MAGMA GmbH Press Release

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Prediction of Hot Distortion of Sand Cores - a Further Step toward the Digitalization of Core Production.

Aachen and Düsseldorf, April 2019: MAGMA GmbH, specialist for the virtual optimization of foundry processes, and HA, as a supplier of foundry chemicals, have joined forces in a long-term cooperation to quantitatively describe the hot distortion of sand cores. Together, they intend to develop and provide digital core data for foundries. Visitors at GIFA 2019 have the chance to see the concrete steps being taken at the stands of the two cooperation partners.

Increasing demands on the dimensional tolerances of castings are especially critical for thin-walled sections, where even small deformations of sand cores can be critical for maintaining the required wall thicknesses and component geometry. The deformation of a sand core is dependent on its thermal expansion and the position of the corresponding core marks. For long thin-walled cores, buoyancy forces of the metal on the core play an additional important role. In the case of organic binders, even low buoyancy forces can lead to time-dependent deformation of the core due to creep effects in the binder resin **(Figure 1)**.

In order minimize the deformation of sand cores, their thermal and mechanical behavior during casting must be understood. With this knowledge, simulation programs can be used to predict how the core sand will behave during the casting process, particularly at high temperatures **(Figure 2)**.

MAGMA has implemented a numerical model in MAGMASOFT® in which the core sand is treated as a porous medium, and both the pressure and temperature dependence of the core strength is considered. Time-dependent

core deformation due to binder softening and decomposition are additionally taken into account through creep models. The effects on the core of e.g. buoyancy forces during casting are also calculated.

The cooperation between HA and MAGMA is aimed at quantifying the thermo-mechanical behavior of different molding materials during casting for the primary HA binder systems. MAGMA has developed a methodology to characterize the material behavior of cores using standard samples. HA is using this systematic approach in carrying out extensive investigations at its Center of Competence for both organic and inorganic HA binder systems and different sand types. These data will be used to generate product-dependent data sets, to make both the time and temperature dependent behavior of core distortion quantitatively predictable in MAGMASOFT®. The results are being validated through in-situ measurements at the HA technical center in Baddeckenstedt, Germany, using optical measurement methods to quantify the deformation of sand cores as a function of time during solidification **(Figure 3)**.

"The aim of our cooperation is to provide users of MAGMASOFT® with validated data for the quantitative prediction of core distortion for HA products," confirms Dr.-Ing. Jörg C. Sturm, a Managing Director of MAGMA. "With this new database, our joint customers will be supported even better in the layout of their core and casting designs." "We have a great interest in quantifying the behavior of our binder systems during casting," says Amine Serghini, member of HA's Executive Board responsible for Sales and Marketing. "The cooperation with MAGMA in this area will enable us to offer our customers another important added benefit."

At GIFA, both partners will present the first results of the joint development project, which is planned as a long-term cooperation.

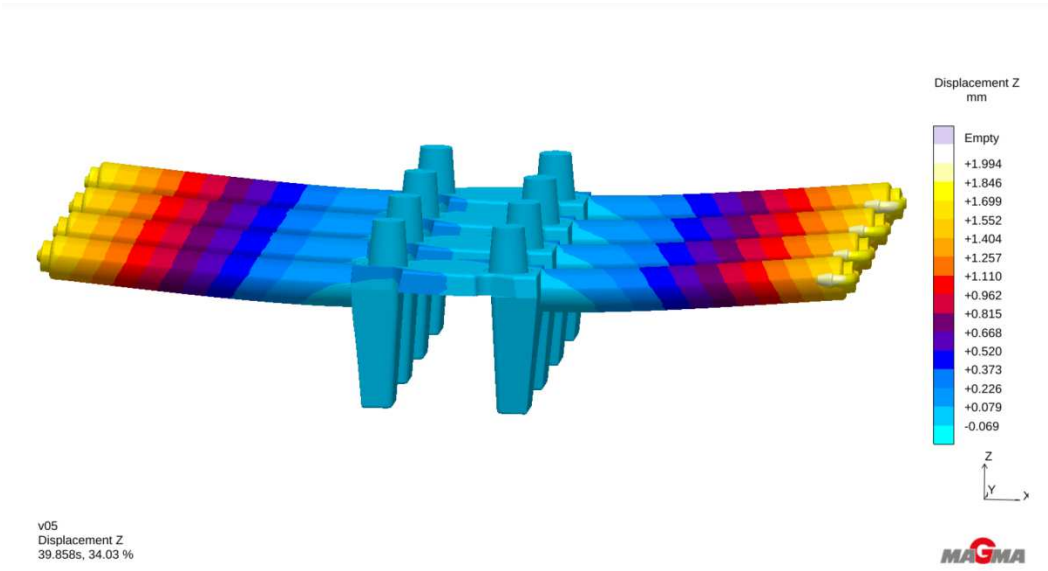

Figure 1: Core distortion during casting is a complex interaction between thermal, mechanical and time-dependent influencing factors.

