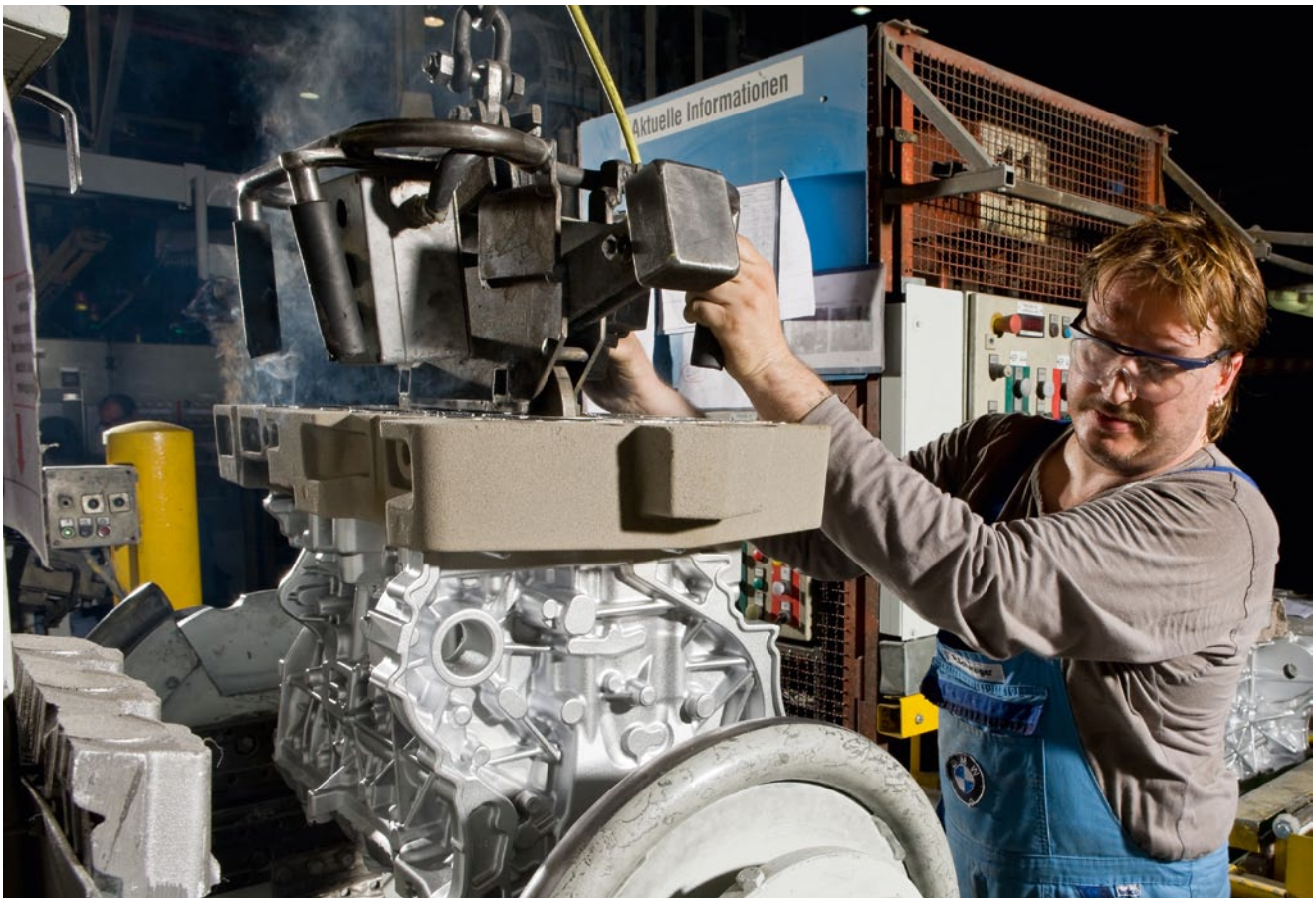
Internet-PDF from "Casting Plant & Technology " 01/2012, pages 6 – 8

Economic and environmental benefits of Inotec in serial production

Dr. Jens Müller, Head of Product Management for Inotec at global foundry supplier ASK Chemicals, talks to CP+T International about the advantages of the Inotec-process in series production, discusses the challenges faced in introducing it and gives a foretaste of the current developments



In the casting process, Inotec is proving its worth with significantly greater economy and lower emissions. This is underlined by the successful introduction of Inotec to the automotive industry for series production, e. g. at the light-alloy foundry Landshut of German car maker BMW where crankcases for diesel engines are manufactured (Photo: BMW)

When reconciling the often conflicting priorities of productivity, quality and sustainability in core manufacture, the choice of binder system plays a decisive role. Core molding operations face a choice: Whether to use organic core binding agents or inorganic binding agent systems? Can you tell us something about the importance of inorganic binders for the foundry industry?

In the case of inorganic binders, increased productivity and a reduction of emissions are not mutually exclusive. Above all in the casting process, significantly increased economic efficiency is achievable with Inotec. The absence of organic residues perceptibly reduces the time and effort invested in cleaning work. Moreover, accelerated solidification in the casting process – a function of the lower tool temperatures made possible by inorganic methods – cuts cycle times.

What is more, accelerated solidification enables greater component strengths to be achieved, which is especially relevant in the development of the new generation of low-consumption, super-charged engines. This is not possible with organic binders, due to the large quantities of con-

densates that are generated and the amount of cleaning that this entails.

