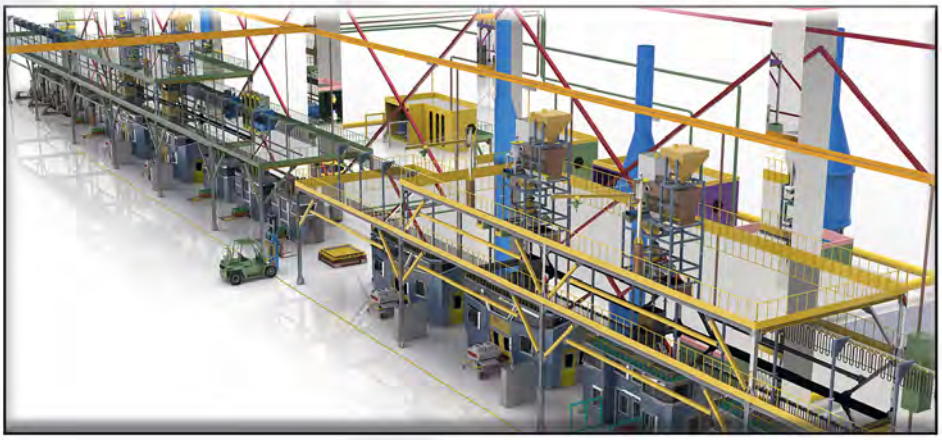

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Photos: DLR

Interview with Dr. Elmar Beeh

„We need the sharp engineering mind“

The transport sector has so far made little progress in decarbonization, as has been widely criticized. Vehicle construction, which is particularly important in Germany, is thus under particular pressure – the transformation toward climate neutrality has begun. The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) has its own „Materials and Process Applications for the Entire Vehicle“ department in Stuttgart, which Dr. Elmar Beeh heads, as does the „WerkstoffPlus Auto“ conference. The scientist explains his view of the industry in an interview with the CPT.

What do you think is the top issue in the industry right now?
Definitely sustainability. Of course, this has been on our minds for many years, but now the awareness has arrived everywhere in the industry. In the past, the focus was primarily on reducing consumption in the use phase, on lightweight solutions via weight reduction. Today, a more holistic approach is required. All the innovations we are now discussing are seen in this context; no technical solution is implemented anymore that does not address the aspect of the CO_2 balance, even in production – how can our developments contribute to the 2050 emission reduction targets? – Of course, there are different approaches and strategies here.

Hasn’t lightweight construction exhausted its effect?
No, on the contrary. The effects that can be achieved through lightweight con-

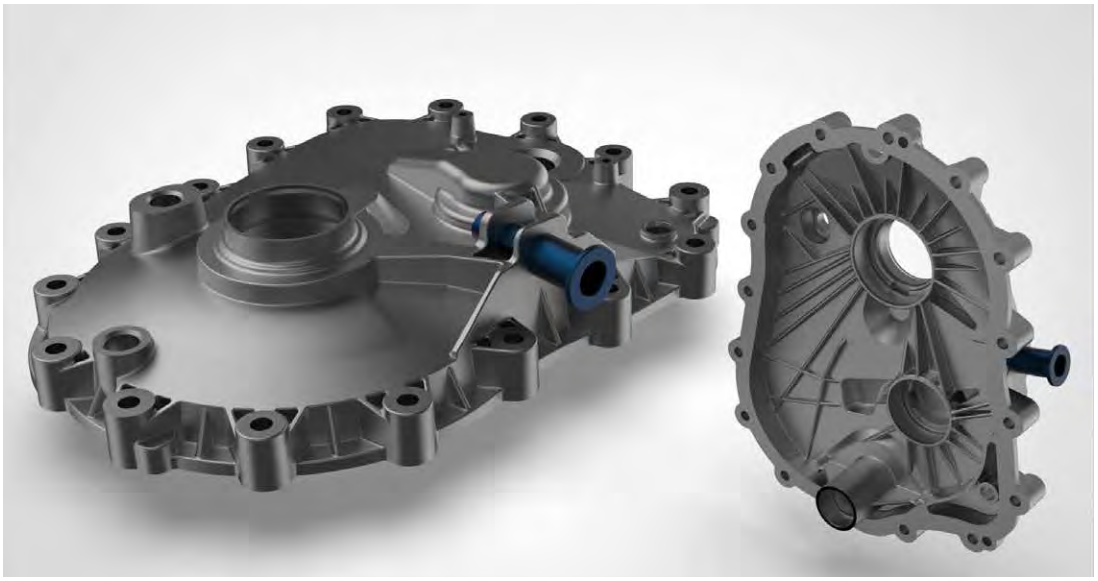

Fig. 1: **Optimized cast component from the InDruTec-E project.**

struction are so diverse that they cannot be reduced to consumption in operation. For example, the material saved through better material utilization does not even have to be produced and later disposed of or recycled. But secondary effects should not be forgotten either: Lower weight enables a leaner design of other parts, for example with regard to vehicle dynamics, which in turn saves weight. We are glad that these aspects, as we have seen in various keynotes, are increasingly being taken into account by CEOs.

When so many effects come together here, does it become more and more important to do a complete, automated calculation?

I warn against blind faith here. AI can do a lot for us, but the information base must be right. We need a sharp engineering mind – which we urgently need to retrain. We are already confronted with many problems here today.

Can you elaborate further on that?

Yes, for example, decision-makers in product development, in an effort to reduce Scope 3 emissions, make a material ranking at a very early stage, based only on the available figures regarding average CO_2 emissions of the materials. However, these figures are rarely objectively correct; for example, they are often only global averages. In addition, the database is not always up to date, which means that technology options that would have been the best choice can be lost at a very early stage of development. Positive effects in the utilization phase may also be incorrectly evaluated due to the early exclusion of solution options. We must be careful not to lose sight of the technical reality throughout the entire assessment methodology, especially in Scope 3, where it is important to consider the supply chain from raw material extraction onward. If we blindly rely on purely numerical values, our technical solutions will also be worse in terms of their carbon footprint if we forget that different aspects come together.

Let's take magnesium, which brings a large CO_2 backpack with it in production. Now, the consequence could be to simply avoid the material altogether, which would deprive us of some valuable technological applications. Or you could apply it exactly where it makes sense: I always say magnesium needs to be moved. In aviation, the lightweight effect has offset the CO_2 emissions from production after 20 to 30 days; in cars, it often takes years, but there is still a positive effect. This example illustrates very well that while the use of digital tools is an important part of today's development activity, it must not replace engineering expertise, especially when the problems to be solved become more complex.

What is still burning under the nails of the industry or you as a scientist?

The whole subject of vehicle construction methods: How far does it make sense to go down this path of large cast assemblies and function integration, or does it not also take us some distance away from the optimum in component weight and casting quality? There are many different opinions on this question. The question of benefit and risk when I think very large and integrative in my technical solution cannot always be answered unambiguously. This also depends on non-technical aspects, such as how established a company already is. Greenfield approaches, e.g., in and from China, that enter with new products and production plants can plan their investments directly with machines for gigacastings. Established manufacturers have a broader discussion here about where it is worth investing in new equipment and rebuilding the plant or where it makes more sense to use the flexibility of the smaller casting centers.

However, there is also a need for discussion on electromobility, for example. For example, whether the battery should remain an add-on part or be integrated. The question in which components it makes sense to integrate sensors or other functions by using partly new manufacturing processes was also discussed in many ways from different perspectives at the conference.

How do these trends influence your research and development topics?

In Germany, for many years we had the advantage that the further development of the combustion engine placed steadily higher demands on manufacturing processes. This gave us technological leadership in this area. This would be severely jeopardized if we did not extend our focus to the electric powertrain, where much more intensive development work is now underway. With the InDruTec-E project (innovation leadership in die casting technologies for electromobility) we are working with our partners to develop areas in

which we can also maintain a leading role for e-mobility, from design (fig. 1) to the materials and process parameters used to the quality of the castings and their machining.

In lightweight construction, there is still a great deal of potential for reducing resource consumption and emissions. In our part of the project, highlighting design technology, we were for example able to save considerable weight solely by completely redesigning the functional concept: An aluminum component from the powertrain, which is state of the art, was reduced by 38 % from 2.5 kg to 1.55 kg in the aluminum variant and by 54 % to 1.15 kg in the magnesium variant by applying an improved design method. The key here was better and more consistent use of the full material properties. If we focus our expertise on our knowledge of design, materials and process engineering and apply it consistently, and then use the digital optimization tools on the basis of a mechanically well-thought-out basic concept, we can provide the market with the right impetus, also for greater sustainability.

We hear more and more about function integration, what actually happens at the "end of life"? How do I get it all apart again?

So far, the development activities of most companies have been aimed at creating permanent connections over the lifetime. The question of how to get it apart again is not yet in focus. A rethinking takes place only very slowly. Some companies are starting to commission their engineers to take their own components apart again to see where the difficulties lie.

In any case, there is still a lack of knowledge about the influence of all the joining and material combinations: Where will the problems arise as a result of the integrative processes, which things can I separate, and which ways of recycling are appropriate in the particular case? Some of the expertise on this already exists in the recycling industry, but it is not yet networked with the development departments of the automotive industry.

So there is still a lack of interdisciplinarity?

This is precisely the question we are addressing in our DLR research project MaTiC-M: Transferring the knowledge of what will happen to a material at the end of the product's service life according to the state of the art or even in perspective to the early phase of product development: Could there be compatibility issues with surrounding components? Could I perhaps ensure with a slightly different choice of materials that the components, even if they should not be separated, are recycled together? Or are there more suitable joining techniques? All of this should be made transparent to the developer. "Design for Circularity" will be one of the next trend topics. There is still a lot to do there, because the industry crossover between product development and disposal and recycling is still missing.

Does individual transport still have a future or do we need to pursue alternative transport concepts?

It is definitely interesting to discuss these concepts. But you always need an implementation solution in the end. The autonomous swarm solution presented at the conference, for example, in which individual driving units gather at intersections and continue driving in a convoy in order to split up again at other intersections, is certainly not yet fully developed in all aspects, but research is there to try out such ideas and think them through further. The resulting solutions usually look different from the original idea when implemented afterwards. We have to learn from each other, and perhaps partial solutions can be implemented and combined. It is essential to think through the transition phase in detail, because then old and new must be able to coexist well.

Will climate neutrality succeed?

I think you first have to ask, what does that mean? Chimneys still smoke, because if I want to cast something, for example, I have to heat the material with a defined amount of energy beforehand. Hence there must be enough projects for CO_2 compensation. A first essential step is to reduce the overall energy consumption. Climate neutrality is not a sure-fire success, although the direction of development is right. There are always building blocks that do not by themselves solve the very big problem. But awareness is growing, from small suppliers to large corporations. Many are now setting themselves more or less ambitious goals. In the English-speaking world, words like sustainability or responsability always imply "ability," i.e., the possibility of doing something. So, anyone who is in a position to contribute something has the important task of doing it now as quickly as possible.

The interview was conducted by Dr.-Ing. Monika Wirth

CONFERENCE WERKSTOFFPLUS AUTO

The „WerkstoffPlus Auto" conference, which takes place annually in Stuttgart, is organized by the German Aerospace Center (DLR) in Stuttgart. The organizers want to provide a platform for decision-makers or developers from the automotive engineering sector to find out about trends and technological solutions and to network with solution providers. Especially in these times marked by crises, an intensive professional exchange on important and future-relevant topics is indispensable. At the 8th edition on February 15 and 16, 2023, vehicle concept and structural developers as well as materials experts reported on current challenges and approaches to solutions, sustainable lightweight construction technologies and enablers for the passenger car and commercial vehicle sectors. A new thematic block dealt with concepts and solutions for improved design for recycling.

www.werkstoffplusauto.de

Part-specific Tracing

Optimization Concept for Dot-peen Marking of Al-Si-alloy Castings

For foundry, the accurate and individual traceability of cast parts is the bases for the establishment of intelligent quality management. This can be implemented with a marking system to identify each cast part. The dot peen marking process has satisfying performance and low equipment costs compared to other marking methods. However, the codes marked with dot peen cannot usually withstand heat treatment and sandblasting, which leads to a low decode rate. Here, we test different optimization concepts based on the dot-peen marking method. The results show that a concept with the dot hole painted with high-temperature paint has the best performance regarding the multi-aspects of code quality after heat treatment and sandblasting.

By Fangtian Deng, Steffen Klan, Marius Schilling

1 Introduction

It is known to foundries that the accurate part-specific traceability of cast parts has various benefits, such as certificates for customers, product recall and intelligent production [1]. Especially product traceability is becoming necessary to meet compliance mandates of IATF 16949 in the automotive industry [2].

Most accurate traceability is achieved through different marking methods. However, most marking methods produce the symbols on the surface or near to the surface. Therefore, it is still a big challenge for foundries to keep code symbol quality stable in harsh production environments during raw part post-treatments, which often change the surface of the cast parts significantly. Nowadays, marked codes are usually covered with different protection layers for heat treatment and sandblasting. However, these protection methods increase the cycle time and decrease traceability to production parameters. Currently, the most used marking methods in foundries are laser and dot peen marking. The dot peen marking machine uses a pneumatically driven marking pin to stamp symbols, such as text, logos, and 2D DMC (Data Matrix codes). The stamp pin can usually mark on a surface with up to a height difference of 10 mm [3]. According to our previous work, it is noteworthy that dot peen marking has satisfying performances as well as low investment and maintenance costs; the codes produced by laser marking are relatively completely removed after sandblasting. [4] Thus, we conduct some experiments to optimize the dot peen marking process and stabilize the DMC code quality along different raw part machining processes, such as heat treatment and sandblasting.

In our work, we test four different optimization concepts with three dot-peen forms and three coloring processes. The code quality is evaluated according to the standard ISO/IEC 29158 [5]. A dot code painted with high-temperature paint shows the best performance for each status after the heat treatment and sand blasting. When the automation of the painting process is realized in the future, an affordable marking method can ensure the high code quality of cast parts after heat treatment and sandblasting.

2 Experiment

2.1 Experimental process

Figure 1 shows our experimental process. Firstly, 10 cast parts are marked using each optimization concept. Afterward, the T6 heat treatment and 10 s of sandblasting are carried out for all marked cast parts. Finally, the code quality is evaluated for each status with a 1D/2D code reader, Keyence SR-2000, according to the ISO/IEC 29158 standard.

2.2 Cast parts material

In this work, the Al-Si alloy cast parts were cast using a permanent mold casting process. The chemical composition (Table 1) was measured by the Foundry-Master Pro2 spectrometer from Hitachi High-Tech Analytical Science GmbH. The hardness of the cast part is approximately 70 HV5, measured with NEXUS 8100.

2.3 Dot peen marking setup

The dot peen marker is a Mega-Marker produced by Schilling Marking Systems GmbH [3]. Table 2 shows the setup parameters for the dot peen marking process. Moreover, three different dot peen forms are tested (fig. 2):

> The original form is the reference,
> the second form, whose appearance is like the stamping tool, is designed for the painting process with adhesive tape,
> the last form is a pyramid, which changes the symbol contrast by changing the dot form.

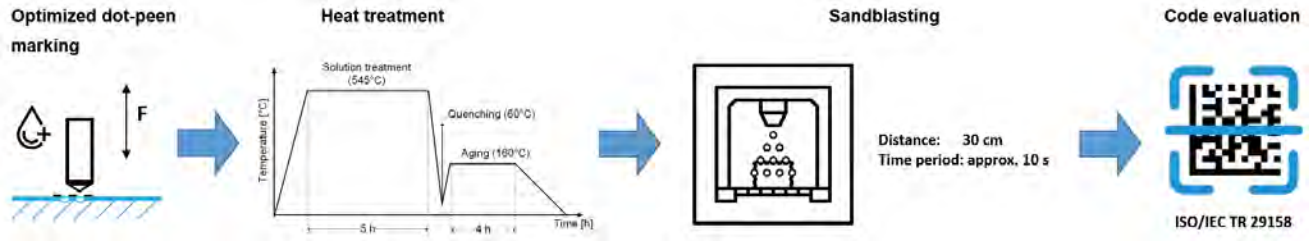

Figure 1: Experimental process.

Table 1: AlSi Alloy Chemical Composition.

Element	Si	Mg	Ti	Fe	Zn	Sr	Cu	Mn	Al
Wt-%	6.2–7.2	0.32–0.34	0.12–0.14	0.06	0.02	0.0002	0.001–0.003	0.003	Base

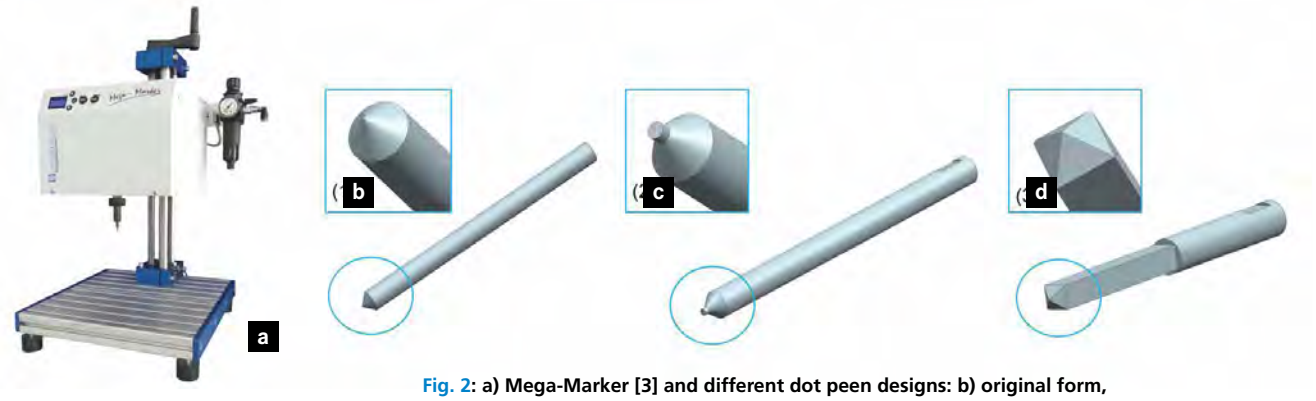

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Fig. 2: a) Mega-Marker [3] and different dot peen designs: b) original form,

2.4 Optimization concepts

In our work, four concepts were tested to optimize the dot peen marking method. Figure 3 shows the sketch process for each concept with different dot-peen forms:

> In the first concept, the dot peen form is changed to a pyramid design, which may change the direction of the reflected light.

> In the second concept, the high-temperature paint, ThermoDur 600, is sprayed onto the as-cast surface, then the dot peen is stamped into the as-cast surface. In this case, the painted background and stamped white dot produce a high contrast between the code and background.

> In the third concept, the process sequence is reversed. Firstly, the dot peen is stamped, and then the high-temperature paint is sprayed on the stamped surface. Finally, the paint on the background is cleaned with an ethyl-based cleanser. In this way, the painted dot and metal-appearance background also produce a high contrast.

> In the last concept, black adhesive tape is stamped into the dot holes with the stamping-design peen. The residual tape is then removed. We tested six black adhesive tapes made of different materials, the textile tape, Tesa 4541, left the tape part in all dot holes. Therefore, we use this tape for further tests.

3 Results and Discussion

The quality of codes marked with the original dot peen marking process and the four above-introduced optimized concepts are scanned and evaluated according to the ISO/IEC 29158 standard. Moreover, the topography of the original dot peen code and code painted with high-temperature paint is also scanned with a laser scanning microscope (Keyence VK-X100).

Table 2: Set-up parameter for dot peen marking process.

Model	Mega Marker
Pressure	4 bar
Distance to marked surface	3 mm
Pulse duration	3.0 ms
Feed rate	15 mm/s
Frequency	80 Hz
First impulse	1.5 ms

3.1 Code quality evaluation protocol

Figure 4 shows the comparative evaluation of the code quality produced by the original dot peen marking and the four optimization concepts. For the original dot peen code, the code recognition and results under all criteria decrease noticeable after heat treatment and sandblasting. The pyramid-design dot peen does not improve the code quality after the raw part processes. The quality of codes without treatment is even lower than the original cone dot peen. For the background painted with high-temperature paint, the general code quality is improved, especially after heat treatment. However, the code quality decreases to a minimal level after sandblasting. The painted dot codes perform better after heat treatment and sandblasting process than the original dot peen codes. The last concept, the codes painted with textile tape, show nearly no improvement for most criteria except for decode time.

