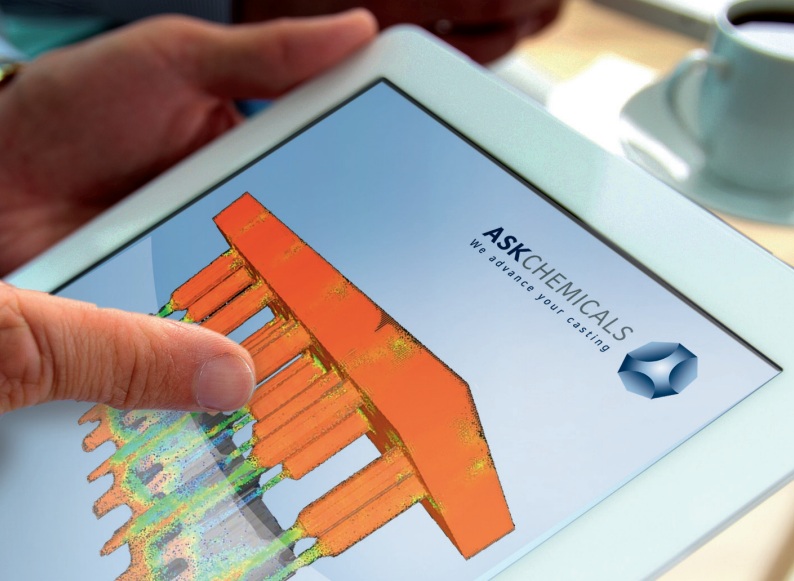


Design Services – Added value for foundries



ASKCHEMICALS
We advance your casting



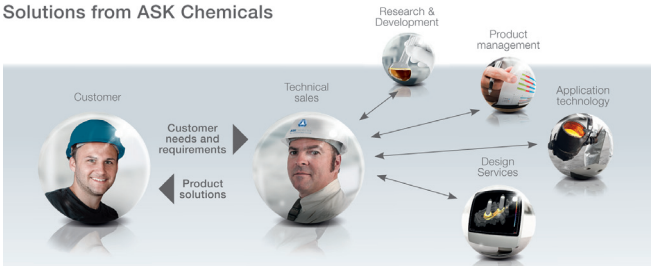


Products, Systems and Services increase product safety and maximize performance

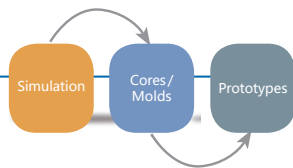
Foundries have valued ASK Chemicals' product portfolio for many years. Yet the ASK Chemicals brand represents far more than its range of premium chemical products. As a supplier and partner of foundry chemicals it also supports foundries with services covering the entire development and production process – developing, in close collaboration with the customer, solutions that offer real added value.

ASK Chemicals supports its customers from the development of casting design through validation to manufacture of the prototype and series production. This global player's foundry men, pattern makers with many year practical experts have the right combination of construction, production and simulation know-how to draw from.

Solutions from ASK Chemicals



In close collaboration with the customer and based on their requirements, ASK Chemicals develops customer-specific solutions.



Solutions from the specialist

Longstanding experience at every production stage of the modern casting process creates the basis for this complete range of products. Thus, it has not taken the experts of ASK Chemicals long to acquire an excellent reputation as adept facilitators and consultants.

Both the company's technical service and technical sales departments provide customers with in-depth expertise and support them with extensive specialist knowledge. The Design Service Team supervises the entire process from the development of the design concept via the validation to the prototyping of the cast part. Designers and engineers provide extensive experience and a clear understanding of all aspects of casting technology and metallurgy.

Using state-of-the art computer technology, ASK Chemicals analyzes and simulates processes such as core shooting, core gassing and dehydration, along with mold filling and core solidification. The team provides comprehensive technical knowledge and understanding combined with the most current simulation programs (MAGMA, NovaCast, FLOW-3D, and Arena-flow®).

"This allows us to develop a secure foundation for risk-free production decisions in the casting process," Christof Nowaczyk of ASK Chemicals explains the company's approach.



Core Shooting Simulation – to the Economic and Environmental Advantage of the Foundry

As part of the Design Service, which has been established successfully on the international market for years, ASK Chemicals is focusing intensively on the topic of simulating foundry processes. This involves using almost all well-known software solutions, such as Magma, Flow-3D, Arena-Flow® and Novacast. The company has thus gained a great deal of experience over several years, both in the area of simulating casting and solidification and in the area of simulating core shooting. The following article provides an overview of the potential that core shooting simulation offers.