I am convinced that inorganic binders will play an increasingly important role. This is because, quite apart from the environmental advantages, Inotec can also save costs and raise productivity.

In 2006, ASK Chemicals was the first company to bring an inorganic binding agent system to the series production stage. What modifications and investments can a core making operation expect to have to make?

Changes are to be expected all along the process chain. Whether these will also require a major investment must be determined in consultation with the client. The process is hot curing, i.e. heatable core boxes are essential. The right technology is required for this so that the curing process can be promoted by blasting with hot air. Ultimately the core box design is also a decisive factor. Among other things, we offer a simulation as a customer service and this is a great help in making such decisions. However, machine and tool makers have generally also realized the potential of the market for inorganic binders and are now offering solutions that are compatible with inorganic agents.

Here, I would like to point out that for us it is a matter of course to provide continuous technical support even after successful introduction. We face new challenges every day and we try to get on top of these as quickly as possible in cooperation with our customers and with our experts from applied engineering and research & development.

We jointly operate our own inorganic core production facility with ASK CoreTech in Moosburg/Germany, i.e. we are ourselves users of our own product and the direct experience that we have thus obtained in series production has proved invaluable.

Are reductions to process reliability to be expected when the Inotec process is introduced?

The process is technically demanding, requiring process parameters to be fine tuned along the entire production sequence. Organic systems have been well established for many years now and customers are familiar with the quirks of the conventional technologies. They still have to get to know the "new" Inotec process. Once they have done so and processes have been optimized, they soon discover that process reliability with inorganic methods is in no way inferior to that with organic methods.

Dr. Jens Müller is Head of Product Management for inorganic binders since December 2010 (Photo: ASK)

There is a difference to organic methods in the way in which the cores are handled. Although in some cases inorganic cores exhibit greater strengths than their organic counterparts, the former are less impact resistant due to their vitreous character.

It may be more difficult to decore inorganic cores with fine geometries due to the absence of the firing process, which is not to say, however, that it cannot be done. Otherwise their application in series production would not have been so successful.

Cores produced with inorganic binders have a poor resistance to humidity. To what extent does this limit their application or represent an obstacle to universal application?

The limited resistance to humidity is attributable to the underlying chemistry. The Inotec binder system is water soluble which is also why it is emission-free. However, this water solubility is not entirely irreversible when the curing process is completed. Nonetheless, ASK Chemicals has been able to gradually increase the moisture resistance of the cores.

Even so, it must be remembered that inorganic cores absorb air humidity, which is why extended storage times should be avoided under certain climatic conditions. In the last analysis, however, I do not regard this as a stumbling block as modern production methods such as lean production and reduced inventories work in favor of this process.

Have there been any recent developments in the regeneration of inorganic core sands?

Yes, there have. The two-stage mechanical/thermal regeneration process has proved to be especially effective in laboratory and pilot trials. The thermal stage seems indispensable in deactivating residual binder traces on the sand. If this is omitted, the sand's benchlife is reduced and the flow characteristics of the sand mixture also suffer. However, such disadvantages are not found in sand mixtures composed of 90% reconditioned sand and 10% new sand, provided that the old sand has been thermally treated. The high pH value of the reconditioned sand means that it must be strictly separated from organic sand usage cycles, e. g. a PU cold box mixture would immediately harden if it came into contact with reconditioned old sand.

The reconditioning concept described above has now been implemented in a series production plant for the first time. This first experience with a series production process is now being collected so that hopefully we will soon be able to tell you about the results.

Where do you see the limits of the technology where you would no longer recommend the use of inorganic binders?

Due to the investment required in heatable core boxes, the use of inorganic binders is likely to be restricted to large casting runs; it does not pay to make the change for small and medium-sized runs. In the production of really large core geometries, such as cores for axle housings, the inorganic process will not be able to compete with the cold box process because of cycle times. In this case physical limits are set by the curing mechanism, i.e. drying.

ASK Chemicals is continually developing the Inotec technology. Could you give us a foretaste of the developments we can expect in future?

In the area of aluminum, the focus is on continuous improvement of the binder systems. No binder is perfect and even after 40 years of cold box development, innovations are still regularly being introduced on the market. The same applies to Inotec.

The application in iron castings is currently in the test phase. In this case the challenge of course lies in the higher casting temperatures, which is why the focus is on the prevention of penetration and deformation. Here, too, we aim to be in a position to start with large series production applications in the near future.

I can see developmental quantum leaps in the transfer of this technology to other casting materials, e.g. steel. However, the range of application of inorganic binders will also be extended by the application of findings obtained in core production to form production. Replacing the classic no-bake binder systems such as furan resins with inorganic alternatives is another focal point of research & development at ASK Chemicals.

Finally could you say something about your approach to intellectual property and the market trend over the next 5 years?

Of course, we take steps to protect our know-how. Therefore all key development stages of the binder have been registered for patenting and in some cases the patents have already been awarded. This is not only essential for us but also for our customers, as they invest time and money in a new technology and this must be protected, also indirectly.

As far as market trends are concerned, I am convinced that inorganic binders will become accepted for aluminum permanent mold casting in the medium to long term because of the numerous environmental and economic advantages. I see the main market in automotive series production casting. Some OEM's have already opted for inorganic methods, others will doubtless follow. However, there are other attractive markets such as in cast valve bodies that would also benefit from the application of inorganic binder systems.

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