Though the ISO/IEC 29158 standard can give detailed code quality in different criteria for dot-peen codes, the total evaluation depends strongly on the worst performance among these criteria. This evaluation system based on the ISO/IEC 29158 standard is designed for the square code cells, such as

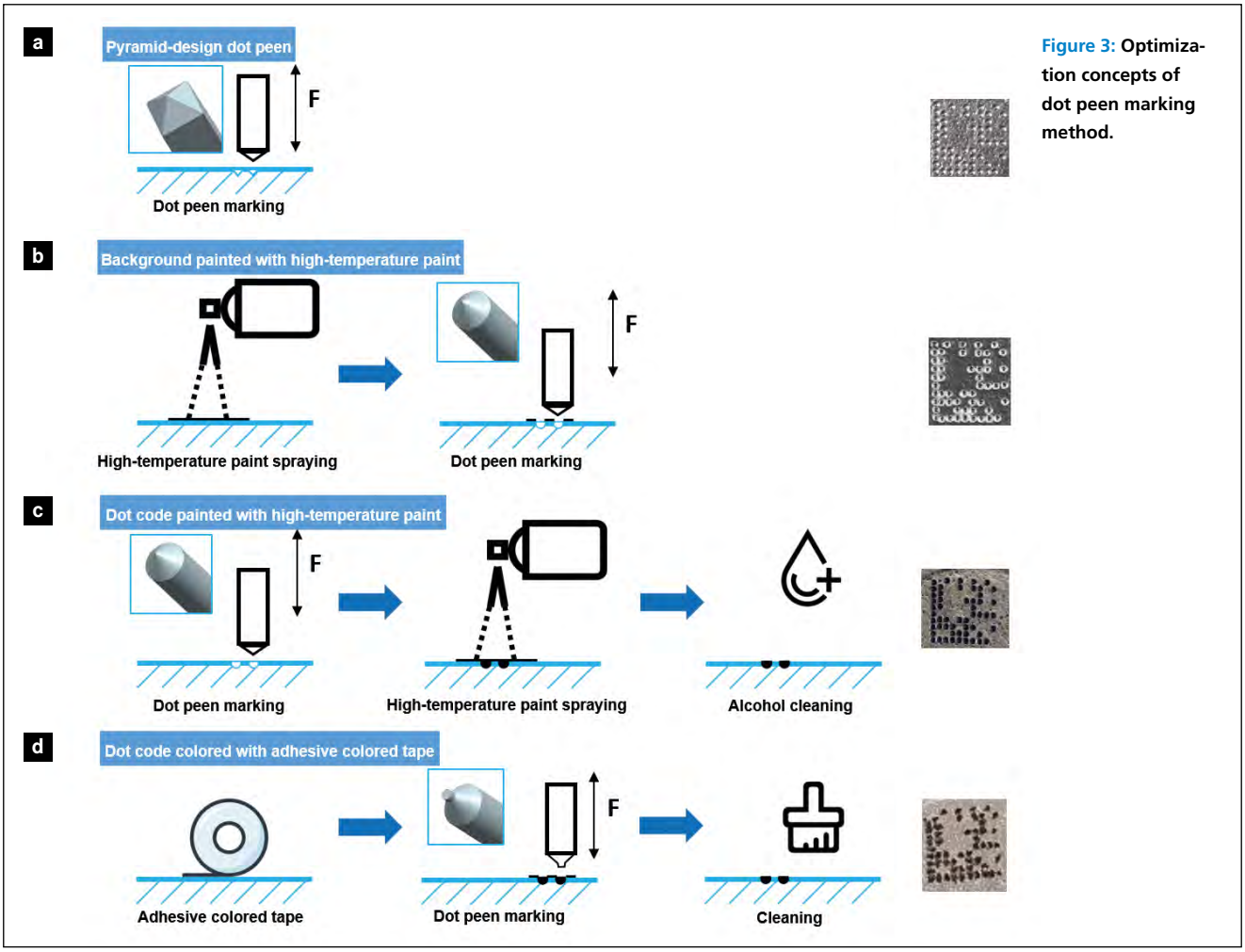

Figure 3: Optimization concepts of dot peen marking method.

laser-marked codes, instead of the round cells of dot-peen codes. Therefore, the total evaluation is always low even when the decode rate is high. This standard is not suitable for dot-peen codes to get the total evaluation.

3.2 Code topography

The marking symbol topographies of the original dot peen marking and the two optimization concepts with the best performance, dot code, and background painted with high-temperature paint, are scanned. Figure 5 shows the changing topography of the dot codes after heat treatment and sandblasting. For the painted dot code, the paint is almost completely preserved in the dot holes, even after sandblasting. This could explain why the painted dot codes perform better than the other optimization concepts.

4 Conclusion

Our work focuses on the optimization of dot peen marking at different stages. Taking into account the code quality evaluation and scanning results, we can draw the following conclusions:

> The dot hole painted with high-temperature paint has the best performance during heat treatment and sandblasting.

> The ISO/IEC 29158 standard is not suitable for the evaluation of dot-peen code quality.

In the future, further development of the automation is necessary for the painting process. Moreover, an algorithm for the quality evaluation of round dot-peen codes will be developed. In this way, the optimized dot peen marking process can meet the requirement of cost and performance along the raw part machining process.

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Acknowledgment

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References:

[1] Kopper, A. E., & Apelian, D.; International Journal of Metalcasting (2022), 16 (1), 93–105. https://doi.org/10.1007/s40962-021-0

[2] IATF 16949 (2016); Quality management systems, International Automotive Task Force (IATF).

[3] Nadelpraeger Mega-Marker, www.schilling-marking.de/nadelpraeger/pneumatik/mega-marker.html, seen on 23.01.2023

[4] F. Deng, R. Li, S. Klan, W. Volk; Inter Metalcast 16 (2022), 1122-1139. https://doi.org/10.1007/s40962-021-00661-0

[5] Information technology — Automatic identification and data capture techniques — Direct Part Mark (DPM) Quality Guideline, ISO/IEC 29158:2020. (2020).

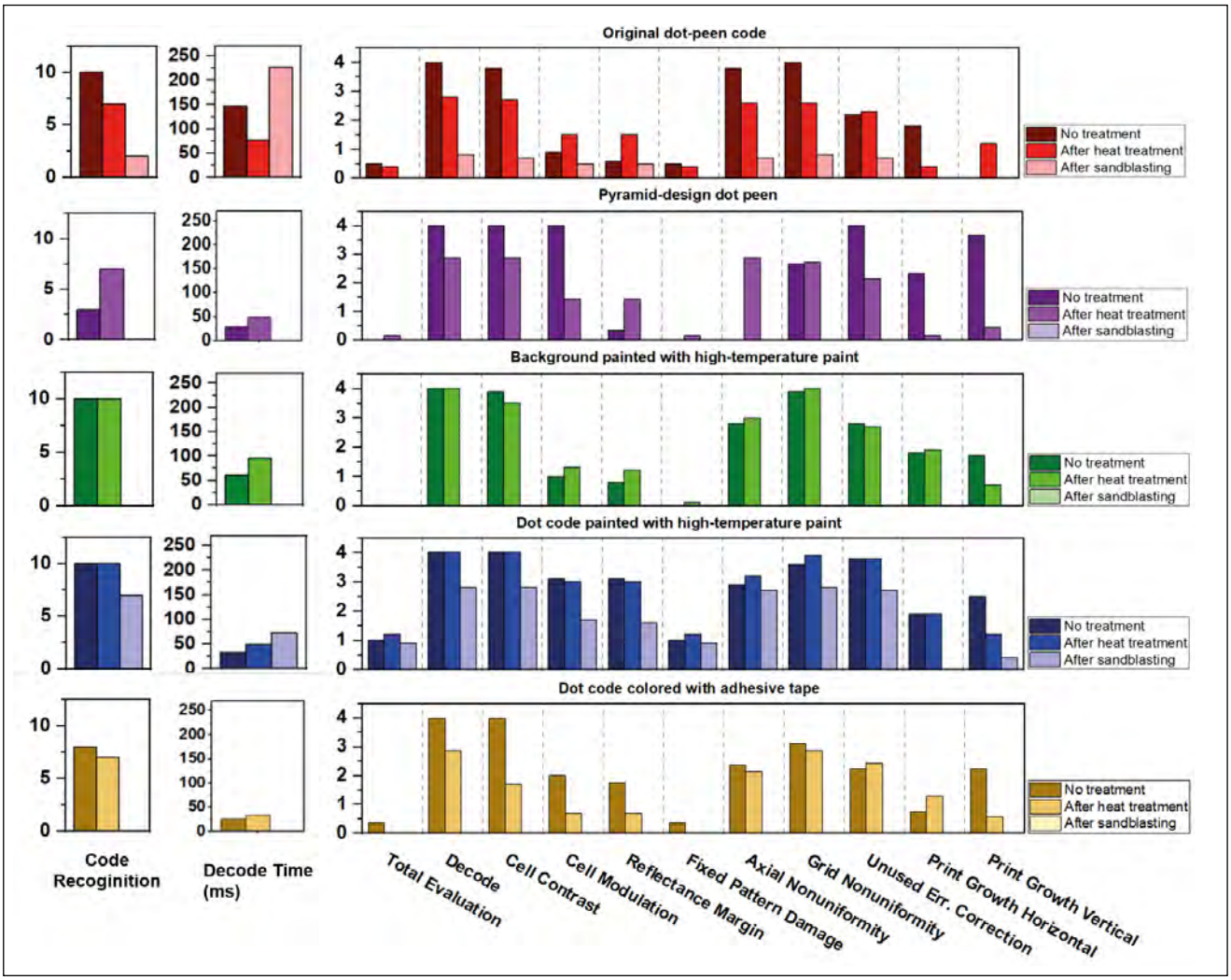


Figure 4: Comparative code quality evaluation in aspects of code recognition, decode time and 11 criteria of the ISO/IEC 29158 standard.

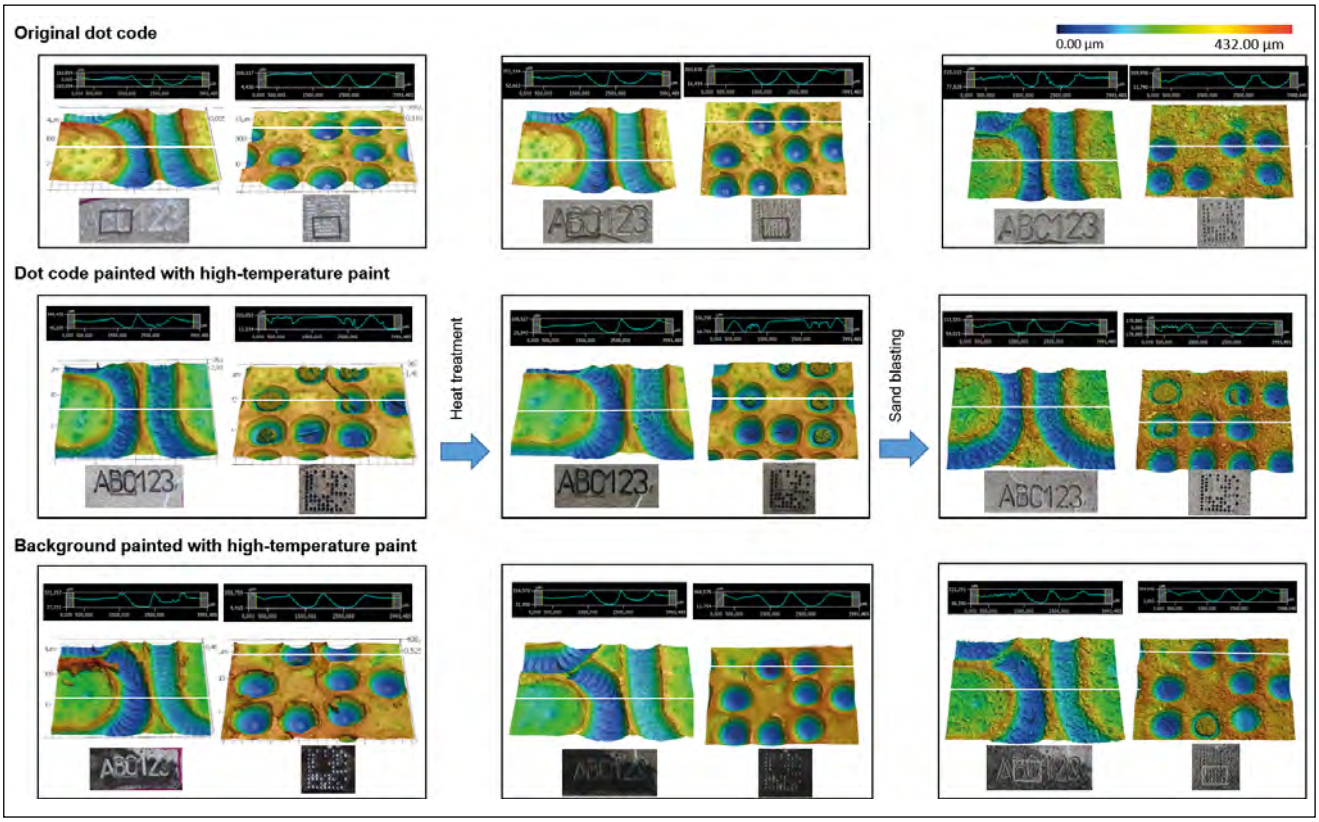


Figure 5: Scanned topographies of original dot code, painted code, and painted background.

Photo: Darius Soschinski/BDG

With the help of AI, the best possible sequence planning can be determined in a given computing time.

Production planning

Optimal use instead of waste: better planning of machine capacities

In (almost) every production there are bottleneck machines that determine the cycle rate of a complete production area and therefore require the special attention of production planning. For this task software tools are available. But practice shows: Even if these tools are used and the planners take the potential bottleneck into account, there are still repeated stagnations and delays in production.

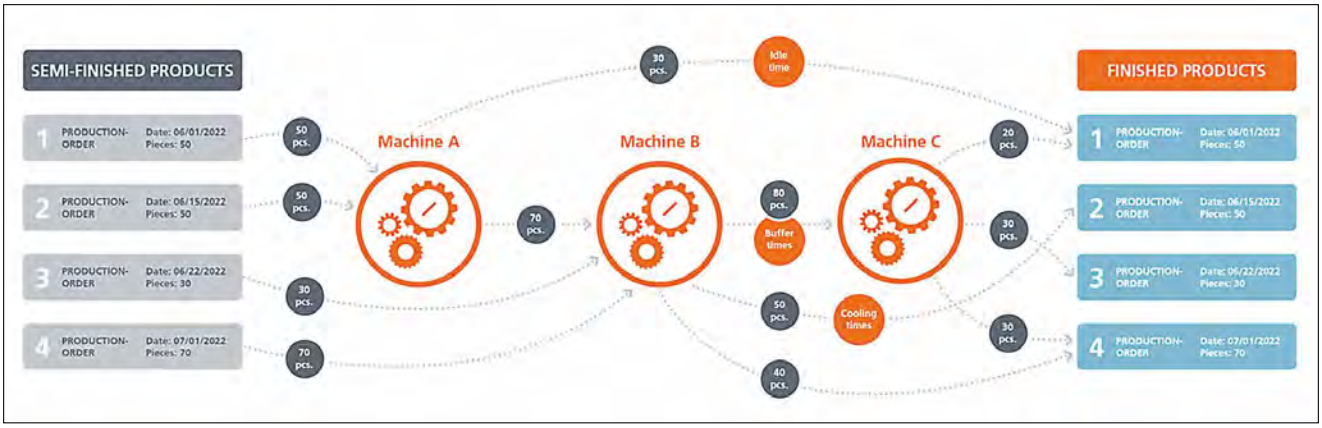
By Gerald Scheffels

The reason: The software can very well monitor the operation of the machine and ideally also optimize it. But it lacks a view of the environment – with the result that the supposed "problem machine" runs perfectly and consistently delivers top performance, but now the upstream and downstream processes cause problems.

The consequence of this: A software tool that optimizes only a single plant in interlinked production is clearly "suboptimal". Production planning systems, PPS for short, are used in many places. Although these are helpful, they only consider the manufacturing processes schematically sequential, comparable to a string of pearls. Dependencies between work centers, real-time data and time stamps are not considered here. Therefore, it remains a "theoretically" possible plan. Even with such a tool, bottlenecks can occur, as the more or less painful experience in many companies proves.

Optimizing the production process – but how?

Is there another way, that means a better one? Sure. One example: In a pilot project, an automotive manufacturer consistently collected and analyzed data in its body construction to optimize processes. The result: 15 % more car bodies can now be produced per time unit.



Graphic: ifm

Fig. 1: In the so-called pegging, the dependencies of all workstations are determined for each order to be processed in the period under consideration.

However, one must add: An entire team – including scientific monitoring – has worked on this project, and around two billion data records have been examined, correlated and evaluated with algorithms. This may be possible in automotive series production, but not in "normal" industrial production – apart from the fact that evaluating the data and implementing the findings requires a lot of time and expert knowledge.

Artificial Intelligence (AI) is required

The question that arises is: Is it possible to go one size smaller? This is where an AI-based algorithm comes into play, which is used to mathematically determine the best possible result in a prescribed computing time. The first algorithms already existed in ancient times and have proven their worth since then. Nowadays, such methods are used, among other things, for the evaluation of random samples. The new software tool GIB GXM Factory Optimization Excellence (FOX) from ifm is also based on an AI-based algorithm and thus enables simultaneous and optimal planning of all work centers in the plant.

Optimal and simultaneous scheduling of several machines or work centers

That doesn't sound spectacular at first. But to fulfil this function practice-oriented, the software must consider all requirements, dependencies, orders and capacities and put them in relation to each other. The volume of data to be considered is staggering. A team of experts as described above would take months to calculate: not an ideal situation for rolling planning or a planning horizon of one to two weeks.

Calculate the "best possible" production plan

The AI-based algorithm of the ifm solution ensures that all resources and requirements across all orders considered and across all available machines are combined into a real feasible production plan. The system then calculates another plan with the same data, compares the results and rejects the worse plan. The system calculates new production plans, compares them and keeps the better one until the given time limit is reached. The best plan at that time is then passed to the production planner.

But the intelligent algorithm is only part of the groundbreaking ifm solution because even mathematics at the highest level needs the right data. In the so-called "pegging", the dependencies of all work centers are determined for each order to be processed in the period under review (fig. 1). This also includes time stamps, for example, downtimes and set-up times. In pegging, the complex network of manufacturing operations is "unraveled" and can then be used to calculate the production plan.

The combination of AI and pegging brings clear advantages

The use of resources can be planned much better and thus waste can be stopped. An example: A bottleneck machine causes a jam in the production flow. The consequences: The order cannot be completed on time, the downstream machines and workers are at a standstill, and the intermediate products from the upstream processes have to be stored temporarily. This costs storage space and empties

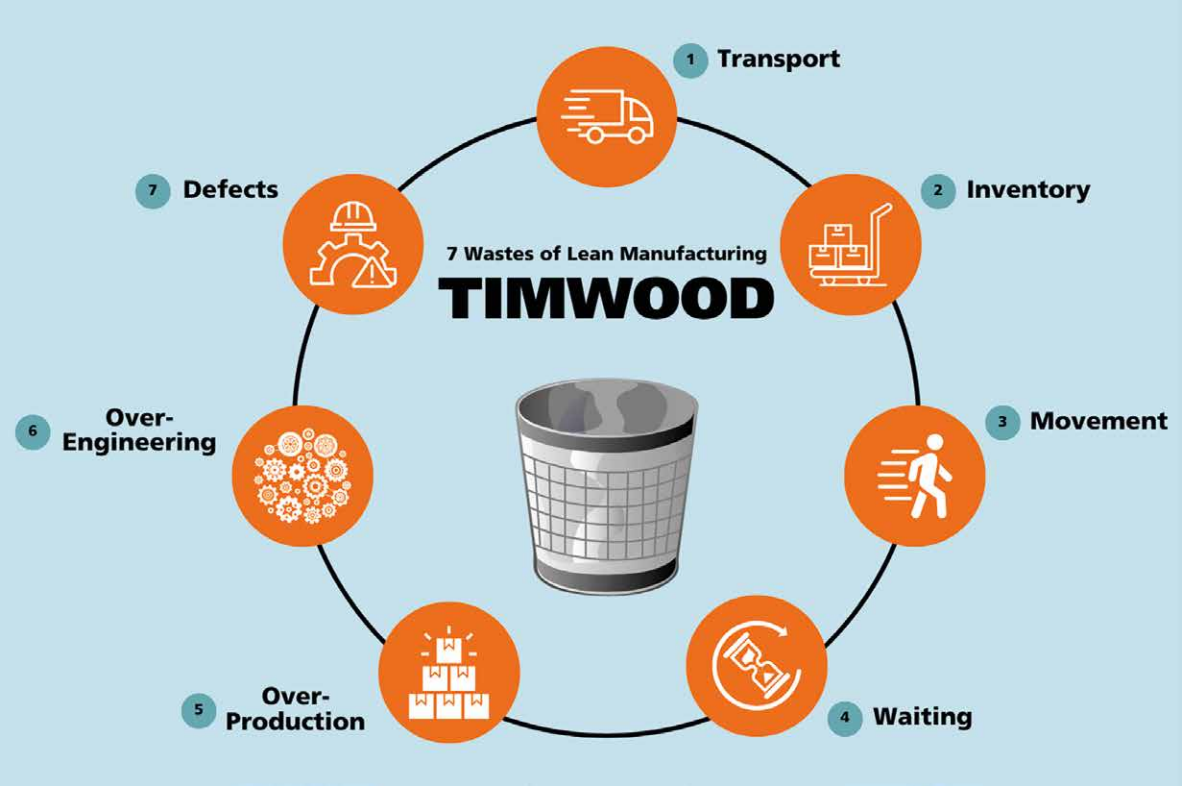


Fig. 2: The seven types of resource waste.