Not only does global competition demand ever-improving quality with shorter development and production times at lower costs from the companies; the constant upgrade of an increasingly diverse product range is the rule nowadays and presents a challenge to the caster that is at least just as great. In this situation, computer programs, such as simulation software, can help lower costs, reduce development times and design optimized stable processes. This is not a new insight, as this practice has been mastered in the casting and solidification area for years.

While the development process from the idea to production led in the past from the drawing board via model construction, test casting and various adjustments to the finished product, computer-aided design (CAD), simulation, computer-aided manufacturing (CAM) and prototyping are used today. In brief, we speak of computer-aided engineering (CAE). With regard to model construction and also, specifically, the development and design of casting systems, this has certainly been the case for some years now. We are all familiar with the advantages and possibilities that simulation methods offer in this context.

However, the simulation of core production must still be considered to be relatively new. But do we need this type of simulation? Surely, nobody knows more about their core business, i.e. their core production, than experienced casters themselves. Nevertheless, we must ask ourselves – is this true? Do we really know what happens and whether we have designed the most optimum setup?

Two key simulation steps are distinguished in core shooting simulation. The first is the simulation of the filling process of the core box, i.e. the actual shooting of the core. The second is possible or necessary gassing, i.e. a through-flow of gas through a cavity of a core box with any type of filling.

The visualization of the filling dynamics (Figure 1) allows us to make precise predictions of areas with highly diverse degrees of compaction (Figure 2).

Conclusions about areas with increased tool wear can also be drawn, or predictions can be made for areas in which an increased level of binder application can be expected (Figure 3).

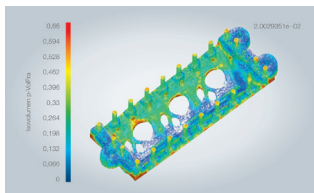


Figure 1: Visualization of the filling dynamics

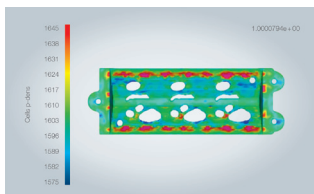


Figure 2: Areas with highly diverse compaction

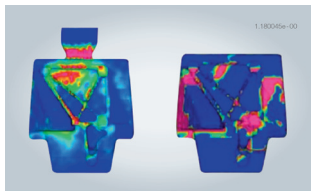


Figure 3: Tool wear – Kinetic energy \times impact angle



You could almost say that this sheds light on one of the last dark areas of our casting processes, and that this helps us to master our "core business" even better.

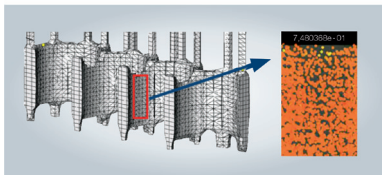


Figure 4: Crankcase water jacket with a poorly compacted area between cylinders 2 and 3

The simulation software Arena-Flow® is the only software on the market that can depict the actual interaction between particles (sand grains are particles) and the flow medium (air) in a realistic manner. It can depict problem areas with insufficient compaction very clearly (Figure 4). The compaction problem illustrated here is caused by a venting situation that is not ideal.

This example also clearly shows that the filling dynamics or the filling behavior depends primarily on the flow conditions of the air in a core box. This flow behavior can be illustrated by flow vectors and shows very clearly where insufficient compaction or problems with gassing can be expected.

In Figure 5, areas with insufficient airflow are shown in dark blue. With regard to gassing a core, this type of evaluation by means of simulation provides an initial insight into whether the process is homogeneous. If the lower box area already displays poor flow conditions, it can be assumed with

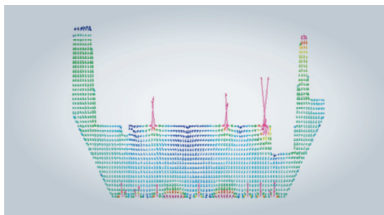


Figure 5: Airflow in a core box

certainty that gassing problems will occur. In this case, this means that significantly longer gassing times and unnecessarily high amine consumption are accepted in practice as a “series production status” of production. We must therefore speak of inefficient use of the amine here.

The following example (Figure 6) shows how systematic use and an appropriate optimization of the setup can help improve the quality of the core significantly while simultaneously reducing the cycle time by approx. 28%. In this case, only the venting setup has been optimized.

What are known as family core boxes are often designed to go with

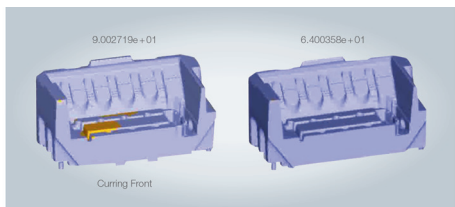


Figure 6: Gassing result – before (left) and after (right) optimization

existing core shooting machines. Production is then frequently faced with the problem that the compaction of certain cores or areas of cores is insufficient, which often leads to increased cleaning effort or even considerable rework of the cast parts.