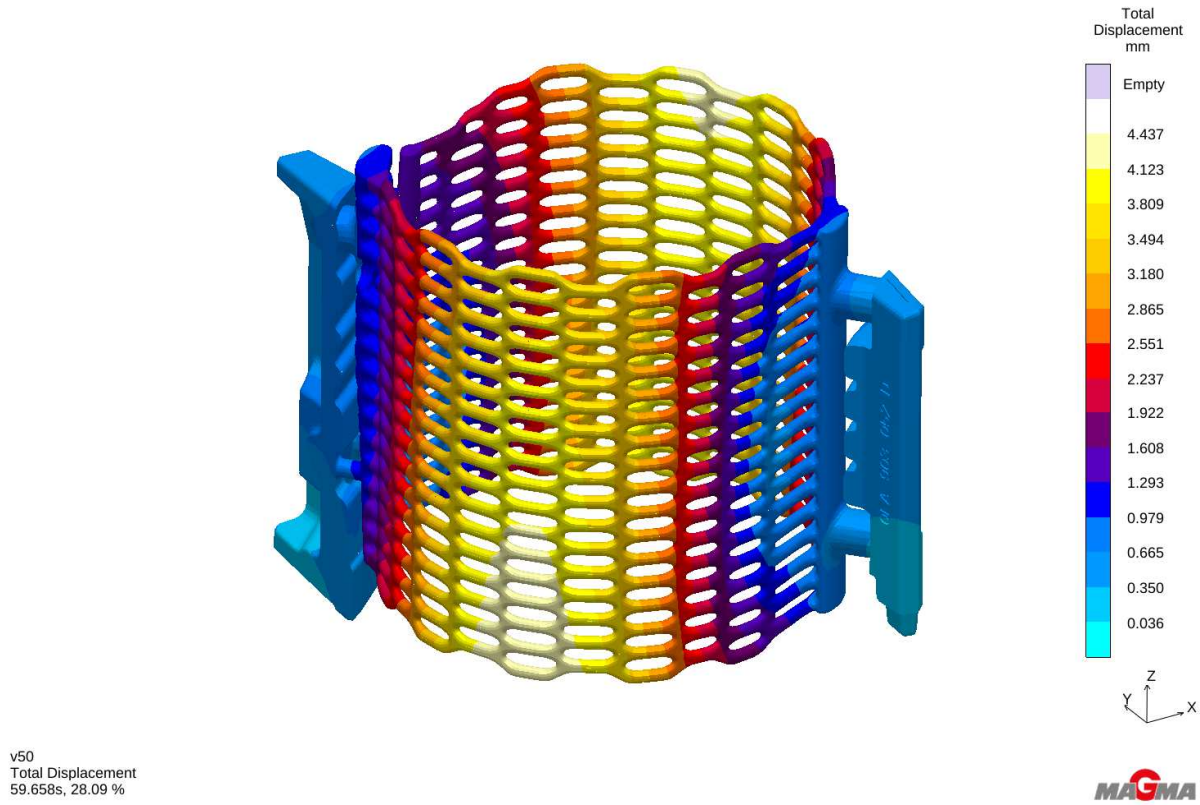

Figure 2: Core distortion of thin-walled, filigree cores is a major cause of deviations in the required wall thickness of the casting.

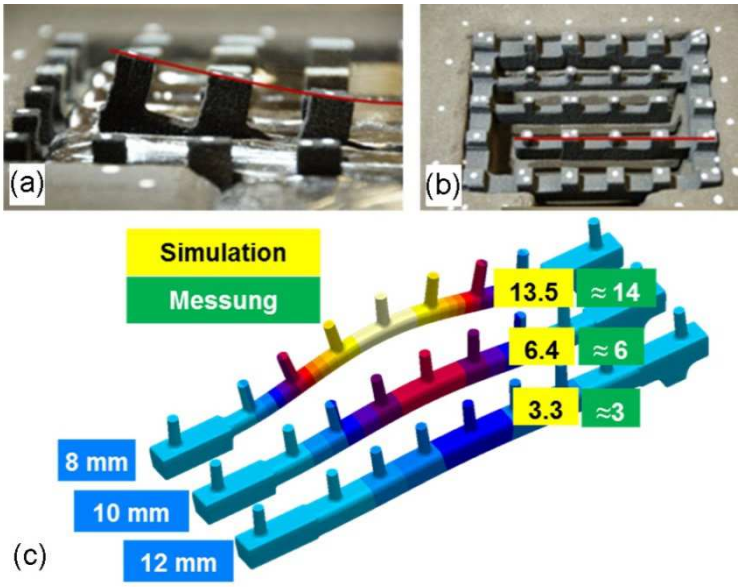

Figure 3: Casting tests to characterize core distortion. Close-up photos of warped cores, (a) and (b), and comparative simulation to predict core distortion (c). Source: MAGMA, Nemak and Foundry Institute of the RWTH Aachen University.

HA at GIFA

Hall 12 C50

MAGMA at GIFA and METEC

Hall 12 A19/20 and Hall 4 E29

About MAGMA

MAGMA is a worldwide leader in developing and providing software for casting process simulation and virtual optimization. MAGMA stands for robust, innovative cast solutions and for reliable partnerships with the metal casting industry, including casting designers and buyers. MAGMA's products unite the complexity of the casting process with user-friendliness to create economical solutions for its customers. MAGMA partners with its customers in the integration and effective use of the software, helping them to realize clear cost advantages.

MAGMA's range of products and services includes the simulation software MAGMASOFT®autonomous engineering, for virtual designs of experiments and autonomous optimization of casting processes, as well as comprehensive engineering services for casting design and process optimization. Today, MAGMA's software is used by more than 2000 companies all over the world for cost-effective casting production, reduced quality costs and for establishing robust processes for all applications, particularly in the automotive industry and mechanical engineering.

With the MAGMAacademy, MAGMA provides extensive implementation and educational offerings for all topics associated with casting process simulation. MAGMASOFT® users, together with their colleagues and managers, learn in trainings, workshops and seminars how they can use simulation and virtual optimization for optimizing casting design processes, lowering production costs and increasing resource efficiency.

MAGMA Giessereitechnologie GmbH was founded in 1988 and is headquartered in Aachen, Germany. A global presence and support are guaranteed by offices and subsidiaries in the USA, Singapore, Brazil, Korea, Turkey, India, China and the Czech Republic. Additionally, more than 30 qualified partners represent MAGMA around the world.

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560 words, 3962 characters including spaces

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