Graphic: ifm

and increases capital commitment. And this can, as seen above, be avoided.

The throughput is accelerated because waiting times, downtimes and set-up times are coordinated. This reduces operating costs and ensures even capacity utilization. In addition, Overall Equipment Effectiveness (OEE) is increased and overall output raises without having to increase production speed to critical areas or arrange extra shifts.

More precisely, the new software offers sevenfold benefits. That's because it addresses each of the seven types of resource waste that exist in the supply chain. These wastes are known by the acronym "TIM WOOD": Transport, Inventory, Movement, Waiting, Over-Production, Over-Engineering, Defects (fig. 2).

A concrete example from manufacturing:

> **Transport** – Parts and materials are transported from one place to another
The material supply to the work center is adjusted to the production plan in terms of time and capacity. This avoids waiting times, material bottlenecks and oversupplies.

> **Inventory** – unfinished (intermediate) products or components; warehouses of vendor parts
Instead of building up buffer stocks to bridge "feared" bottlenecks, all orders are manufactured in time. Less inventory means lower costs.

> **Movement** – Unnecessary movements of employees or machines
Instead of constantly working on disruptions in the process and thus only playing fire department, materials and people can be used optimally and stress-free. Workarounds as a result of disruptions are obsolete.

> **Waiting times** – e.g. for delivery of purchased parts or intermediate products
Delays due to jams in the production process belong to the past.

> **Over-Production** – Production "on stockpile" without (internal or external) customers
The user does not have to plan buffers for supposed bottleneck machine systems. This manufactures based on "real" orders.

> **Over-Engineering** – Adding features that do not bring value
Instead, the algorithm determines a solution that provides high efficiency within a performant time limit and does not strive for a perfect plan, but for the best strategy. At the same time, it remains "lean" and does without complex analysis options, for example, which have a counterproductive effect on transparency and usability.

> **Defects** – Parts must be reworked
Sudden changes in plans, rescheduling of resources to other machines and work centers and unplanned downtimes: Such irregularities often lead to errors in production. This can also be avoided by combining AI and pegging.

Conclusion: This makes it easier to plan the use of resources and thus stop waste.

In all seven "pain points" of the internal supply chain, the new software tool can reduce waste and optimize the use of existing resources. This applies to the "stand-alone" operation of GIB GXM FOX and – to an even greater extent – also to its use in combination with other IIoT tools from ifm, which address the topics of maintenance and track and trace quality, for example. The tool is also recommended as an add-on to the core GIB products, which, among other things, identify dead stocks as well as surpluses and shortfalls, optimize ranges and balance safety stocks.

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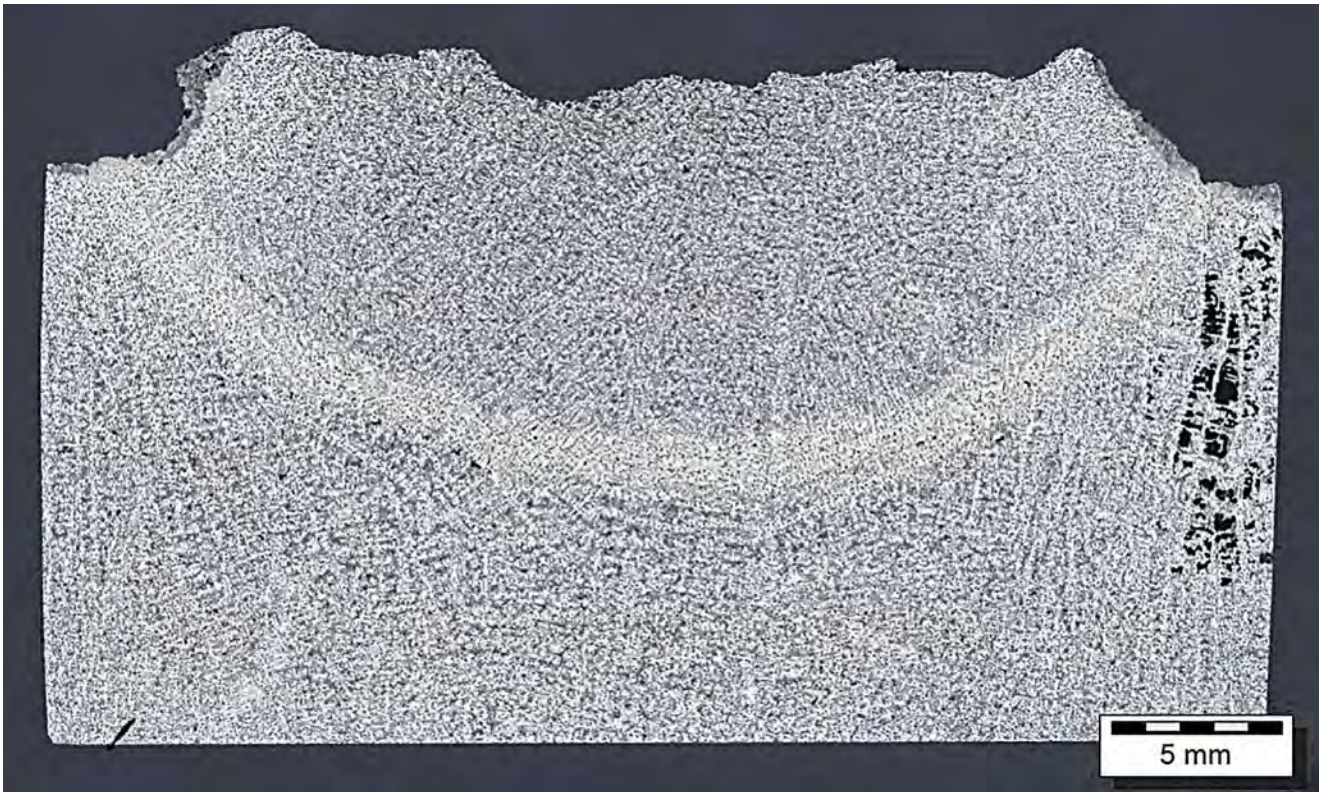


Photos and Graphics: ÖGI

The causes of typical defect appearances could now be clarified.

Quality management

Casting defects at the riser seat of GJS castings

The Austrian Foundry Institute (ÖGI) performs research on the origin of casting defects and their prevention, among other things. The motivation for this is to investigate the defects together with foundries and casting users to offer solutions for quality optimization. A specific, or in fact, several related casting defects in the area of the riser seat of GJS components have been the subject of extensive investigations at the ÖGI over the past 10 years. With a special macroscopic representation of the affected area around the riser seat and based on the scientific description of this topic in the literature, it is now possible to present clear approaches for solutions.

By Hubert Kerber and Albert Jahn

After the feeder has been knocked off, casting defects repeatedly occur at the riser seat, which impair the quality of the castings, must be mended at great expense or even lead to rejects. This article presents the work carried out over many years on the causes of these various defects and possible solutions.

Fault appearance

Macroscopically, after the feeder has been knocked off, plate, slate and depression fractures, crater rings, porosity clusters as well as small, but unrepairable shrinkage cavities are visible (fig. 1 and 2), even though the feeder is sufficiently large. Often one gets the impression that the riser did not work properly, as it still remained more than three quarters full.

Microscopically, one primarily recognises graphite spheres arranged in rows (nodule alignment), often embedded in striking ferrite bands in the perlitic microstructure. The microstructure also shows graphite degenerations and inclusion accumulations, mostly in the

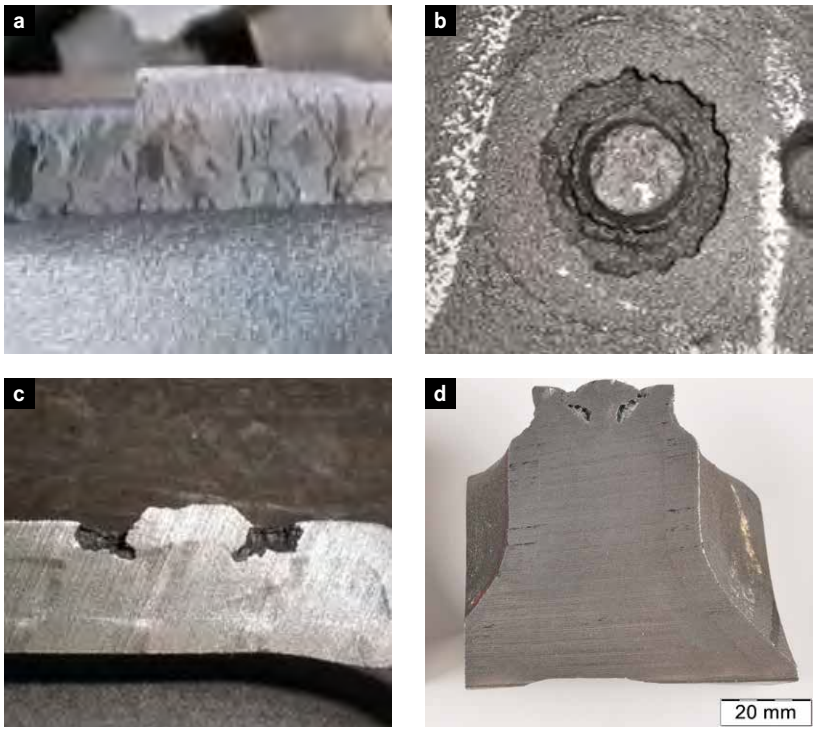


Fig 1: **Macroscopic appearance of non-repairable defects on the riser seat of GJS castings that emerge after the risers have been knocked off: a) plate and b) slate fractures, c) crater rings, d) small shrinkage cavities.**

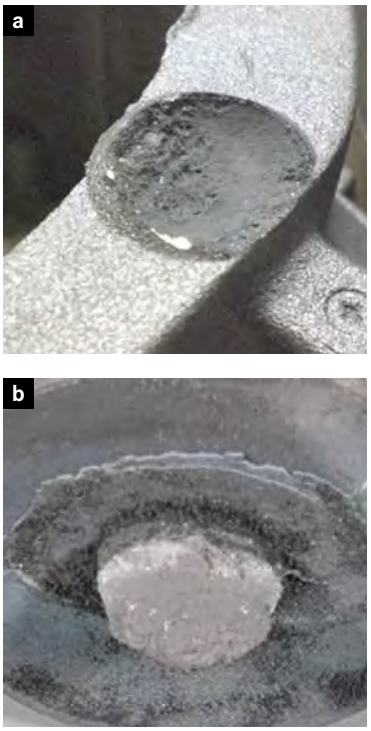


Fig. 2: **a) depression fracture on the casting and b) remaining cone on the feeder.**

area of the graphite cords (fig. 3) and degenerated spheres. The nodule lines and similar structures, which we see in in the 2-dimensional metallographic specimens are plane areas in the 3D-volumina. At the edge of the feeder neck, clusters with GJL lamellar graphite or GJV vermicular graphite are often observed, but sometimes there are also large areas of chunky or vermicular graphite as well as strange semicircular bands (see initial photo), which can lead to depression fractures when knocked off. Semicircular bands are difficult to interpret from a purely microscopic view of the microscopic specimen.

What does the literature say?

These faults have been described in the literature since the early 1980s, but until 2010 there were only vague assumptions about the origin of the conspicuous graphite cords and the formation of the plate and depression fractures (fig. 4). Promising solutions were missing [1-4]. It was not until the research work of Dr. Heckmann [5] in 2009 and 2010 (then IfG Duesseldorf), which is described in detail and briefly summarized in the chapter "Experimental and numerical simulation", that the plate fractures were systematically ana-

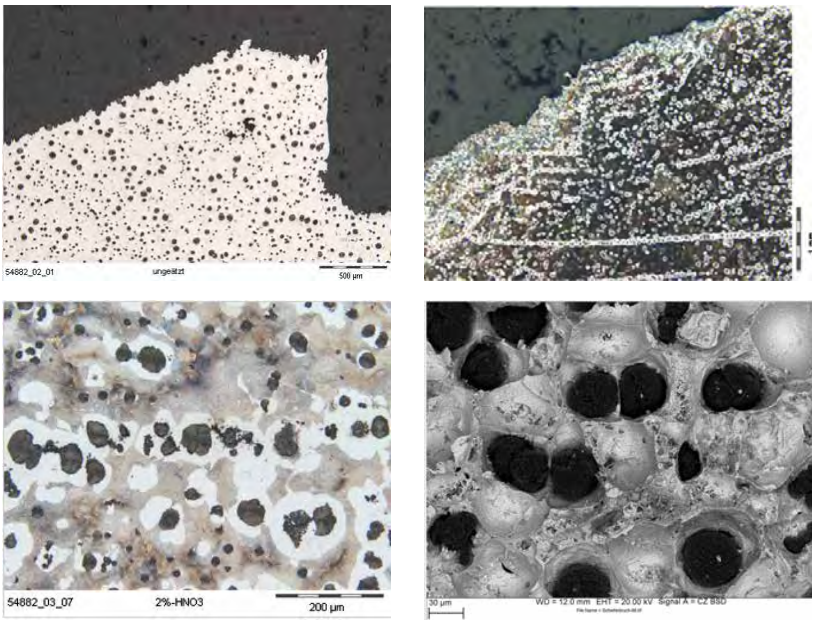
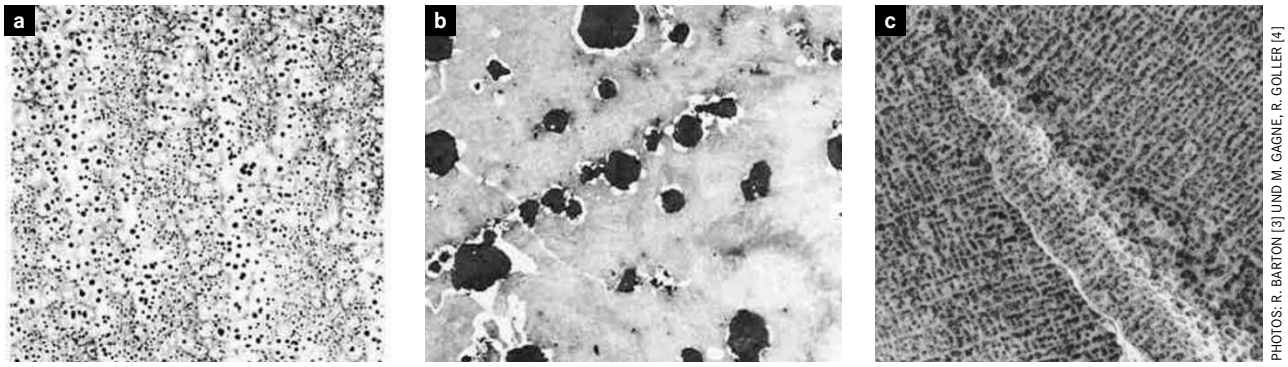


Fig. 3: **Spheroidal graphite rows embedded in ferrite bands associated with clusters of non-metallic inclusions.**



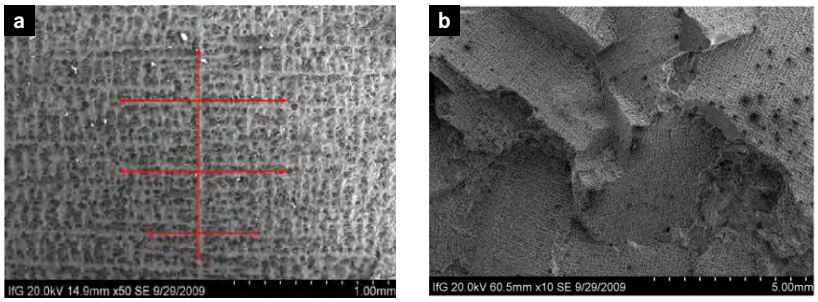
PHOTOS: R. BARTON [3] UND M. GAGNE, R. GOLLER [4]

Fig. 4: Typical micrographs: a) ferrite bands, b) spheroidal graphite rows and c) large-area dendrites.

lyzed (fig. 5) and specifically reproduced in test series. This made it possible to identify the causes of these defects by simulating the solidification process in the critical feeder neck area.

Processes in the riser seat

It is noticeable that there is an impeccable GJS structure the upper area of the riser. The feeder itself often appears somewhat oversized and has only little feeding effect. Even a few centimeters below the riser seat in the casting, the GJS structure is perfectly fine as well. In the area in between at the riser seat, where the riser neck is supposed to be, there are apparently metallurgical conditions of their own that are significantly different from the solidification processes in the surrounding area. The above mentioned defects, such as GJL and GJV islands, burst spheres and non-metallic inclusions arise. Above all, however, we see very coarse dendrites. This was discovered very late in all these investigations and also in the literature. Between the dendrite arms the rows of graphite spheres are arranged, which can be recognized in the cut as nodule alignment. All these defect phenomena



FOTOS: C. J. HECKMANN [5]

Fig. 5: SEM image: a) large-area dendrites, b) plate fracture.

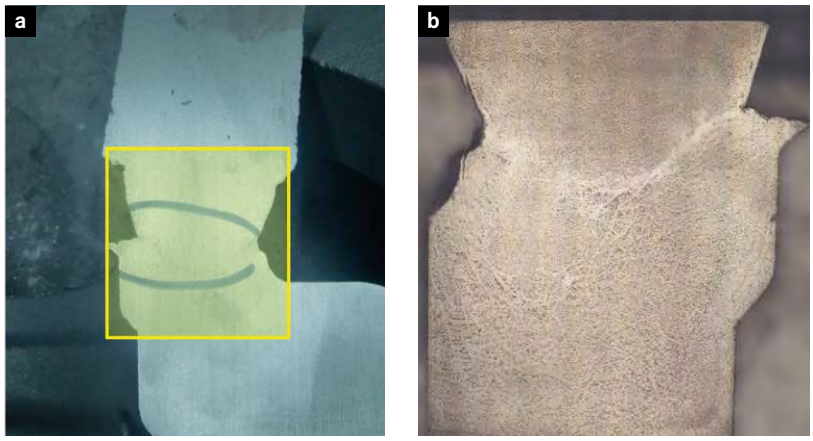


Fig. 6: a) Casting section with riser and riser connection, b) nital etched macrosection from this area.

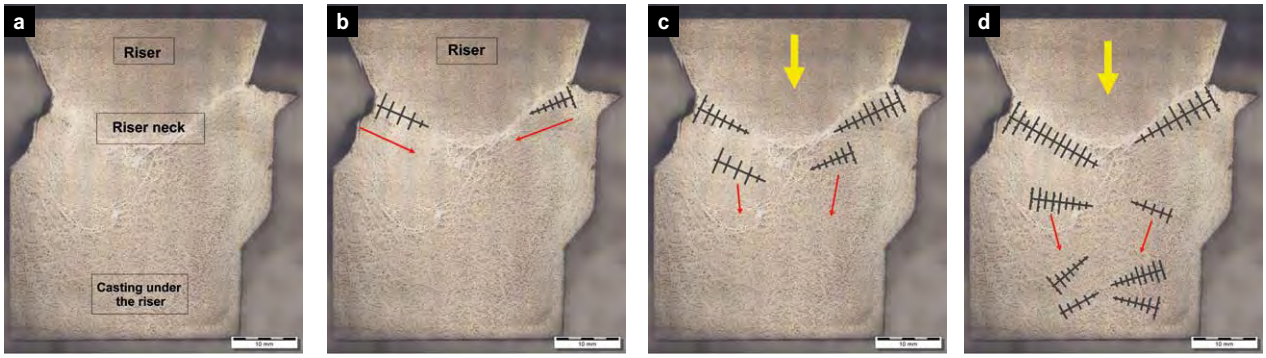


Fig. 7: a) – d) Solidification sequence in the critical riser neck area, with formation of very coarse dendrites and the above-described casting defects.