In most cases, this is caused by the interaction between the geometry of the shooting head, which is installed, accepted as given and not considered further, and the actual setup of the core box and the arrangement of the shooting nozzles.



The following images show clearly that the existing geometry prevents the back left area of the core from being filled completely, since the amount of mold material that can flow through the sand magazine in the given time is not sufficient.

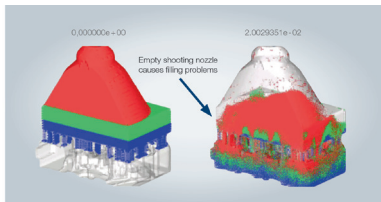


Figure 7: Analysis of the interaction between the shooting head and the core box

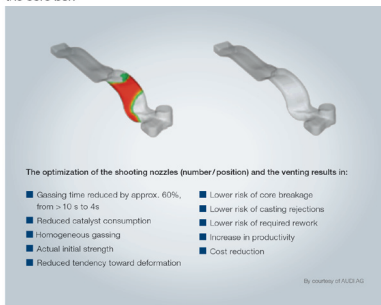


Figure 9: Simulation of gassing

Such a situation inevitably leads to significant additional costs, which could have been avoided by performing a corresponding simulation beforehand.

Adapting the design of the shooting head would certainly be the less expensive form of remedial action. In the worst case, however, this could jeopardize existing timelines and the possible adherence to milestones that determine the project.

A further practical example, based on an oil duct core in a design by AUDI AG, shows the potential that core shooting simulation offers in terms of saving costs and resources.

As part of a customer project, the task was to check an existing setup and to optimize it if necessary before constructing new core boxes. This project was supported and promoted not only by the foundry itself, but also by the client, AUDI AG. As an OEM that does not itself operate a foundry in which cores are used, AUDI AG consistently relies on simulation as a means of achieving stable processes, both in the foundry and in the purchasing companies later on.

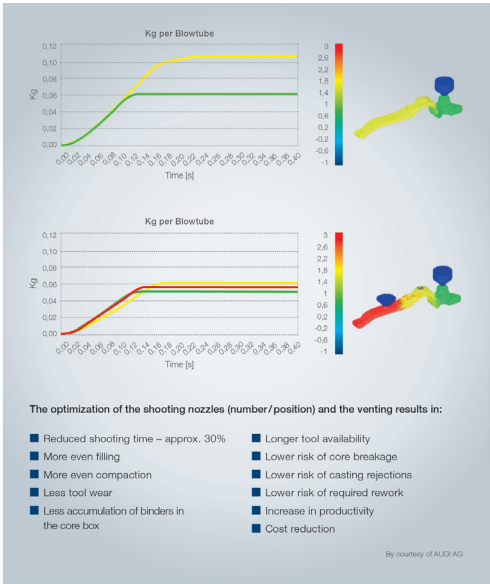
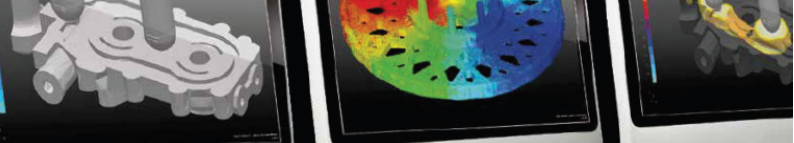


Figure 8: Shooting nozzle dynamics



From the concept to the prototype – success factors for managing casting processes

By using simulation to reproduce casting processes, foundrymen are able to generate relevant information for the construction of a mold. Casting systems, overflows, vents and feeders can all be optimized in this way. An exact representation of such aspects enables such casting defects as shrinkage cavities, veining and many other flaws to be avoided.

What support does ASK Chemicals provide in this area, and what are the benefits of this support? Below are the answers that Christof Nowaczyk, Product Manager Design Services, gave to these questions.

What do the simulation services of ASK Chemicals consist of?

Practice shows that cast parts are still being developed without all the concerns of foundry manufacturing being taken into account. The upshot: production problems first occur with the casting of prototypes, and sometimes these are not even recognized until series production is due to start.

It is in this very area that our provision comes into its own because we are there for our customers long before series production commences. With our know-how, our experience and diverse IT resources, we actively support the process from conception to prototype. This succeeds, among other things, due to the optimum variation of relevant production parameters. Simulation is a great help to us here, though our industry experience is vital.