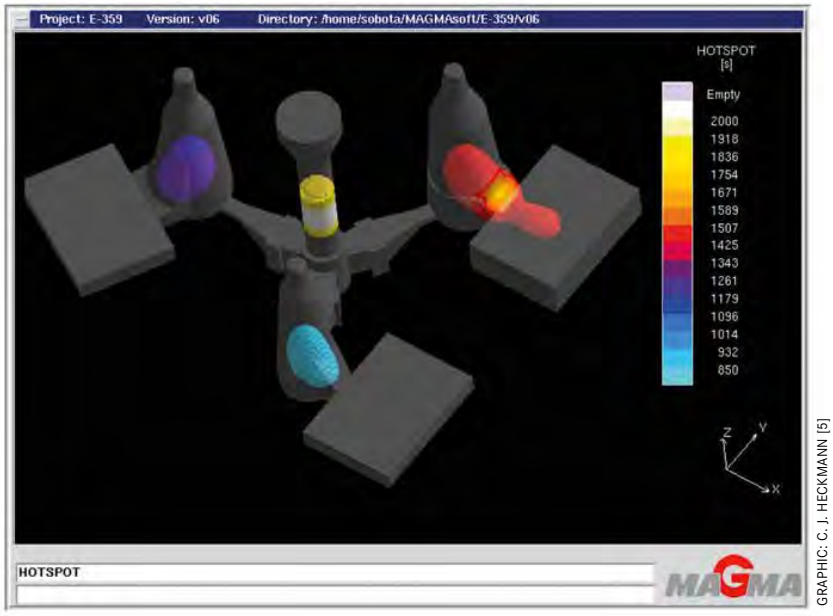


Fig. 8: Test set-up for the experimental analysis and numerical simulation of the solidification conditions in the feeder neck area, which can lead to plate and slate fractures.

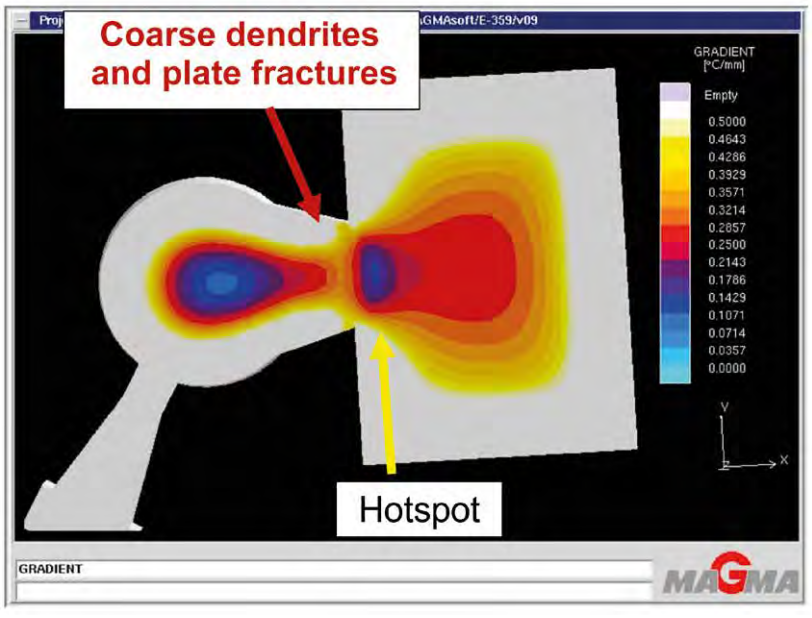


Fig. 9: Numerical simulation of the temperature gradient in a plate-shaped casting sample with feeder and incorrectly dimensioned feeder neck. This results in the formation of a hot spot just next to the feeder connection. In combination with the thermal center in the feeder, very long liquid times in the feeder neck are effected. As a result, the coarse dendrites and the described defects in the area of the riser seat occur.

point to one essential fact, namely an extended liquid phase and long solidification times in this critical area of the riser seat.

Macro-map of microstructure

A macroscopic observation of the affected area was made at the ÖGI. For this purpose, a large section which covers a part of the feeder, the feeder neck (the feeder connection) and the casting was prepared as a micrograph (fig. 6 a). In the etched state (fig. 6 b) this section shows a microstructure map with indications of the solidification process in the riser seat area. This so-called Macro-Map of Microstructure is composed of up to 60 individual microscopic images and therefore reproduces the macroscopic overall picture in clear focus (see also initial image). Figure 7 shows the sequence in the final solidification process.

Due to a near solidification stop in this area, extremely large dendrites grow from the edge to the center. This dendrite growth, corresponding to the hesitant heat dissipation in this zone, occurs very slowly from the edge to the center of the neck of the riser. We know that there is a sandy edge or crushed core in this area that heats up and retains heat in an unfavorable way. Inclusions are formed, especially in heating feeders (exothermic reactions) but also in natural feeders. These attach themselves to the slowly growing dendrites and are pushed towards the center in between the dendrite arms.

Due to the still sucking casting – the solidification is still in progress – this conglomerate of dendrites, spherical mats and inclusions is pulled downwards or into the casting (the feeder can also be tied horizontally). This process continues until solidification is also complete in this critical feeder neck area. The result is a remarkably inhomogeneous macrostructure below the feeder neck in the casting.

The graphite spheres stored linearly and two-dimensionally in the spaces between the dendrites, which often are formed as irregular compact graphite (form IV) and are associated with inclusions, result in the ferrite bands in the pearlitic microstructure. The two-dimensional section shows a narrow ferrite band, the three-dimensional image under the scanning electron microscope (SEM) shows very coarse dendrites, which lead to two-dimensional plate fractures. Often, porosity clusters are visible.

Experimental and numerical simulation

At the IfG – Institute for Foundry Science – (now BDG-Service GmbH) in Duesseldorf, a large series of experiments (fig. 8) provided the practical basis and measurement data for solidification simulation, which can explain this defect pattern around the riser seat [5]. The significant results of this work are summarized below.

The solidification must be directed from the casting via the feeder connection (feeder neck) into the feeder. This

is only possible if the solidification modules of the casting, feeder neck and feeder are correctly dimensioned, i.e. if the module rule is observed:
$M_{feeder} > M_{feeder\ neck} > M_{casting}$

Especially with pattern plates for semi-automatic molding lines, the feeder neck is often neglected or underestimated (too small) in its dimension and effect on heat dissipation. In addition, a crushing core often causes additional heat accumulation here. Under these conditions, very flat temperature gradients form in the riser neck in interaction with the (correct) thermal center in the upper riser area, so the solidification of the residual melt in the critical area of the riser neck proceeds extremely slowly, one could even almost speak of a solidification standstill. As a result of this hesitant heat dissipation in the riser neck, a hotspot develops adjacent to the riser connection in the casting. This was shown in [5] by means of numerical simulations (**fig. 9**).

The solidification standstill and the slow growth of coarse dendrites are thus comprehensible, as well as the formation of degenerate graphite precipitates and structural inhomogeneities because of the extremely long local liquid times. It is therefore necessary to pay attention to the correct feeder neck dimensioning, with the possibility of heat dissipation into the molding sand. A correct modulus of the feeder neck and the feeder results in the directed solidification from the casting into the feeder. Then these casting defects will be avoided.

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References

[1] Campbell, J.: A Hypothesis of cast iron structures. Metallurgical and Materials Transactions B Vol 40B Dec. 2009.
[2] Sorelmetal: Gusseisen mit Kugelgraphit, Rio Tinto Iron & Titanium Inc. 2004.
[3] Barton, R.: Graphite nodule number and distribution; Foundry Trade Journal 1985.
[4] Gagne M., Goller R.: Plate fracture in ductile iron castings. Transactions of the American Foundrymen`s Society (1983).
[5] Heckmann, C. J.: Verfahrenstechnische Maßnahmen zur Vermeidung von Platten und Schieferbrüchen; IfG Düsseldorf, Forschungsbericht 2009.

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Smart Factory

MES vs. IIoT: Supersede or Complement?

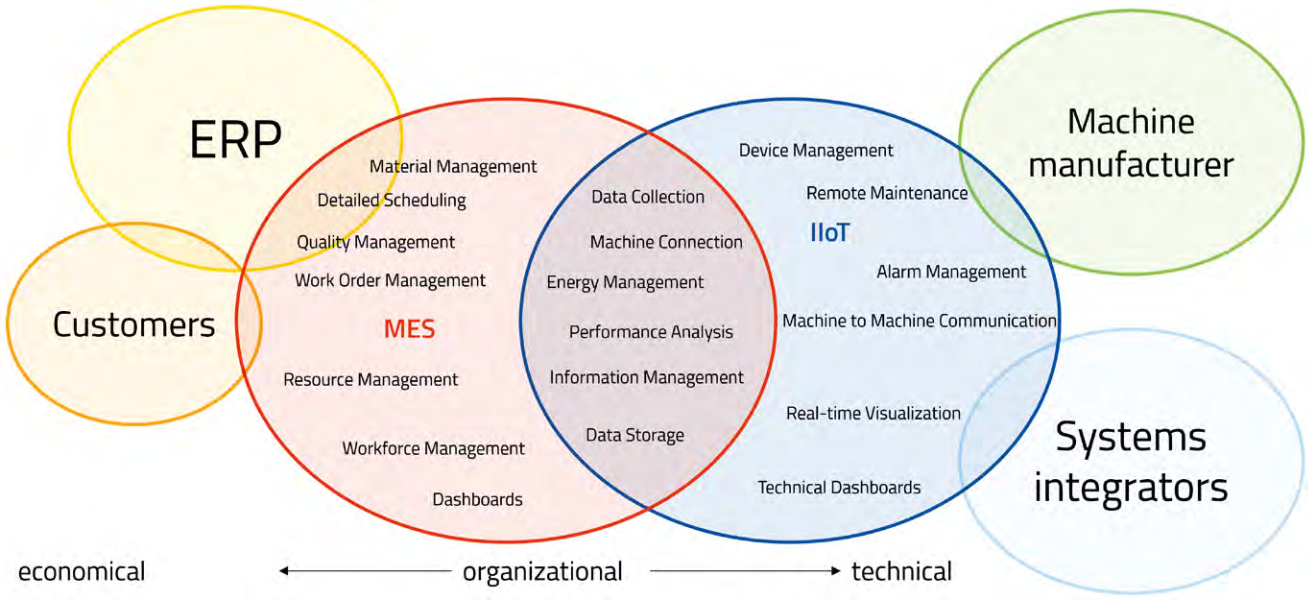
Either – Or: This is a popular method of juxtaposing or playing off two issues against each other. But is there also a middle way? Must there always be a winner and a loser? In the Smart Factory, the Manufacturing Execution System (MES) has been regarded as an established building block for a long time. Lately, however, the Industrial Internet of Things (IIoT) seems to be staking claim for top spot. Find out in this article what this entails and see if it is at all meaningful.

By Markus Diesner

The longer we talk about Industry 4.0, we hear statements like "IIoT is replacing MES" or "after MES comes IIoT". Such headlines sound like a disruptive development, but one that is atypical for the traditionally down-to-earth manufacturing industry. After all, these companies rely on tried-and-tested methods and mature technologies – at least in those industries that involve substantial levels of investment, high production output and/or strong revenues. It is therefore well worth taking a closer look and putting both MES and IIoT to the test. Another question that arises is whether one can or should compare the MES and the IIoT at all, or whether a true substitution is actually possible.

What distinguishes the MES from the IIoT?

First, let us look at the similarities: Both, an MES and the IIoT collect data, process it, and produce a result. Both systems operate in the manufacturing environment and aim to produce more efficiently. Key differences lie in the perspective from which the particular



Graphic: MPDV, inspired by CIM Aachen

Fig. 1: MES and IIoT share a lot of tasks and profit from each other. Further systems like an ERP advance different approaches to production.

application operates and the impact an optimization can have.

The IIoT tends to capture real-time technical data such as temperatures, speeds, vibration, status changes, and the like. As a result, the IIoT gains a technical view of the current situation of a machine or equipment. Processes can be viewed, and predictions made based on historical data. Such a technical perspective facilitates applications such as Condition Monitoring and Predictive Maintenance. Possible optimizations relate to individual machines or equipment or to individual process steps. IIoT software functions are intrinsically linked to assets such as devices, machines, and equipment.

The MES, on the other hand, provides an overall business context for the collected technical data – comprising of data from the Industrial Internet

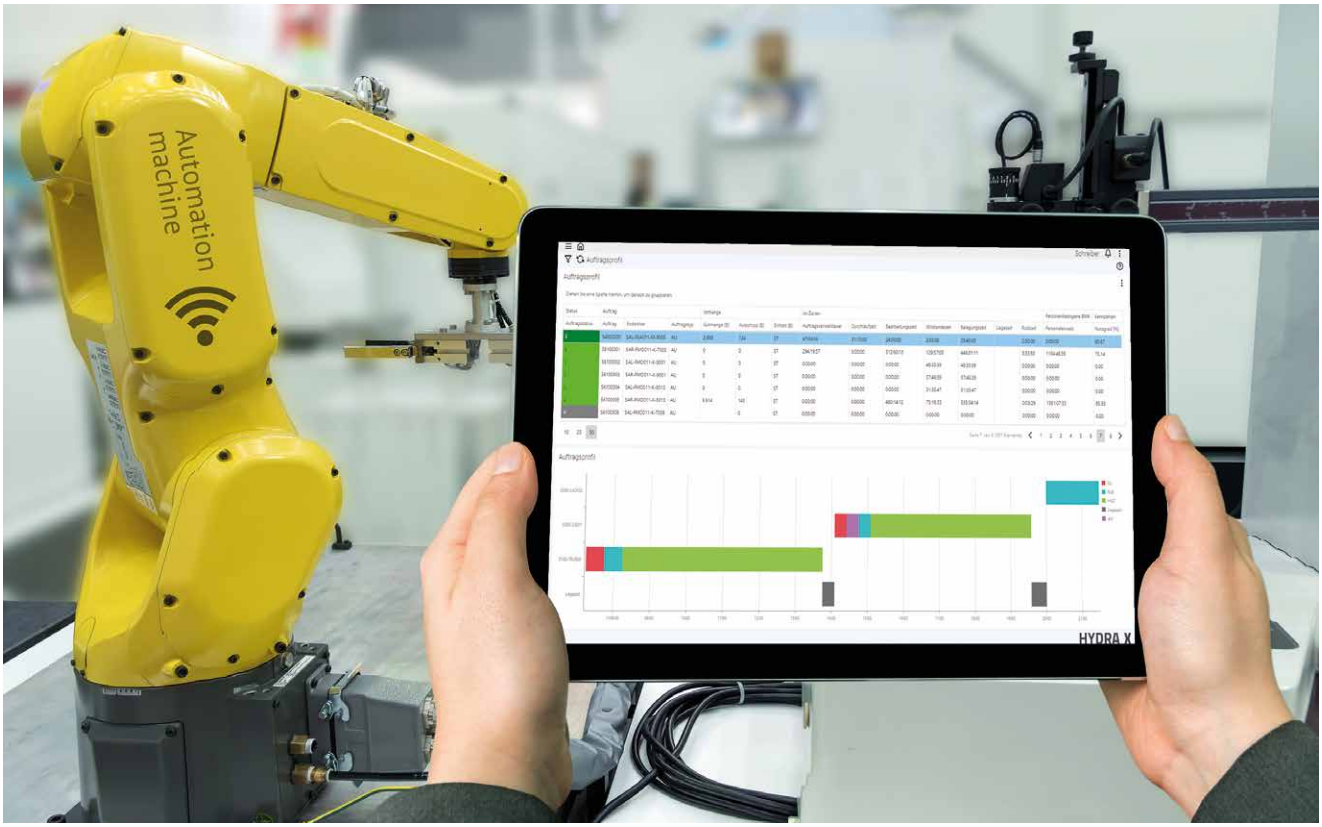


Photo: MPDV, Adobe Stock, zapp2photo

Fig. 2: Manufacturing Execution Systems such as HYDRA X from MPDV expand the technical view of production to include organizational contexts.

of Things as well as data collected directly in the MES. New insights emerge based on known order and product data. An MES not only shows that a part has just been produced, but also whether it is a good or defective part, or to which order the part belongs and how many parts still have to be produced until the order is finished. Furthermore, the MES detects why a machine is at a standstill – for example, if a malfunction has occurred or simply because the machine is being set up for the next order. An MES can be used to take a holistic view of complete manufacturing processes and entire production areas and optimize them by taking this expanded view. As a rule, functions are not geared to specific devices, machines, and equipment but are spanning across all assets and are independent of machine specifics. This extended view in turn forms the data basis for an ERP system and its tasks. It is therefore important to find a clear demarcation here because an MES is not concerned about business processes such as purchasing, materials and production planning, sales, or warehousing.

These tasks are classically performed by an Enterprise Resource Planning (ERP) system. Where the ERP is expecting the manufacture of a product or several parts, an MES comes into play and maps the manufacturing processes much more detailed than an ERP usually does. Even if one or the other ERP takes care of manufacturing issues, the process competence for this lies with the MES, which communicates with the ERP via a comprehensive interface.

Different views

The following illustration of overlapping views of production emerges from examining MES and IIoT (fig. 1):

> The IIoT has a technical spin on things. It's all about utilization of

Fig. 3: In addition to technical data from the IIoT, an MES like HYDRA X from MPDV also understands orders and operations.

Photo: MPDV, Adobe Stock, Blue Planet Studio

machines, and equipment and their performance.
> The MES has an organizational focus and ensures that production processes are transparent and efficient. The aim is to avoid waste such as waiting times or scrap (fig. 2).
> The ERP is responsible for business aspects. It deals with customer orders, invoices, and the profitability of the company.

Only the interaction of all three aspects turns a production facility into a true Smart Factory.

Example: Energy Management

The interaction of IIoT, MES and ERP can be explained clearly with the example of Energy Management.
> The IIoT is looking at how much energy is consumed by individual parts of a machine to optimize the operation of that machine or even predict malfunctions.
> The MES records the energy consumed to produce a specific part or to process a particular order (fig. 3).
> The ERP needs the collected energy consumption to include it in the calculation of manufacturing costs.

Where or by which system the actual energy consumption data is recorded is not relevant. Instead, it is all about the use of this data and their specific context. In modern manufacturing IT, IIoT, MES and ERP are networked so that each system can access the data needed for the task at hand.

Conclusion: IIoT and MES complement each other

So, it's not a question of either/or, but of working together and having different perspectives. The IIoT contributes real-time data with a technical background and the MES puts the data into an organizational or business context. While the IIoT is about machines and equipment, the MES focuses more on orders and processes. Nevertheless, both systems can benefit from each other. For one, the technical data from the IIoT underpins the evaluation of processes in the MES. Then again, the organizational data from the MES extends the technical view in the IIoT. The requirement for this symbiosis of IT systems is a suitable integration or interfaces to ensure that the data exchange between the systems functions seamlessly and that the other system interprets the data correctly. In a nutshell: The Smart Factory needs the Industrial Internet of Things, a Manufacturing Execution System and the appropriate integration platform. We are definitely not talking about substitution or a disruptive development.

www.mpdv.com

Markus Diesner, Senior Marketing Specialist Products, MPDV, Mosbach, Germany

The VX 1000 3-D printing machine enables the printing of models of large construction volumes.

3D printed patterns

Ready for takeoff: PMMA 3D printing and investment casting for aerospace applications

High-quality cast components, for example for use in the aerospace industry, require weight, precision and design freedom, as well as high cost-efficiency, even for small even for small series. The investment casting specialist TITAL relies here not only on the proven wax models as well as 3D-printed plastic models from voxeljet AG.

By Sabine Hensold

TITAL GmbH is specialized in investment casting. For the production of high-quality aluminum and titanium investment castings, the medium-sized company, which has been part of the US Howmet Aerospace group since 2015, relies on 3D-printed PMMA patterns in addition to the lost wax process from its partner voxeljet AG. 3D printing-based investment casting is a particularly efficient tool for TITAL in terms of topology optimization, precision, weight savings and design freedom. It enables:

> fast availability of patterns,
> a high degree of complexity and
> a smooth integration into existing production chains,
> very cost-effective even for small series.

Fig. 1: **A PMMA 3D printed pattern and the part cast from it.**

Table 1: Comparison of milled to investment casting.

Feature	Milled part	Investment casting
Weight	90 kg (raw material)	25 kg (castings weight)
Buy-to-Fly-ratio *	24,3	6,8
Energy for production	1.090 kWh/kg	266 kWh/kg
CO2 produced	650 kg/kg final part	127 kg/kg final part
Scrap	86,3 kg (chips)	19 kg (sprue)
Recyclability	Low	Good to excellent

**Ratio between the mass of the starting ingot and the mass of the finished compo*nent.

Aircraft manufacturing applications

In the investment casting foundry at TITAL, 3D printed PMMA patterns (fig. 1) are used, for example, in the production of the "Channel Fitting" (fig. 2) and "Hinge Arm" (fig. 3) parts. The channel fitting, which measures 1200 x 350 x 300 mm for the Airbus A400M, is located in the landing gear shaft of the main landing gear. It houses the hydraulic cylinder responsible for opening and closing the landing gear door. The Airbus A400M is a transport aircraft with a high payload capacity. "This high payload is only possible if the empty weight is reduced," explains Rainer Sabisch, Director Global Application Engineering at TITAL. "We saw an option to reduce weight by topologically optimizing the design of the channel fitting. After several processes of casting simulation and design optimization, we succeeded with a weight reduction of 17 percent".

The "hinge arm" is found in various types of aircraft. It is the connection between the aircraft fuselage and the aircraft door. TITAL manufactures the hinge arm for the Chinese passenger aircraft Comac C919. Again, TITAL was able to significantly reduce the weight of the part, previously being rather heavy, by 47 percent through topology optimization. "The switch from welded parts to investment casting worked very well in this case", says Rainer Sabisch.

Compared to conventional production from a single bar ("machining from bar"), investment castings score highly in terms of crucial product properties such as weight, energy consumption or CO_2 emissions. Investment casting allows significantly more efficient material use and higher recyclability than milling. The following example of a reference part from a public study by the German Federal Environment Agency illustrates this impressively (table 1). It is a part for an aerospace application cast with TiAl6V4 (dimensions 1030 x 110 x 180 mm).

Wax or PMMA?

TITAL relies on both lost wax casting and 3D printing of PMMA for the production of investment castings. In the lost wax process, the required wax patterns are traditionally produced by injecting wax into aluminum molds. The wax pattern is then fitted with a sprue system. The feeder and riser are glued on accordingly and the entire pattern is covered with a ceramic shell. After the ceramic shell is in place, the wax is melted out. What remains is a hollow ceramic mold into which the molten metal is poured.

The process is similar when using PMMA 3D printed patterns, but with a key difference: instead of aluminum tools for the wax patterns, only 3D data is required. Another advantage is that the sprue system can be printed directly. In addition, making the wax tools takes a certain amount of time, they are not very changeable and flexible but very cost intensive.

PMMA is a transparent thermoplastic material obtained by polymerizing the monomer methyl methacrylate. Due to its transparency and scratch resistance, PMMA is often used as a lightweight and shatterproof alternative to glass and is referred to as acrylic or Plexiglas. In 3D printing, it is processed as a powder and bonded layer by layer (layer thickness 150 µm) with a special binder

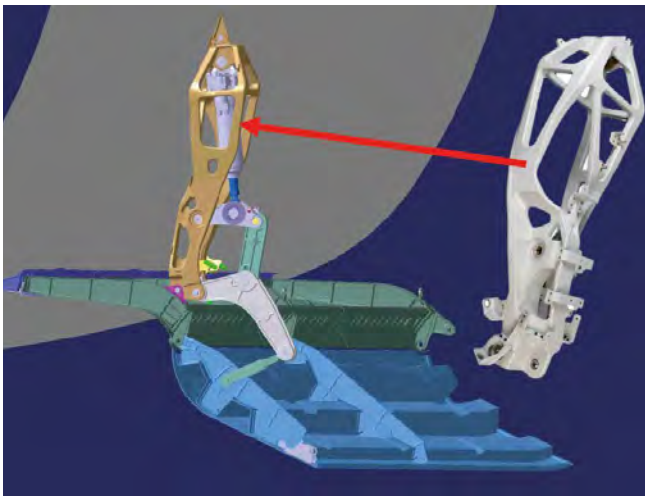


Fig. 2: **The "channel fittings" installed in transport aircraft have a size of 1200 x 350 x 300 mm. PMMA 3D printing and investment casting make it easy to create components of this size.**

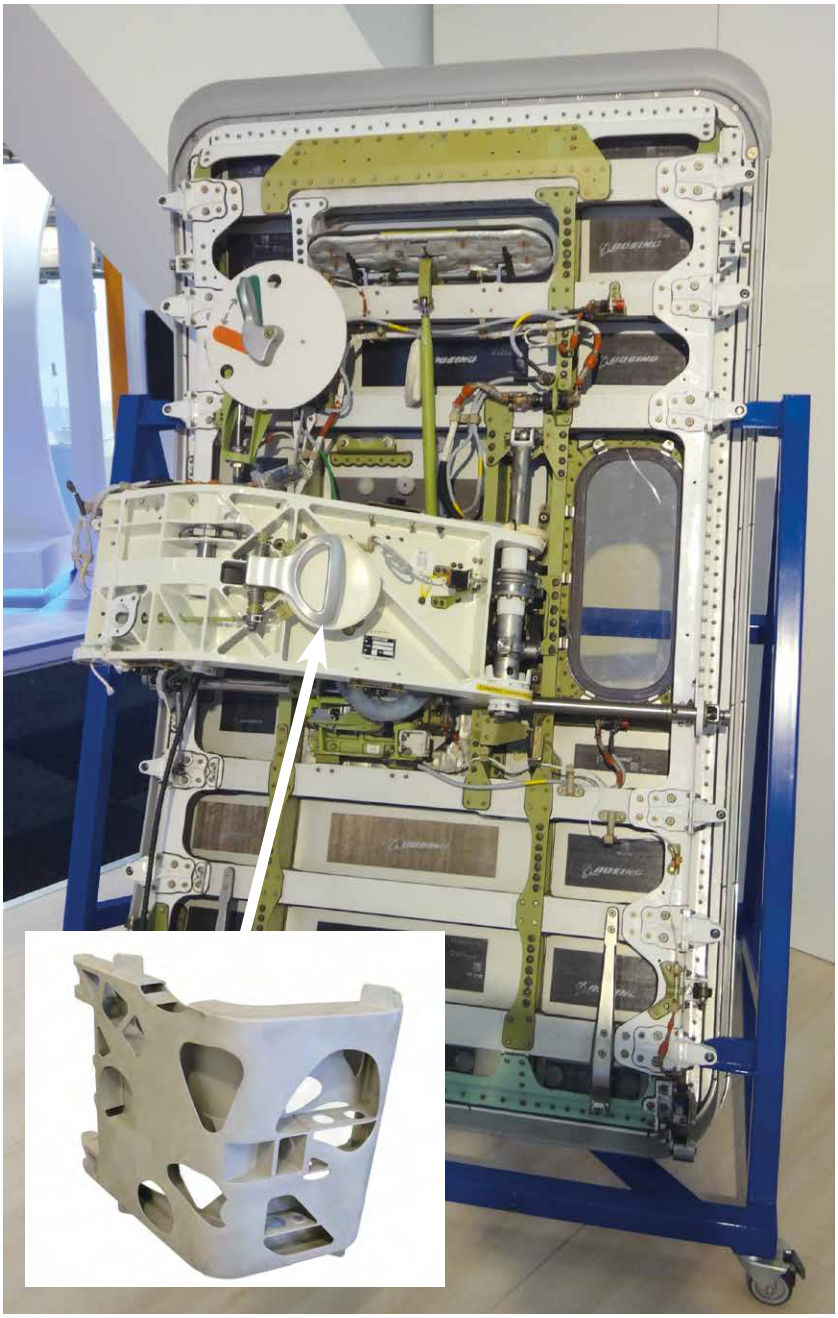


Fig. 3: **The optimized "Hinge Arm" from TITAL in detail: Through topology optimization and the PMMA 3D printing process, the weight could be reduced by 47 percent.**

to form three-dimensional objects. Voxeljets VX1000 is used for this. A large-format 3D printer with a build volume of 1,000 x 600 x 500 mm (fig. 4).

The question is: "When do I choose which process?" Florian Rauscher, Manager On-Demand Printing at voxeljet AG, explains: "The decisive factor is the number of parts needed. In series production, when the quantities become large, wax injection molds are unrivaled and still the first choice. PMMA systems are at their limit here, depending on the complexity of the geometry. Especially for simpler geometries, the tooling costs are manageable and therefore the break-even is relatively low compared to 3D printing. Also, in terms of part cost".

A wax pattern molded over a tool costs less than a PMMA model. However, the production of those necessary tools is very expensive initially. TITAL has the corresponding production equipment in-house. The investment casting specialist can operate them in multiple shifts. The production of wax patterns is much faster, provided the tooling is already in stock. Additionally, higher capacities are possible via the wax injection molds set up in a series compared to PMMA 3D printing. The size of parts is not a factor in either process. TITAL can cast dimensions of up to 1.1 x 1.1 meters via both wax and PMMA, though not in one piece.

Finally, design consistency is another factor. If a motorsport company changes their design every two days, the manufacturers won't be able to keep up with the constant tool changes. In the aerospace sector, this applies to research and development. If a part goes through many iterations, especially in the initial phase, the use of PMMA patterns is more efficient and goal oriented, at least until the basis for series production is reached. Thus, PMMA models are excellently suited for development purposes and small to medium series production.

3D printing tradition

TITAL first encountered 3D printing over 20 years ago. It all started with a toolmaker who, even then, was very active in 3D printing at that time. Back then, they were working with polystyrene. "Polystyrene powder in combination with the laser-sintering process was the first process on the market that we could use to generate parts for our purposes," Sabisch continues. In 2005, voxeljet came along with its new PMMA material set. Ever since, TITAL has been purchasing PMMA patterns from voxeljet, who produces them using the binder jetting process.

PMMA has become increasingly popular and has gradually replaced polystyrene completely. The focus was on dimensional accuracy, less on material properties. It turned out that the dimensional accuracy of polystyrene

ABOUT VOXELJET

voxeljet is a leading provider of high-speed, large-format 3D printers and on-demand parts services to industrial and commercial customers. The Company's 3D printers employ a powder binding, additive manufacturing technology to produce parts using various material sets, which consist of particulate materials and proprietary chemical binding agents. The Company provides its 3D printers and on-demand parts services to industrial and commercial customers serving the automotive, aerospace, film and entertainment, art and architecture, engineering, and consumer product end markets.

Fig. 4: voxeljet manufactures the PMMA models with the VX1000 3D printer.

was nowhere near as good as that of PMMA patterns. Laser sintering is a hot process in which the polystyrene material is melted by a laser. The energy and heat introduced by this process often causes distortion in the patterns. Instead, PMMA models are manufactured at room temperature, which is why no warping occurs and high dimensional accuracy is achieved. Another plus point is the negative coefficient of expansion of PMMA. Instead of expanding, PMMA simply collapses when it encounters heat, like when the model is burned out of the ceramic shell. When the ceramic is enrobed and fired, it is less likely that the shell will break.

Is metallic 3-D printing an alternative?

One of the main reasons for investment casting is the part size. With metal 3D printing (DMLS – Direct Metall Laser Sintering), large-format, topology-optimized structures can hardly be produced. At least not in one piece. Most metal 3D printers offer build volumes averaging 300 x 400 x 400 mm. With PMMA 3D printing, segmentation and subsequent assembly into a single part is possible. This way, customers can produce parts of up to 1.5 m in size.

In metal printing, there is also the problem of anisotropy. The mechanical properties are not the same in every axis. With investment casting, on the other hand, the mechanical properties are always identical, regardless of the axis. This is not the case with a printed part, so that these are not yet approved for safety-relevant applications or must be thoroughly checked. The investment casting process has always been well established and qualified at TITAL. "We can produce safety-relevant, structurally highly stressed parts based on PMMA-printed patterns in the best quality, especially for the sensitive aerospace sector. That does not work with metal-printed parts," says Sabisch.

All around satisfied

TITAL is very pleased with the collaboration with voxeljet: "voxeljet delivers high-precision PMMA patterns, even for very complex parts. They enable easy processability in the investment casting process and great design freedom for complex geometries." The resource-saving process can be easily integrated into existing production chains. Through 3D printing-supported investment casting production, TITAL simplifies workflows and benefits from reduced downtimes, which in turn has a positive effect on the casting price.

www.voxeljet.com

Sabine Hensold, trade journalist, EPR Advisors GmbH & Co. KG, Augsburg

ABOUT TITAL

TITAL GmbH manufactures and develops highly complex, ready-to-install aluminum and titanium investment castings for well-known companies in aerospace, defense, electronics, optics, racing, mechanical engineering and medical technology. More than 90 percent of TITAL's customers are in the aerospace industry, including world leading aircraft manufacturers such as Airbus and Boeing as well as engine manufacturers such as Safran Aircraft Engines. The medium-sized investment casting specialist, which has been part of Howmet Aerospace (then Alcoa) since April 2015, was founded back in 1974 and benefits from over 45 years of experience in investment casting, topology optimization, design-to-cost and rapid prototyping. The Bestwig site in the Sauerland region of North Rhine-Westphalia currently employs around 600 people. The globally active parent company has locations in 20 countries with 65 plant branches and approximately 21,400 employees. In 2022, Howmet Aerospace achieved global sales of around 5.7 billion US dollars.

PhotoS: Waygate Technologies

Automotive foundries benefit from valid quality data acquisition and processing.

Digitalization

Data from industrial inline CT increase quality and efficiency

With consistent, valid data acquisition and processing, from development through to the entire production process, considerable efficiency and quality gains can be achieved in production and development and production ramp-up times can be shortened. 3D data from inline computed tomography (CT) of castings or molds can be an important building block in this process.

By Ferdinand Hansen and Michael Ulbricht

Data is the new gold." This motto is often quoted when describing the benefits of digitalization in production. Advantages can be achieved here, among other things, by comparing CAD data and real measurement data, as well as through the statistical evaluation and interpretation of 100 % inspections.

In automotive foundries, it has been common practice for decades to collect data, e.g., during the production of cylinder heads and electric motor housings. However, this data has previously only been used to compare actual measured values against a defined target value. In each case, a tolerance was or is defined, which ultimately determines whether the part is considered to be "OK" or "not OK ". Further analyses and thus additional benefits were lacking until now. This is now changing, as first application examples of the intelligent 3D data processing of inline computed tomography (CT) show.

Automated CT scan and intelligent evaluation

Leveraging this unused data potential requires a computed tomography system for the rapid and thus mass 3D analysis of light metal castings. While

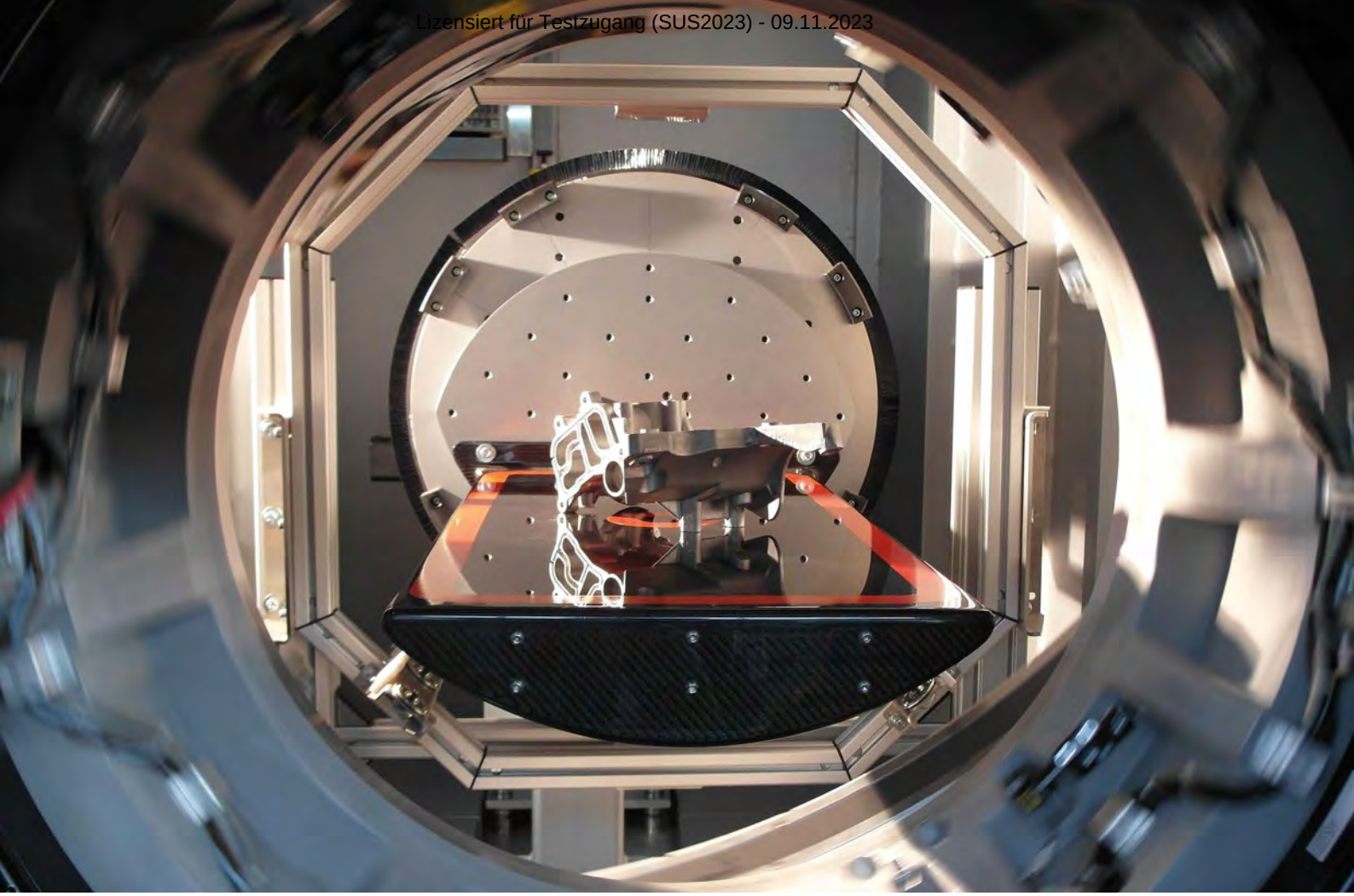


Fig. 1: As with medical tomographs, the CT gantry of the Phoenix Speed|scan CT64 rotates around a specimen placed on the inspection table.

CT inspection in general is nothing new in casting technology, the Phoenix Speed|scan CT64 (fig. 1) developed by Waygate Technologies (formerly GE Inspection Technologies), for example, opens up fundamentally different ways of using data, for three reasons:

> First, the device works exactly like CT systems in the medical sector, including a rotating CT gantry. This enables fast inspection processes with exceptionally high cycle times: the scan of a cylinder head takes only around 15 to 30 seconds and is thus considerably faster than standard industrial CT processes with flat panel or even line detectors.