Only when all the parameters are perfect are core box and tooling constructed. This saves on resources and optimizes processes.

Many foundries also have simulation software like this in use – could they not deal with everything themselves?

The use of simulation software is absolutely no problem for foundries or pattern makers. However, the mastery and coverage of the different simulation types and programs is another thing. Many process steps and independent variables need to be specifically optimized and accounted for from design to production in order to keep manufacturing risks as low as possible. To go it alone on this is very complex and difficult.

It is here that our teams of pattern makers, foundrymen and metallurgists assist customers specifically to increase efficiency. By means of material-specific process optimization, we help to actively reduce the use of resources, materials and energy.

Which programs do you make use of?

ASK Chemicals employs specific simulation programs to suit the task at hand. Our specialists use Magma, Flow-3D, Arena-flow® or Novacast – as the job requires. Each of these software options has its strengths and weaknesses for very different problems. Our advantage lies in the command of all these tools, which we sensibly combine.

The software Arena-flow®, in particular, supplies us with detailed results for the core shooting simulation – a major plus for our customers, which other providers are unable to afford in this way.

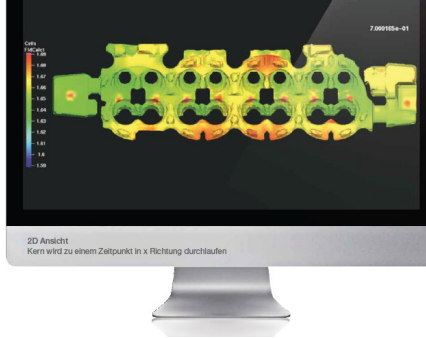


There are a variety of simulation software solutions – how do you want to make your mark with Arena-flow®?

We are not a software company but, rather, manufacturers of high-performance foundry supplies. We develop and produce these products. Our team is made up of experts in the foundry industry with many years of experience. As experts, we realized some years ago how valuable core shooting simulation software would be that could reproduce the core shooting process in a very realistic way.

Arena-flow® is based on CPFD® (Computational Particle Fluid Dynamics) technology and is the only software on the market to date that can simulate not only the movements of the sand grains and air current within the tooling but also the interactions between the two.

The result is an extremely realistic and exact simulation, which leads to greater efficiency in production and less scrap. Other attendant benefits of using the software include: reduction in the start-up costs for tooling due to less wear and tear, reduced core and casting scrap, and optimization of the tooling design.



Arena-flow®

Added value for ASK Chemicals customers

Arena-flow® speeds up the development process due to its exact and realistic simulation of the core shooting process. The latest version Arena-flow® 7.4 provides valuable features: an improved graphical user interface (GUI), individual customization of the gas curing dialog, and an improved color fill process.

Advantages of the Arena-flow® software

- Reduction in development times and costs by cutting trial and error in tooling development
- Increase in core and casting quality due to optimized tooling design
- Increase in productivity through cycle time optimization
- Increase in economic efficiency through optimized consumption of resources



Pilot foundry for customer use



Both in the headquarters in Hilden (Germany) and in Dublin (Ohio), ASK Chemicals operates test foundries fitted with state-of-the-art equipment. Here, the latest production techniques are extensively tried out and analyzed in regard to their application.

Thus customers are provided with an advanced test field in every respect. ASK specialists reconstruct customer-specific requirements in the pilot plant, developing and expediting solutions specifically for the development of new technologies and products, shoulder to shoulder with R&D. With the latest investment, a new core shooting machine, it is now possible to accurately reproduce all the established core making methods including inorganic core making.

The pilot plants of ASK Chemicals provide the facility for complete inorganic mold production, for the melting of gray and ductile iron up to 100 kg, and for the melting of aluminum up to 160 kg.

Extensive metallurgical testing of the graphite structure and the metallic matrix is also part of the technical support, as is comprehensive analysis of the sands used.

The pilot plants at the Hilden and Dublin (Ohio) sites are an integral part of the service concept of ASK Chemicals – because only through exact knowledge of the processes employed by the customer can optimum solutions be created.

A continuous system of project management accompanies each project individually. Thus ASK Chemicals ensures that there is efficient support from the planning stage to the continuing support after project completion.

“We regard our role as the safeguarding, optimization and further development of materials and processes for the manufacture of cast parts and components in close collaboration with our customers,” Jörg Brotzki, Executive Vice President, Europe, explains.

“Thus we have been able to lend assistance to a variety of customers with our solutions in recent years and support their plans successfully.”

Design services, simulation and foundry pilot plant provide the customers of ASK Chemicals with a valuable, integrated service package.

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