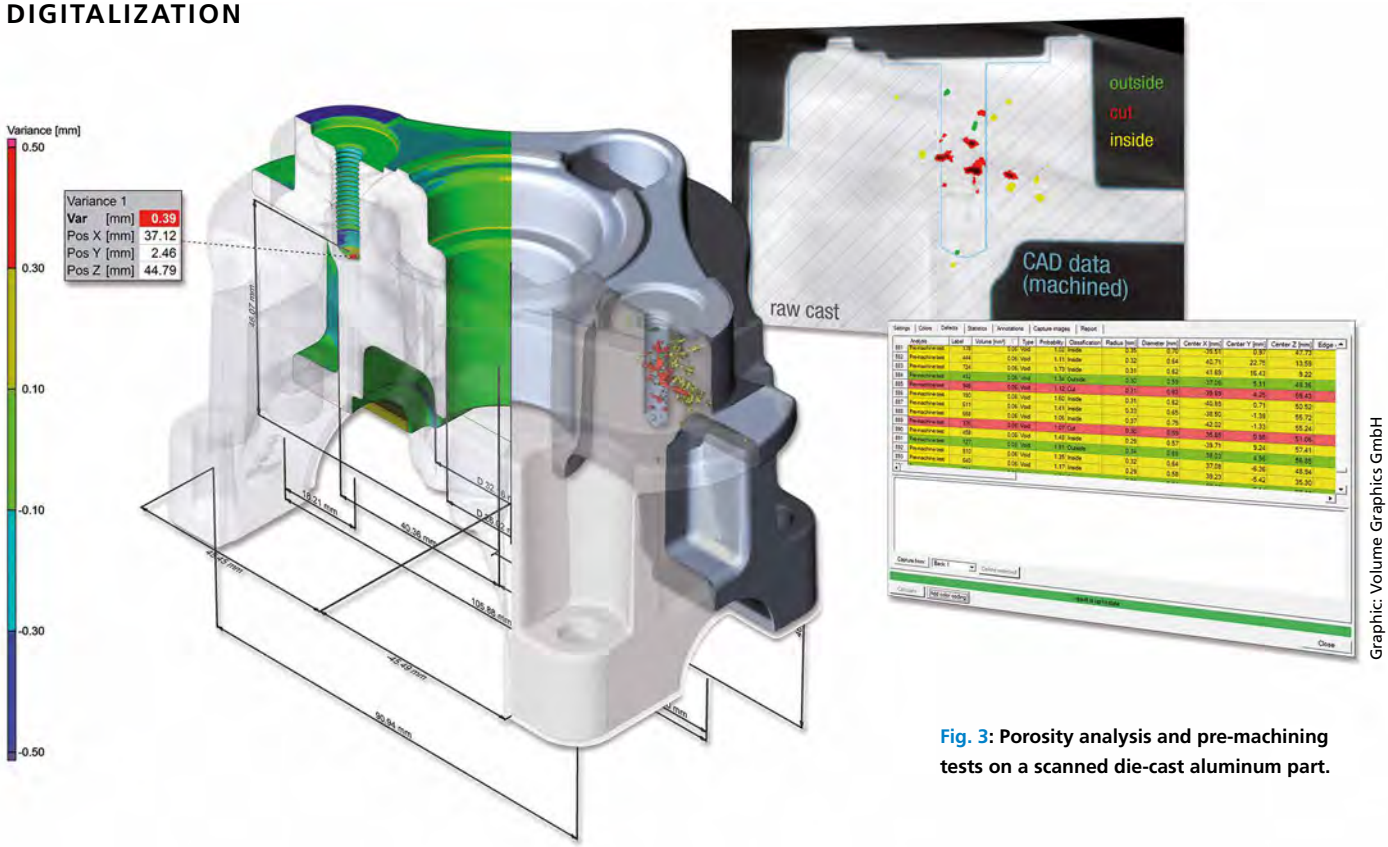
> Second, the scanner can be loaded and unloaded automatically (fig. 2). The table that holds the test specimen moves out of the system for easy loading and there is no need for the part to be fixed for rotation as required in other systems. Both of these features facilitate 100 % inline inspections and thus the generation of large volumes of data. Reconstruction and evaluation of the data take place while the next light metal casting is already being scanned. The system can also be used in atline inspection in the immediate vicinity of several production lines.

> Third, Waygate Technologies has developed the Speed|ADR and InspectionWorks soft-ware platforms for automated defect detection and intelligent data evaluation. They not only provide a highly differentiated 3D view into the casting, but also allow further analyses and can thus significantly increase productivity in the foundry as well as the quality of light metal castings.

Basic task: the quality assessment

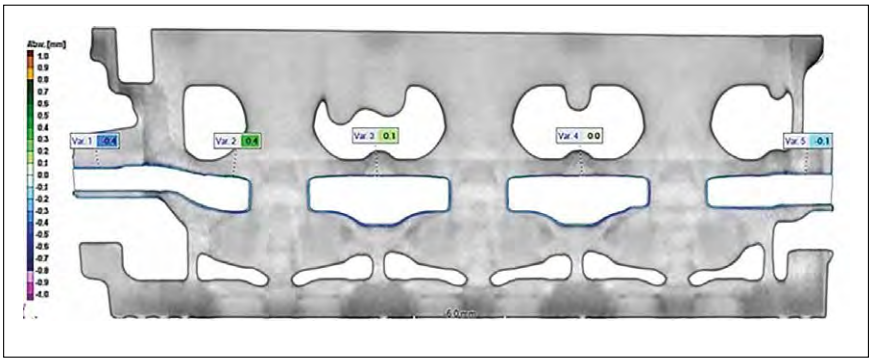
By combining these features, the Speed|scan CT64 is capable of completely digitizing any manufactured light metal casting (or representative sample or prototype parts) up to a size of around 900 mm x 500 mm and create a "digital twin" of it. Not only are the dimensions recorded, but also – and this is at least as important – the internal structures of the cast object. In this way, numerous potential casting defects such as inclusions, blowholes, chipping or sand core residues can be reliably detected even at non-visible or non-accessible locations deep inside the light metal casting – with an accuracy of down to 0.5 mm². The quality of the component can thus be assessed much more reliably than with the destructive or surface testing methods commonly used to date, even compared to two-dimensional radiographic inspection. In addition, the scan allows an assessment of the component porosity in the course of pre-machining tests (fig. 3) – i.e. not only whether problematic porosities are present in terms of their size, but also whether they will also be a problem after further processing.

Fig. 2: Objects for inspection can easily be placed on the extended loading table of the Phoenix Speed|scan CT64 scanner.



Graphic: Volume Graphics GmbH

Fig. 3: Porosity analysis and pre-machining tests on a scanned die-cast aluminum part.



Graphic: Volkswagen AG

Fig. 4: Virtual section through the wall thickness analysis of a cylinder head.

Cores and casts: alignment with the simulation

However, the inspection results can also be used to solve further questions or tasks – including during the development phase. The process development of large series of light metals is accompanied by the use of simulations (core shooting, casting and solidification simulation). With the help of core and casting molds, the foundry generates a number of test cores and casts, which are then scanned with the Phoenix Speed|scan CT64.

The 3D results of the CT inspection show both the potential casting defects (pores, blowholes, inclusions, etc.) and the dimensional deviations. The results are fed to the simulation tools and thus provide "in the loop" optimization of the simulation calculation. This step significantly reduces the number of simulation and test casting loops.

PHOENIX SPEED|SCAN CT64

> Maximum specimen size ~600 mm diameter x 900 mm length
> Maximum scan diameter ~500 mm
> Maximum detail detectability ≥ 300 µm.
> Maximum sample weight: 50 kg
> Powerful X-ray source with high-sensitivity multi-line X-ray detector and single collimated photodiodes
> Patented fast loading manipulator table for high throughput with manual or automatic loading
> Scanning speeds of 15 seconds for a cylinder head
> Automated target/actual comparisons, wall thickness measurements as well as defect detection (3D ADR), localization and classification

Simplified maintenance, minimized scrap

The CT results can also contribute to the maintenance and repair of core molds. They show all dimensional deviations that can be traced back to dimensional deviations of the core molds (nominal/actual comparison, automatic wall thickness analyses). For each core mold, the scans of the casts are evaluated against the cores from the respective core mold (fig. 4). Any detected dimensional deviations can be directly incorporated into the working plans for contour reworking.

The same also applies to the handling of dimensional deviations on casting tools and molds, which can be caused by wear, for example. The measured 3D-CT actual values of the casts of a particular mold are compared with the CAD nominal values. The dimensional deviations generated, indicate where and by how much a particular casting mold needs to be reconditioned. The same process is repeated for the remaining casting molds.

In addition, the emergence and development of dimensional deviations are documented as part of the tests. For the sake of predictive maintenance (i.e., before rejects are produced), it is thus

possible to trace at which point a deviation will reach a value that is no longer tolerable. The user can then take countermeasures at an early stage – for example by correcting the core and casting molds. As a result of this process, the number of rejects can be drastically reduced, leading to cost savings so significant that the inline CT system pays for itself rather quickly.

Efficient and proven technology

In summary, 3D data sets of scanned light metal castings can be used to save time and effort at multiple stages in the overall manufacturing process. It is up to users of the Phoenix Speed|scan CT64 to decide which of the use cases presented here they should begin with. Several car manufacturers and suppliers already use this CT technology in their foundries – both inline for meaningful 100 % quality (fig. 5) control with minimized scrap or atline in development and prototype production as well as for statistical process control and the optimization of several parallel production lines.

The first system of this new type, based on a medical CT gantry, was Waygate Technologies' Speed|scan CT16, the predecessor of today's even faster CT64 model. Having been in use continuously for almost a decade following its installation at the Volkswagen component foundry in Hanover, Germany, the system has scanned approximately 150,000 large aluminum castings and is still going strong – leaving no doubt that this technology is well suited for continuous industrial use (fig. 6).

Another example: A well-known Asian automotive manufacturer acquired a Speed|scan CT64 system more than three years ago and initially used it "offline" in the laboratory – with the aim of learning how to handle the system and to be able to use it optimally in series production. Subsequently, the system was converted to robot loading in order to gain experience with fully automated operation before integrating further inline CT systems into series production.

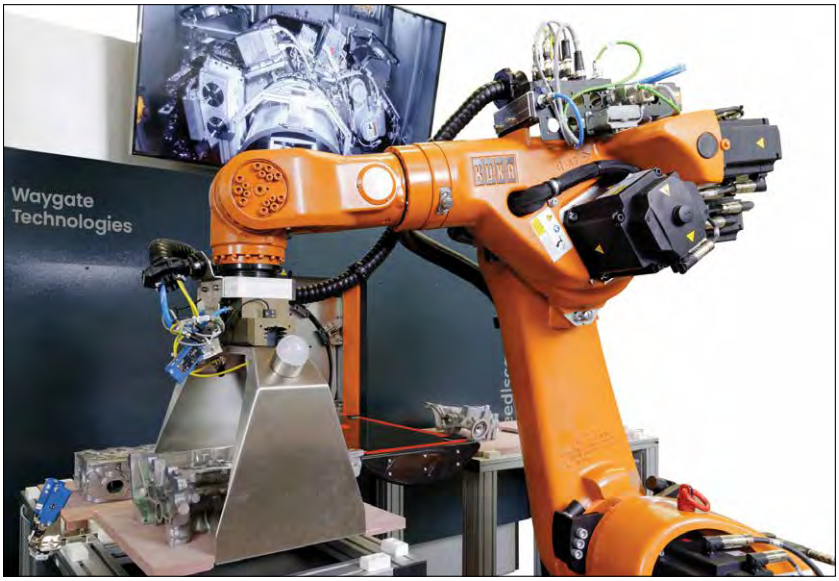


Fig. 5: Speed|scan CT64 system with robot loading for fully automated inspection.

Conclusion: Driving digitalization forward

By linking these sub-processes, a data structure for the essential process data can be achieved step by step. These digitalization steps clearly lead to economic advantages, primarily through process acceleration. With the approach outlined in this article, the realization of the smart foundry can be advanced a good deal in two areas:

> in prototype production as a comparison of simulation and real component, and in
> inline or atline inspection during series production.

Interested users can test the Phoenix Speed|scan CT64 with their individual parts at the Waygate Technologies Customer Solutions Center in Ahrensburg, Schleswig-Holstein, Germany, among other places.

www.bakerhughesds.com/waygate-technologies

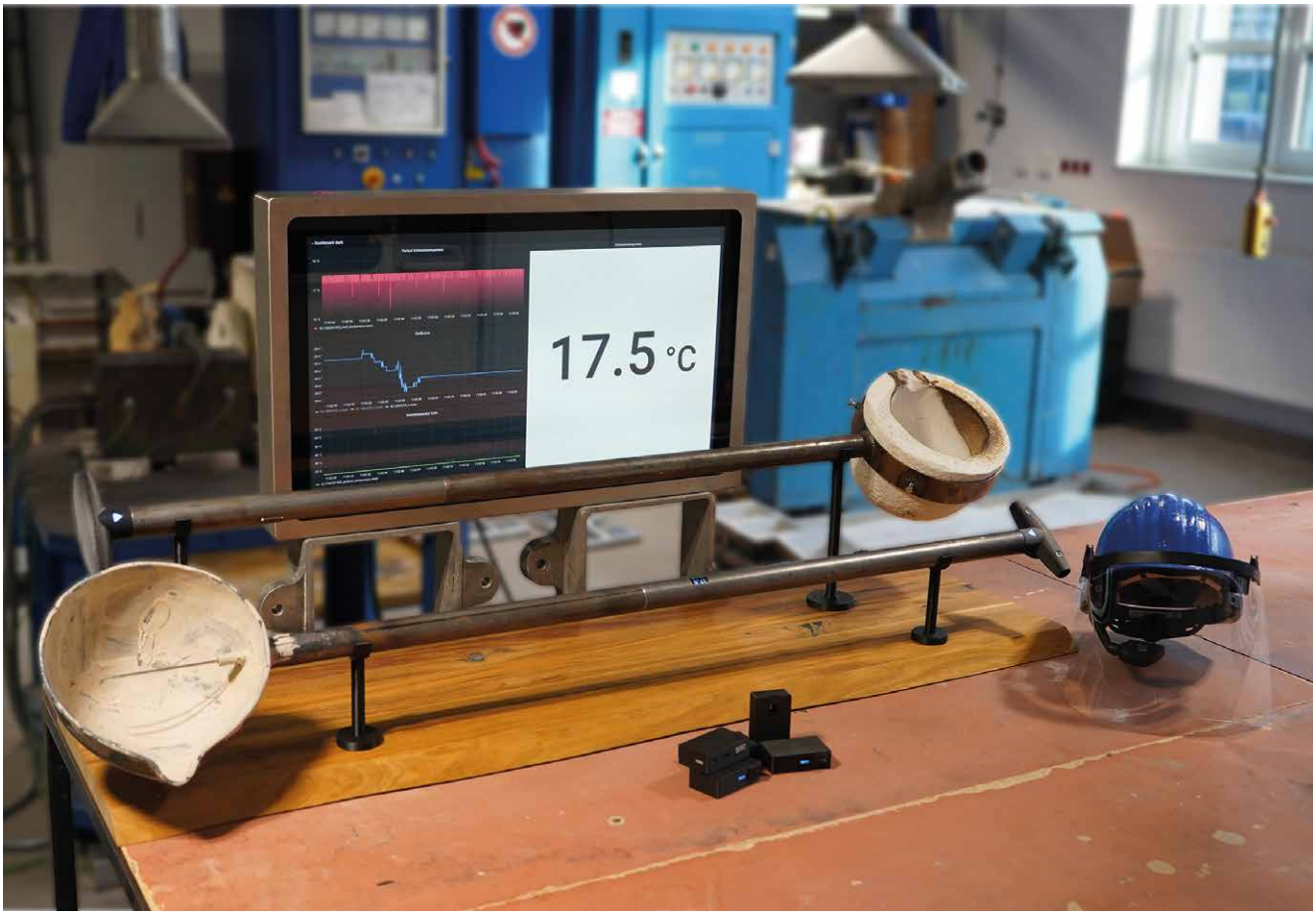
Fig. 6: Endurance test passed: In the span of eight years, approx.150,000 large castings have been scanned and analyzed with the Speed|scan CT16 system at the Volkswagen foundry in Hanover.

Photo: Volkswagen AG

Dr.-Ing. Ferdinand Hansen, Ing. Beratung F. Hansen, until 2015 VW Component, Foundry Hanover, Germany
Michael Ulbricht, Global CT Product Management Leader, Waygate Technologies, Wunstorf, Germany

References

[1] Die Gießerei 4.0-Welt in der Leichtmetallgießerei Hannover von Volkswagen, Gießerei 4.0 Symposium, Bad Dürkheim 19.-20.11.2015.
[2] Experiences with Helix Atline Computer Tomography (CT) and VG Inline at Volkswagen Foundry Hannover, 73. World Foundry Congress, 23.-27.09.2018, Krakow, Poland.
[3] Verkettete Zylinderkopf- und Zylinderkurbelgehäuse-Fertigung in der Volkswagen-Komponente in Hannover, Gießerei Praxis 2019, [Nr. 5], S. 16-20.



PHOTOS AND GRAPHICS: UNI MAGDEBURG

Digitalisation for SMEs.

The digitalized foundry lab

Prototype of an SME (Light) Metal Foundry 4.0

The major challenges the foundry industry is facing, such as the change in the dominant powertrain technologies in the mobility sector, the corona pandemic and the (oppressive) energy costs in many places, have pushed the topics of digitalization and Industry 4.0 into the background of many foundries. Yet they hold great opportunities for innovative solutions in the areas of process understanding and efficiency, which can strengthen the competitiveness of Germany as an industrial location and its companies, but also of the entire foundry industry worldwide.

By Eric Riedel

According to numerous surveys on the status of digitalization and Industry 4.0 among small and medium-sized enterprises (SMEs), for various reasons these companies are often faced with the question of concrete approaches. Often, the cost-benefit ratio of operational developments in this area is unclear, in many cases there is a lack of both financial and human resources, and historically grown plant stocks make their digital linking even more difficult. Also, the orientation in the selection of a concrete solution strategy is understandably difficult in view of the rapid pace of development in this area. In the following article, concrete technological solutions in the context of digitalization and Industry 4.0 are presented that address this problem(s) and can be applied to the entire process chain. This includes, among other things, the concrete implementation of a new type of digitally linkable casting ladle.

The findings and solutions presented in the following are intended to serve

as a prototype for the digital process monitoring and as an assistance for the entry of small and medium-sized enterprises (SMEs) into the field of Foundry 4.0. They essentially cover two concrete areas: On the one hand, these are the information and communication technology basics that enable the realization of a company and shop floor digital infrastructure in the first place. On the other hand, various tools for process recording as well as the sensor units required for this purpose have been developed, which in different versions enable flexible wireless recording of relevant process parameters. Even though the following descriptions focus on light metal foundries, the concepts are also technologically transferable to iron casting.

The concept

Regardless of what the concrete solution will look like, it is first necessary to determine which data (especially for the start) is to be recorded and how and where it is to be collected. In view of the process chain established in many foundries (core production not included) and the relevant influencing parameters in the operational process, the temperature is the most recurring and relevant process parameter in all process steps (fig. 1). Recording it can therefore be a first sensible step in a foundry's digitalization strategy, encompassing the entire process chain, and offers the following additional advantages:

> In a typical SME foundry, the process steps of melting, holding, casting and heat treatment account for about 70 - 80 % of the total energy demand. Monitoring critical temperature levels can therefore contribute to more efficient and sustainable casting technological processes.

> Casting and mold temperature directly determine the solidification behavior, thus the resulting microstructure, the mechanical properties, and the quality of the casting.

> Considering the more distinct proportion of manually executed process and work steps in SMEs, the temperature is a parameter that can be directly controlled by the employees.

By now, numerous communication protocols exist that allow for a suitable data exchange for the Industrial Internet of Things (IIot). Deciding which one to use without the necessary knowledge in this IT-related professional field can be a great challenge. If it is possible to determine, a technological solution should be selected that is already established, is used by well-known companies as a reference and thus offers the prospect of long-term support. Furthermore, an uncomplicated and largely unlimited integration of (measuring) devices as well as a flexible query of the data is advantageous.

The question of storage location confronts most users with the alternatives of a local or cloud solution. Without going into too much detail about the advantages and disadvantages of the two options, a local operational database is recommended for a simple start, which must be able to accommodate a great amount of high-frequency incoming data in a storage space-efficient manner. These data should be able to be visualized in real time and as needed for the employees.

Communication basics

The following explanations and described programs are not without alternatives. They are the solutions with which the project at the Otto-von-Guericke-University Magdeburg (OVGU), Germany, could be successfully realized and which are relatively easy to use even for less IT-experienced users. In addition to minimizing potential costs, the selection criteria included ensuring long-term availability supported by the developer, compatibility and, above all, an established user community so that self-help is possible via forums in the event of any difficulties. In addition, potential users are thus relieved of the worry of selecting niche solutions. All the programs presented are open source software (OSS), which often

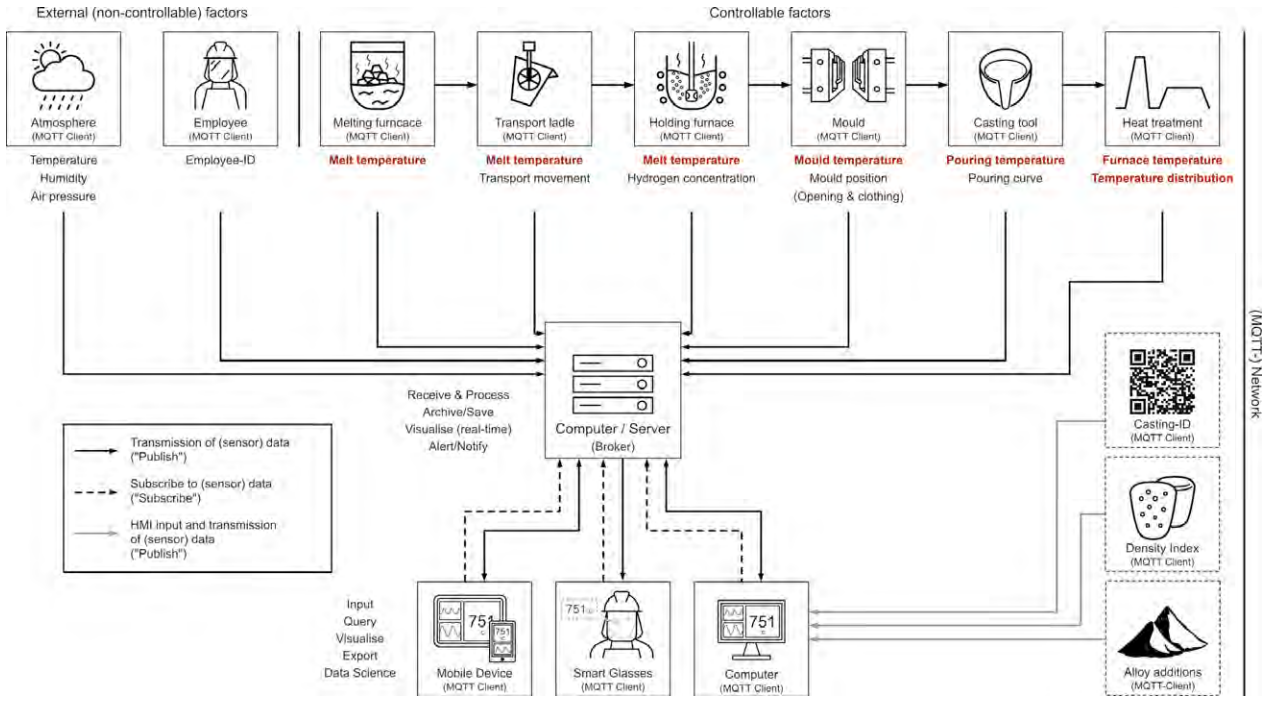
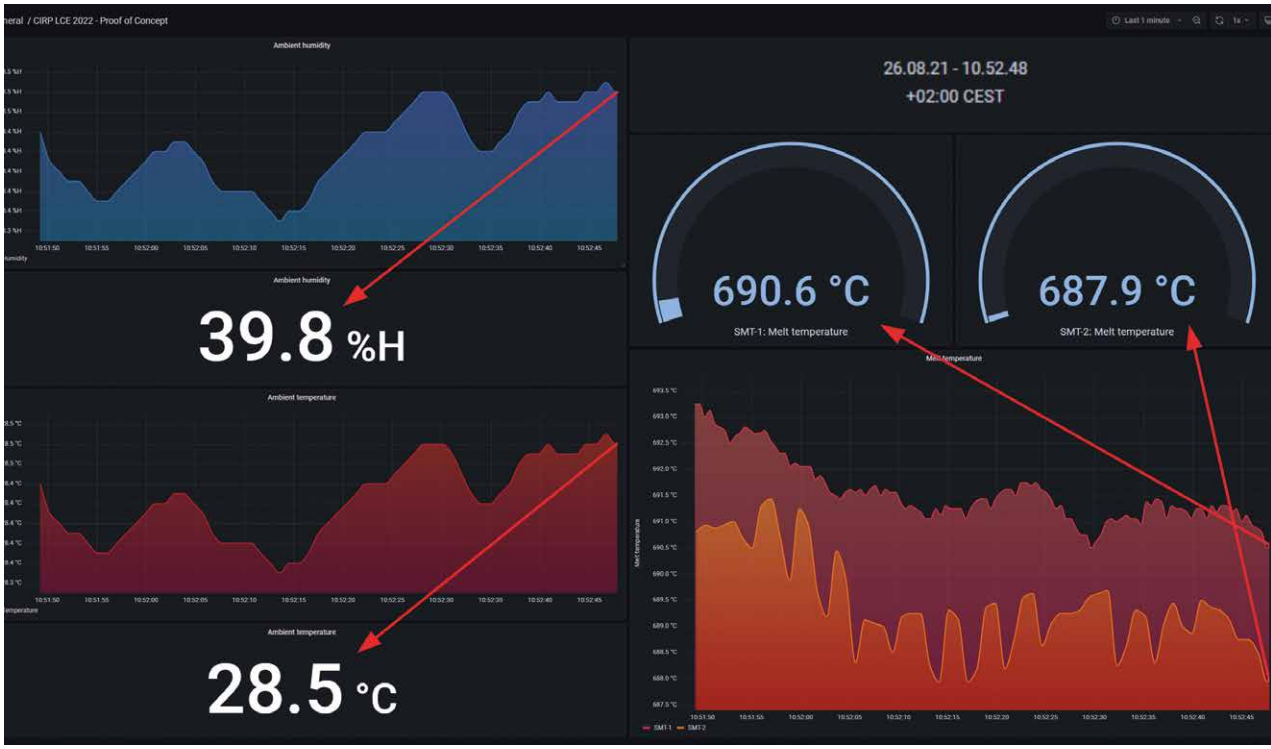


Figure 1: Quality-relevant factors and stations in casting production as well as their integration and linking through MQTT.

Photo: GRAPHIC: ACCORDING TO [1]



GRAPHIC: ACCORDING TO [1]

Figure 2: **Dashboard for visualizing the furnace temperature with two different thermocouples as well as humidity and ambient temperature.**

Figure 3: **Sensor units for digital process recording.**

makes a broadly accessible user community possible in the first place. The realized overall solution comprises four core components:

> To ensure suitable data exchange, the so-called MQTT communication protocol is used, which was developed from the beginning with the lowest possible energy requirement as well as an equally low bandwidth. Today, it is one of the most established solutions for IIoT data exchange and has an officially approved OASIS and a ratified ISO standard. The main strengths of MQTT include transmission speed, reliability and simplicity in integrating further devices, energy efficiency, available support and an almost unlimited number of further linkable devices in the protocol. Due to these strengths, it is used as standard by companies specializing in IIoT solutions, e.g., IBM or Amazon Web Services (AWS). The basic architecture applied to the foundry application is shown in Figure 1 and shows the exchange of data between the central broker, which regulates the data flow, and the so-called clients, which send and receive data via this broker.

> The application-oriented storage of the data is carried out using InfluxDB, a so-called Time Series Data Base, which is distinguished from conventional databases by very fast storage and query speeds as well as a storage space-efficient storage of time-stamped, even high-frequency incoming data.

> The flow-based programming tool Node-RED, originally developed by IBM, is used to organize the data flow managed with the help of the MQTT protocol. Due to its visualized user interface, the flow editor, which can be accessed via established internet browsers, it is suitable for many users without pronounced programming skills and still allows sophisticated systems to be built in this way. Flow-based programming enables the handling of data and applications with the help of nodes, each of which serves a specific purpose. This can be, for example, the function as a data source, the processing of data or its storage.

> The last component is Grafana, a program for visualizing measurement data, which serves to query, visualize, warn and alarm as well as analyze and understand this data. It allows to visualize, examine and share these data professionally (visually sophisticated) and flexibly via so-called dashboards (fig. 2). The refresh rate as well as the time frame considered can also be configured flexibly and according to need.

Foundry Lab 4.0

Digital infrastructure

In the overall concept of the technical realization, the MQTT protocol provides the basis with which the data is exchanged within an (internal) network between clients and broker. On the device, which serves as a broker among other things, Node-RED allows the configuration and regulation of the data

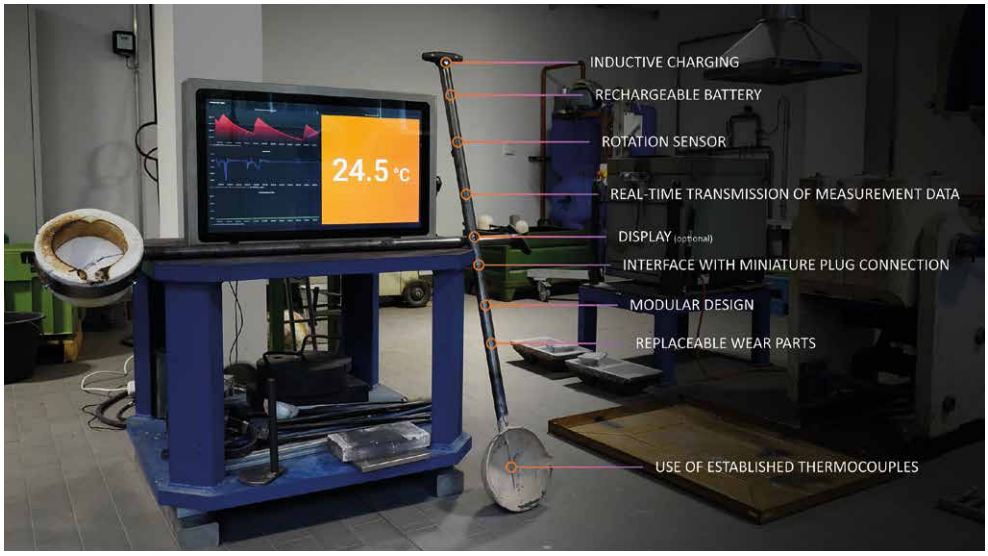


Figure 4: Selection of elements for the digitalized process monitoring in the foundry laboratory of the OVGU: 1, 2) Sensor unit for recording and real-time visualization of the melt temperature in the furnace; 3) and 4) Sensor unit for recording and real-time visualization of the mold temperature; 5) Input and visualization of further relevant parameters (here density index); 6, 7) Casting ladle 4.0 Mark I and Mark II; 8) Real-time visualization of the process parameters measured by the casting ladle 4.0.

Figure 5: Functions of the casting ladle 4.0.

flow. In this specific case, this is the transfer of the data sent by the sensors via MQTT to the InfluxDB database.

For visualization, the data is queried directly from the database by Grafana and displayed on dashboards. In the scale presented, all programs run on a device with a Linux distribution serving as a broker, since the programs described above are primarily designed for Linux. In this specific case, it is the free Linux operating system Ubuntu Desktop. It has its own application manager via which all the programs described above can be installed in a user-friendly way without command line input.

Process monitoring

The cornerstones of digital process recording are sensor units (fig. 3). They allow for the flexible and demand-oriented application and can be operated with a rechargeable battery as well as from the grid. The variants shown have a PCC connector (miniature plug connection) and allow the usage of type K thermocouples. The chip used in the measuring amplifier also allows the use of thermocouples of types J, T, N, S, E, B and R. As an alternative to the sensor with PCC connection, those with the same chip and wire connection were also tested. Other variants have rotation, ambient (relative humidity, ambient temperature, and air pressure) and distance sensors. If required, the units can also contain several identical and/or different sensors. The sensor units automatically connect to the MQTT network that has been set up and are ready for use within a few seconds. The input of other important parameters, such as the

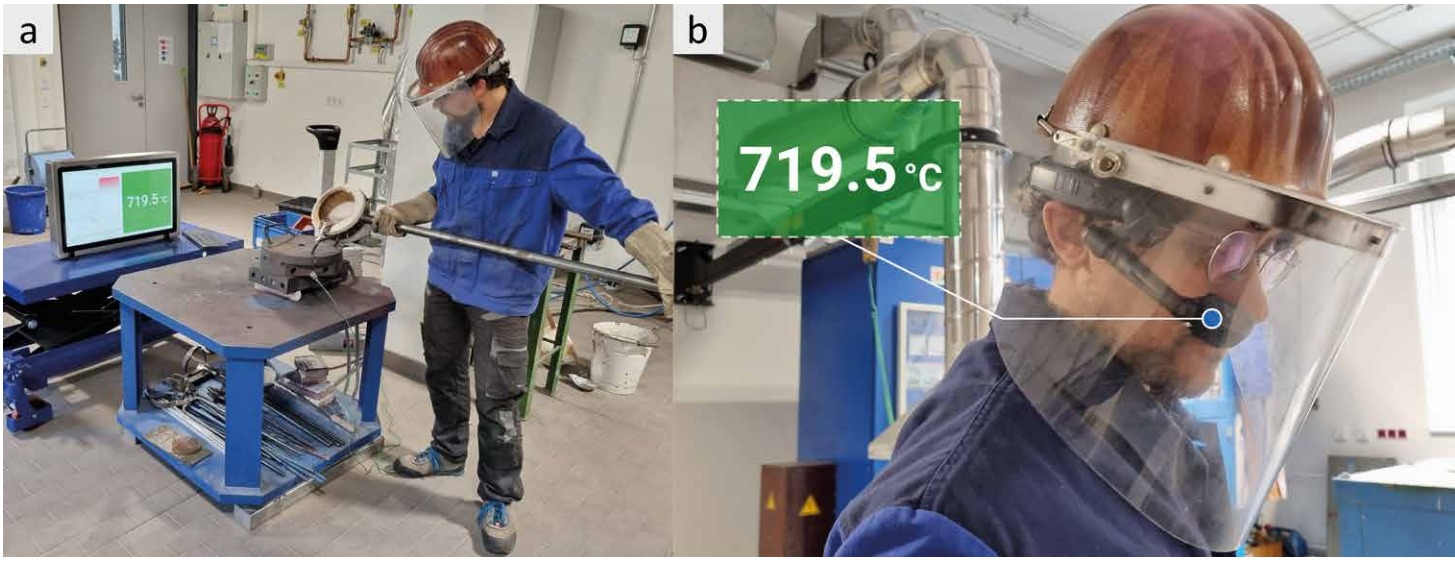


Figure 6: **Laboratory testing of the casting ladle 4.0: a) pouring; b) use of industrial data glasses attached to the casting helmet for flexible real-time visualization of the process parameters measured by the casting ladle 4.0 (here melt temperature with traffic light approval).**

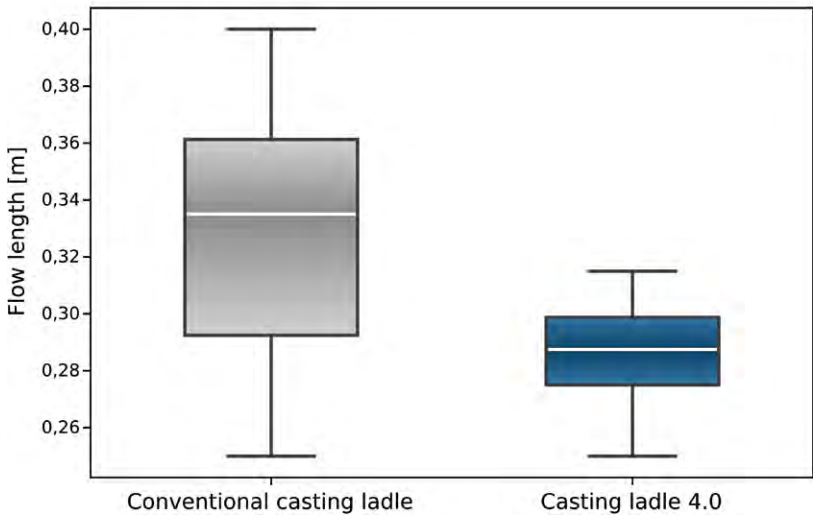


Figure 7: **Box plot diagram based on the statistical evaluation of the experimental results described above.**

employee ID, the amount of alloy additives for grain refinement and modification or the result of the density index measurement, can be done via computer or other electronic terminals input.

The advantage of this solution, apart from the collection of all relevant process data in one database, is that older, non-networkable but fully functional devices can still be used. In the specific case of the OVGU foundry laboratory, for example, this is the density index balance, whose measured results can be easily entered via the computer and stored in the database. With the visualization software Grafana, limit values can be defined for all measured data and displayed in a similar way to quality control charts by means of tolerance lines in the diagram or by color highlighting according to the traffic light principle. Thus, in preparation for casting trials, all target values for melt, mold and casting temperature as well as density index are first defined in the system (fig. 4) and the trial is only started when the green background visualization of all target values gives the approval.

Casting ladle 4.0

Concept and realization

In the context of the developments described here, the casting ladle 4.0 [2], which has since been patented, has the highest degree of innovation. With it, relevant process parameters in manual casting production can be recorded in real time for the first time and thus important data can be collected for well-founded analyses. With the aim of increasing the reproducibility of manually produced castings, it is intended to help SMEs in particular to make a concrete start into the topics of digitalization and Industry 4.0 and to take advantage of their benefits. Starting with the design, the first specification was that the new casting ladle should differ little from conventional designs in terms of appearance and handling in order to keep the barrier to use as low as possible, especially for seasoned employees. The simple design hardly allows any conclusions to be drawn about the functionality of the casting ladle 4.0; only an LED informs about the current operating status.

Considering industrial and commercial use, a modular design was chosen. The main module, which comprises the upper part of the ladle including the grip, contains all the electronic components and is designed for permanent use. The lower section of the ladle is made up by the casting module, which is subject to wear and can be connected to the main module via an interface. This modular design allows, on the one hand, the wear-related replacement of

Figure 8: **Application of the casting ladle 4.0 in the Hans Seifert GmbH metal foundry: a) waiting for and b) casting with color approval on a monitor at the casting station.**

Figure 9: **Burning in the coating applied to the casting ladle 4.0 by immersing the ladle in the holding furnace.**

the casting module without the need for a new main module and, on the other hand, the application of different casting modules as required, depending on the necessary melt volume or the intended cooling rate. The interface has a miniature plug connection for type K thermocouples on the side of the main module. These are inserted through the casting module into the spoon for melt temperature measurement and can be easily and independently replaced by the user. The measuring speed of the melt temperature depends primarily on the design of the thermocouple (diameter, earthed, insulated or exposed measuring tip).

Especially in view of the rough conditions in many foundries, the main module of the casting ladle 4.0 was designed without (visible) interfaces to the outside. The configuration is done wirelessly via over-the-air updates and the battery contained in the ladle is charged using inductive charging technology to prevent the penetration of coating particles, for example. All components inside the main module are also encased once again. Other functions of the casting ladle 4.0 are the real-time recording and transmission of process parameters such as the melt temperature and casting ladle movement for recording the pouring curve. Another sensor permanently measures the temperature of the basic module at the interface. Optionally, a display can be installed that allows the current melt temperature to be read directly from the ladle handle. However, this feature was not considered further in the implementation of the second prototype. The casting ladle 4.0 as well as its integration into the MQTT protocol and network allows for the first time the combined use of this tool with digital end devices such as industrial data glasses. Figure 5 gives an overview of the key functions of the new casting tool.

Laboratory testing

The first tests of the casting ladle 4.0 were carried out in the foundry laboratory of the OVGU. The focus was on the long-term use of the tool on the one hand and on the other on investigations with a view to a higher degree of reproducibility compared to comparable, conventional casting ladles. A cast-

ing module with ceramic fibers was used for casting an AlSi7Mg0.3 alloy. The target was to achieve a casting temperature of 720 °C in a spiral mold preheated to 300 °C (± 5) as precisely as possible. The reproducibility was measured on the basis of the flow lengths achieved in the castings as a direct function of the melt and mold temperature. Casting was carried out alternately with a comparable conventional ladle with ceramic fiber spoon as well. For the use of the casting ladle 4.0, a green visualized release was defined for the caster on an industrial monitor stationed at the casting site (fig. 6a). The casting ladle 4.0 can also be used in combination with smart end devices. For example, as an alternative to using a monitor at the casting station, it is possible to use industrial data glasses (fig. 6b), which offer greater flexibility than a monitor with the same advantages, such as traffic light approvals.

The evaluation of the test results carried out with Python and Jupyter Notebook (fig. 7) shows that the standard deviation of the flow length could be reduced by up to 58 % using the casting ladle 4.0 compared to a comparable conventional casting ladle, which in turn means that with the help of the casting ladle 4.0 it is possible to significantly increase the reproducibility of manual casting manufacturing.

Industrial application

While the laboratory tests were aimed at reproducibility, the focus of the industrial testing (fig. 8) was on robustness against the usual operational conditions. With the kind support of the Hans Seifert GmbH metal foundry in Wernigerode (Germany), the casting ladle 4.0 (in this case with a steel module instead of the ceramic fiber casting module used in the foundry laboratory) was tested under near-series conditions in the foundry there. The ladle was handed over to the foundryman with the proviso that the novel casting ladle was not to be treated gently and was to be subjected to the same procedure as conventional ladles. In addition to burning in the applied coating by immersing the ladle into the holding furnace (fig. 9), the usual dipping of the ladle into the melting bath of the holding furnace before the actual removal of the melt was also carried out without any problems.

Figure 8a shows, that after the melt removal from the holding furnace, the melt temperature in the ladle is above the desired pouring temperature which is visualized to the caster by the display of the melt temperature with a red background on the monitor set up at the casting station. Pouring did not take place until the melt temperature was released by the display with a green background (see Figure 8b).

Discussion and potentials

The digitalized foundry laboratory of the OVGU shows the first steps towards an experimental SME foundry 4.0. With the focus on process-side holistic temperature monitoring, essential stations and parameters of casting production are already being digitally recorded and made available to employees as needed. In addition, the recording of further parameters, such as environmental data, is possible and thus allows a process-wide data acquisition for the first time. On this basis, comprehensive, statistically robust and data science-supported evaluations with the potential of new insights and new levels of process understanding are given.

The highest degree of innovation in this context is the "casting ladle 4.0". As part of a comprehensive process monitoring system, it allows the familiar handling of the tool combined with the real-time recording of process data relevant to the manual production of castings. Due to its uncomplicated integration into new and existing digital infrastructures, a simple and concrete entry into the topics of digitalization and Industry 4.0 can thus succeed. The collection of detailed process and manufacturing information thus enables an expansion of existing QA/QM systems and can thus increase the chances of contract acquisition. Furthermore, its potential lies in the targeted training and further education of qualified staff, accelerated induction and practice of new employees as well as the possibility in combined use with VR/AR applications.

The functionality of the casting ladle 4.0 is easily transferable to other casting tools, such as crane casting ladles, and is already the subject of current developments. For companies with automated, robot-supported production lines, the potential of the casting ladle 4.0 lies in the transfer of the casting curve realized by experienced employees to the robot routines and thus in the reduction of their set-up time, i.e. in the transfer of production data from the prototype stage to series production.

Summary

The research work described here has shown both a solution for digital process monitoring in casting production using the example of the OVGU foundry laboratory and the newly developed casting ladle 4.0, as well as highlighting which software and hardware components are required for this. The aim of this contribution is to simplify the entry into these topics, especially for SMEs, but also for all other interested parties. Further developments are necessary and planned in order to meaningfully expand the possibilities that go along with this development. We look forward to your criticism, comments, suggestions, and queries.

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References:

[1] Riedel, E., "MQTT protocol for SME foundries: potential as an entry point into Industry 4.0, process transparency and sustainability", Procedia CIRP 105, 29th CIRP Conference on Life Cycle Engineering, Leuven, Belgium.

[2] Riedel, E., (2022), "Casting Ladle For Scooping And Casting Liquid Metal And Method (DE102021000655A1)", German Patent and Trade Mark Office.

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INDUSTRIAL TOMOGRAPHY

New Nanoscale 3D X-ray Microscope

Bruker, Fürth, Germany, offers the new Skyscan 2214 CMOS Edition, a multiscale X-ray microscope based on nano-CT (computed tomography) for industrial and academic research.

Photo: Bruker

The new Skyscan 2214 CMOS Edition.

With the CMOS Edition, the Skyscan 2214 platform now incorporates the latest scientific CMOS (sCMOS) detector technology and brings cutting-edge X-ray imaging at highest resolution to the next level. Skyscan 2214 CMOS Edition retains the innovative, modular design that accommodates up to four detectors, allowing users to select at the touch of a button the most appropriate detector for their samples and applications. This unique design now encompasses a 6 Megapixel (Mp) flat panel and three optimized 15/16 Mp sCMOS detectors. They provide an unrivalled field of view for the respective true 3D resolution down to the 500 nm range. In addition, the new sCMOS detectors excel at imaging high- and low-density features in the same object thanks to their large dynamic range and ultra-low noise.

According to the supplier the user-friendly, comprehensive 3D.SUITE software for straightforward data collection, advanced image analysis, and powerful visualization complements the Skyscan 2214 CMOS Edition. This powerful software suite includes advanced capabilities such as spiral scanning with exact reconstruction for artifact-free imaging of planar features and variable rotation step tomography for more efficiently scanning of high aspect ratio objects. Furthermore, phase retrieval algorithms for propagation-based phase contrast X-ray imaging can reveal features that would otherwise remain hidden when using only absorption contrast imaging.

www.bruker.com

HUMANS AND ROBOTS

Optimized communication

KUKA, Augsburg, Germany, offers KUKA.UserTech software a user-friendly interface. It allows users quickly equip complex routines in the KUKA robot language (KRL) with simple inline forms and status keys via an editor with the graphical user interface (GUI).

The new software is designed to enable users who have not previously had any contact with robot controllers to create inline forms, status keys, buttons and messages for the robot controller. An editor is used to create the application commands in KUKA.WorkVisual, e.g., status keys for individual applications or entire operating sequences in the form of scripts. Status keys are buttons on the smartPAD that are used to enter frequently repeated commands quickly and easily. Inline forms are predefined input masks that are offered as templates and are intended to facilitate the use of routines in the KRL.

Photo: KUKA

The new interface promises easy creation of inline forms and status keys.

The KUKA.UserTech user interface is intended to score points above all with its user experience (UX). The software solution offers an intuitively usable editor on the computer, on whose standard user interface the configuration files are to be created quickly and easily by drag-and-drop. Intervention in the KRL is no longer necessary due to the user experience design. Subsequently, the commands are transferred as option packages to the handheld operating device for the control system. This is to avoid copying errors at the user interface – then the robot is ready for the application.

The preconfigured inline forms promise the user a safe operability of the editor on the computer. Input errors are displayed directly on the graphical user interface and are not discovered only when testing the robot control. Another advantage cited by the manufacturer is the universal applicability of KUKA.UserTech, which can be combined with all technology packages, such as KUKA.ArcTech or KUKA.PalletTech. The prerequisite for using the interface is a KUKA robot controller from KR C5. This should use at least software version 8.7 or higher of the KSS operating system. For suitable versions for existing systems, the experts are available.

www.kuka.com

Photo: Velo 3D

The new Skyscan 2214 CMOS Edition.

3D PRINTING PROCESS

Flow 5.0 is released

Velo3D, Campbell, Calif., USA, announced the latest release of its Flow print preparation software Flow 5.0.

Flow 5.0 unlocks an array of new capabilities for engineers using Velo3D's fully integrated solution including user-selectable core parameter sets that provide enhanced control over builds with the ability to assign different parameters to any part on the build plate. This improvement, in addition to Flow's ability to apply skin and contour overrides, gives customers enhanced control over the final material properties of printed parts.

The new Flow 5.0 release also includes checks and messages that identify possible errors before a build even starts, reducing the likelihood of customers experiencing failures in their builds. In doing so, engineers can be confident that a part will print successfully before the process begins. Flow also now includes labeling for objects. Customers can easily add alphanumeric characters, like serial numbers or other unique identifying text, to their builds within the Flow print preparation software to clearly identify and label instances of their parts. Once the print file is produced, the characters can be updated through a new Label Updater tool.

According to the supplier the release also enables a faster method to calculate build times for builds of different part quantity. After a part has been prepared for print, users can vary the quantity of that part and see updated build times to better understand the economics of scaled production. This enables contract manufacturers to speed up their quoting process and accelerates OEM planning and scheduling.

The Flow print preparation software is a key part of Velo3D's fully integrated metal additive manufacturing solution. The software takes traditional CAD files and turns them into print files without any specialization or Design for Additive Manufacturing (DfAM). Other parts of the solution include the Sapphire family of printers, Assure quality assurance software, and the underlying Intelligent Fusion manufacturing process that ensures consistent, repeatable outcomes across different Sapphire printers from the same print file.

www.velo3d.com

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SAND RECLAMATION

New technology cuts energy use by 75 %

FSP, Stuttgart, Germany, has commissioned a pilot-scale reclamation plant for water-glass bonded sands. The plant is based on a wet reclamation process patented by Deantec. This process is highly energy-efficient and close to carbon-neutral.

Foundries spend a great effort and considerable financial means on reclaiming foundry sands and core sands containing organic or inorganic binder systems. Especially against the backdrop of the dramatic rise in energy prices, energy efficiency of reclamation processes has been moving increasingly into the focus. The patented process used by FSP reduces the energy required to dry the sand by about 60 % and what's more, it is carbon-neutral. With this process, foundries can substitute some 95 % of their new sand requirements, reducing the costs of used sand dumping at the same time. The reclaimed product has the same quality as new sand. As an alternative option, FSP also supplies a basic-grade product that can be flexibly blended with new sand to achieve the sand quality specified by the customer.

With this process, all common water-glass bonded foundry sands and special sands from 3D printing can be completely reclaimed. In the patented drying system, the sand is not dried with air but by turning the water it contains from liquid into gas. For this, energy recuperated from the condensation process is used to the greatest possible extent. By recuperating more than 60 % of the condensation energy, the evaporation energy is kept within the system. In addition to this, dust particles are removed from the sand in a patented fluid bed cooling separator. The process water is treated and maintained within a closed circuit. One ton of sand generates just 12 liters of waste water. Only this amount of fresh water has to be added to the process. Also during the distillation process, condensation energy is recovered. 95 % of the energy required for the evaporation process is energy recuperated from condensation. The distillate is entirely demineralized. Thus, it is even better suited for the sand washing process than fresh water.

In addition to the sale of the plants, FSP offers an operator model.

Photo: FSP

The pilot plant is also available for customer trials.

Within this framework, the company processes used sand of most different origins in its own plants near foundry locations and returns a regenerate tailored to the customers' processes to the foundries. Plants on the company premises of individual customers are also possible. In both cases, FSP GmbH is the operator. **www.fsp.gmbh**

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NEW RESEARCH PROJECT

Digitalize cast iron production

By using scientific models and artificial intelligence, a new PhD project will open the furnaces at the Danish iron foundry, TASSO, Odense.

Photo: Tasso

A PhD project wants to find out what exactly happens when molten iron is cast.

What exactly happens when molten iron is cast has always been a mystery to the foundry industry, and the answer to this mystery may very well pave the way for the digital transformation of the entire industry. Since 2020, PhD student at the Technical University of Denmark, Ashish Chawla, has been connected to the Danish iron foundry, TASSO. Here, he is well underway writing his final PhD thesis, which will use advanced mathematical models and artificial intelligence to form the basis for digitalizing TASSO's cast iron production.

The thesis is divided into three stages, of which the first stage has just been completed and the results published in a renowned academic journal on casting engineering. Through the development of an advanced science-based model, the first stage attempts to simulate what happens when the molten iron in TASSO's furnaces is cast into continuous cast iron. By looking into this process, it is possible to locate the optimal places to place sensors that will support the following digitalization of the cast iron production.

Ashish Chawla explains that the next stages of his thesis are exploring how to digitalize this process: "Scientific- and physics-based models that simulates the casting process will be integrated with state-of-the-art data analytics and AI models to achieve better control of the manufacturing process. This technology will form the basis for digitalization to optimize production processes in the form of streamlining workflows, robust production and reducing energy consumption, so there is also a sustainable aspect involved".

CEO at TASSO, Kristian B. Pedersen, is very enthusiastic about the project and sees great potential in digitalizing cast iron production – both for TASSO itself, but also for the foundry industry as a whole: "As the thesis is not finished yet, we do not know the results yet, but so far it looks promising. From TASSO's point of view, we have a goal of being able to produce an average of 420 tons of continuously cast iron per week, and a potential digitalization of our production may help us achieve this goal, he explains". TASSO's electricity consumption reached 15 MWh last year, while the company emitted around 3,000 tons of CO_2 within scope 1 and 2. The iron foundry has a strong focus on sustainability and Kristian B. Pedersen therefore hopes that increased digitalization in the long term can help reduce energy consumption and thus the company's climate footprint: "The casting production requires that the iron is heated up to around 1,400 degrees, and this obviously absorbs a large amount of energy. Therefore, even the smallest optimizations of the casting processes can lead to relatively large reductions in our climate footprint, and that makes digitalization even more interesting for an iron foundry like us and the foundry industry in general", he concludes.

www.tasso.dk

BMW GROUP PLANT LANDSHUT

Renewed certification of the Aluminium Stewardship Initiative (ASI)

Since almost two-thirds of the aluminum used at BMW's Landshut light metal foundry comes from the recycling loop and more than one-third of the new aluminum is produced with solar power, the foundry was again certified according to ASI standards.

Photo: BMW Group

The foundry has been sourcing solar aluminum since 2021.

The Aluminium Stewardship Initiative (ASI) is an international non-profit organization supported by environmental and industry associations, aluminum producers and processing companies. The ASI has defined sustainability criteria for an ecologically and socially responsible aluminum value chain.

During casting in Landshut – thanks to the use of inorganic sand cores – virtually no emissions are released. Since 2021, the light metal foundry has been sourcing aluminum for the production of which electricity from solar energy is used. At several tens of thousands of tons, the solar-generated aluminum covers more than a third of the light metal foundry's annual requirements at the Landshut plant.

Around two-thirds of the aluminum used in Landshut comes from a recycling loop, of which in turn almost two-thirds comes from a foundry's own closed loop. In this way, the BMW Group deliberately reduces the use of CO_2-intensive primary aluminum in favor of a CO_2-optimized recycling loop. Green electricity is also used in production. In addition, residual materials are collected by type at all casting and machining plants so that the materials with their individual compositions do not mix. This means that the aluminum waste can be reused after processing for the production of the same components.

www.bmwgroup-werke.com/landshut/en.html

INSURANCE ASSOCIATION FM GLOBAL

Natural hazard maps

FM Global, a mutual insurance company, has developed interactive maps on natural hazards such as frost, floods and earthquakes. The maps, which are available free of charge, combine first-class and up-to-date information from all over the world.

Natural disasters can destroy buildings, disrupt supply chains and affect companies' operations. But there are measures to protect against them. NatHaz's Natural Disaster Toolkit offers numerous resources to help users prepare for and respond to earthquakes, floods, storms and other severe weather conditions. White papers, articles, videos and checklists from FM Global experts address the significant threat these hazards pose to businesses. Resilience is the answer. The NatHaz Toolkit can help make the right decisions.

The latest publication is a worldwide frost map. It is based on data on daily minimum temperatures at 100-year recurrence intervals, which companies can use to determine the necessary frost protection measures for plants and systems that are important to their operations. This includes, for example, pipelines and tanks, but also outdoor facilities that are at risk of freezing. If a temperature of 20 °F (-6.7 °C) or colder is given for a geographic region, there is clear evidence of a significant weather-related risk of frost damage for that region based on historical damage data and laboratory and field tests.

www.fmglobal.de

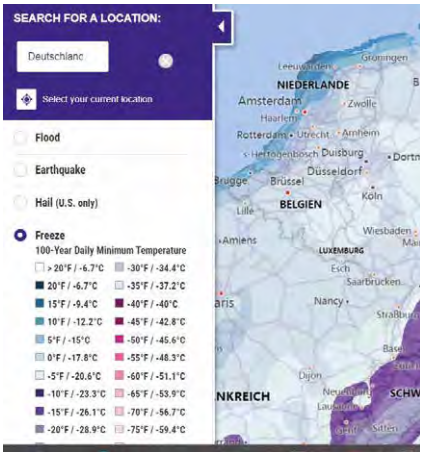

Photo: fm global

Photo: General Motors/Cadillac

The all-electric Cadillac Celestiq.

3D PRINTS CASTING CORES

For structural components of Cadillac Celestiq

voxeljet, Friedberg, Germany, and Tooling & Equipment International (TEI), one of the largest users of 3D sand printing in the US, expand their collaboration: TEI has purchased its third VX4000 3D printer.

As a supplier to General Motors, TEI is using the world's largest 3D sand printer to produce cast cores for the series production of large-format, weight-saving structural components for the Cadillac Celestiq. TEI, an expert in highly complex castings for the engineering and manufacturing industry, has been working with voxeljet since 2018. The collaboration started with a three-year volume contract of over 500,000 liters of 3D-printed sand. Now, TEI is the only company in the US to own three of voxeljet's VX4000 3D printers, which are among the world's largest 3D sand printers with a build volume of 4 x 2 x 1 meters. With its third VX4000, TEI has now expanded its additive manufacturing capacity to up to 2.5 million liters per year. This enables the US company to implement further technically demanding projects such as the series production of lightweight components for the underbody structure of the all-electric Cadillac Celestiq.

The novel underbody structure consists of six large precision sand-cast aluminum parts. In order to realize the complex structures as economically and lightly as possible, TEI uses additive manufacturing in production for all inner cores. This allows stiffening features to be incorporated into the hollow sections, which is not economically feasible with conventional manufacturing. A total of 51 additively manufactured sand cores are used in the production of each vehicle underbody. TEI prints these using the VX4000 printers, each of which prints hundreds of inner cores for several vehicle sets in just one night. After printing, the cores are smoothed, coated with a fireproof coating, placed in sand molds and finally cast using a low-pressure filling process. Each of the six castings reduces the number of parts by 30 to 40 components compared to a typical stamped construction. As each structural part has fully machined interfaces, the six castings can be assembled precisely and very tight tolerances can be maintained for assembly fabrication.

„By eliminating tools and taking advantage of the large build volume of the VX4000 printers, we can significantly reduce delivery times and produce lightweight components with optimized topologies. This would not be possible in the conventional way," explains Oliver Johnson, President of TEI. ww.voxeljet.com

THE KEY to Casting Industry Suppliers

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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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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

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09 Moulding Sands

09.01 Basic Moulding Sands

▼ Chromite Sands 3630

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▼ Ceramic Sands/Chamotte Sands 3645

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09.06 Moulding Sands Testing

▼ Moisture Testing Equipment for Moulding Sand 4410

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▼ Moulding Sand Testing Equipment, in general 4420

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10 Sand Conditioning and Reclamation

10.01 Moulding Sand Conditioning

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10.04 Sand Reconditioning

▼ Sand Coolers 4720

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12 Gating and Feeding

▼ Breaker Cores 5340

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▼ Exothermic Feeding Compounds 5430

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13 Casting Machines and Equipment

13.02 Die Casting and Accessories

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17 Surface Treatment and Drying

▼ Heat Treatment and Drying 7398

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17.01 Plants and Furnaces

▼ Tempering Furnaces 7400

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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

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20.02 Measuring and Control Instruments

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▼ Laser Measurement Techniques 9310

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▼ Positioning Control 9345

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▼ Temperature Measurement 9380

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22 Analysis Technique and Laboratory Equipment

▼ Sampling Systems 9970

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24 Environmental Protection and Disposal

▼ Waste Disposal, Repreparation, and Utilization 24.03

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26 Other Products for Casting Industry

26.02 Industrial Commodities

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27 Consulting and Service

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28 Castings

▼ Aluminium Pressure Diecasting 11390

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Aluminium Die Casting
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Company	Product
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Friedrich Schwingtechnik GmbH	7980
GTP Schäfer Giesstechnische Produkte GmbH	3630, 3645, 5340, 5360, 5375, 5400, 5420, 5430
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www.messe-stuttgart.de/en

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June, 13-14, 2023, Hanover, Germany
www.lightcon.info/en

Intermold Japan
June, 21-23, Nagoya, Japan
www.intermold.jp/nagoya/english/

Lightweight Asia
July, 5-7, 2023, Shanghai, China
www.lightweightasia.com/en-gb.html

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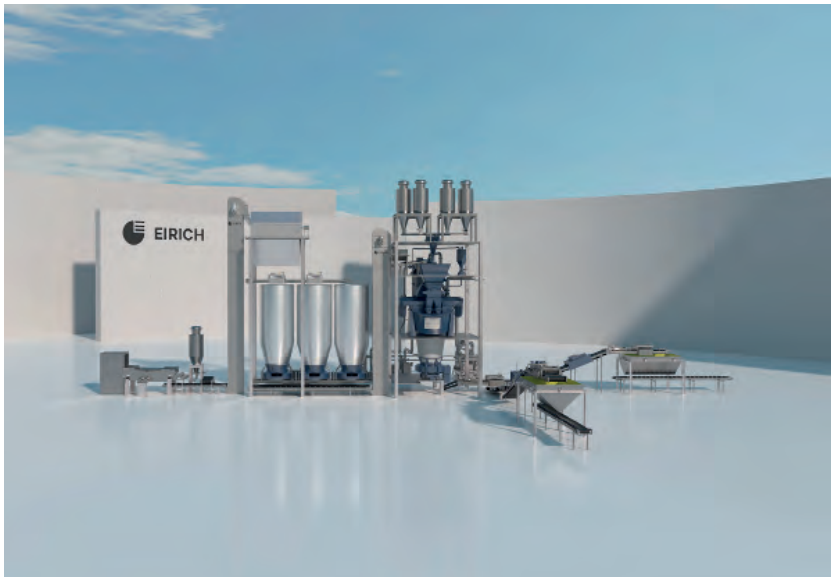

Photo: EIRICH

Eirich molding compound preparation for maximum efficiency and quality.

Preview of the next issue

Selection of topics:

Sand management: digitalization for more efficiency

The foundry industry consumes 100 million tons of sand every year, which is an important basis for optimum casting results. The focus is shifting to resource-saving technologies and processes and a strong development towards sustainability and environmental protection. One aspect of this is intelligent sand management.

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