PRESS RELEASE

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Establishment of a Saxon Network: Cost Effective Production of High-temperature Components Using 3D Printing

(Dresden, 12/03/2024) The development of a continuous process chain for the sinter-based additive manufacturing of nickel-based alloys is at the center of the "Simsalabim" project. The Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Dresden together with the Dresden University of Applied Sciences (HTW) and the Fraunhofer Institute for Material and Beam Technology IWS are addressing all steps from design and sintering simulation through to verification on real parts. The requirements of the industrial manufacturers and endusers are incorporated through close exchange of feedback.

To date, metal additive manufacturing has primarily focused on laser-based processes. Although these are characterized by a high level of technological maturity, they do not meet all the challenges in terms of materials, geometries and productivity. This is why the industry's interest in sinter-based additive processes is growing. Their advantages include the ability to process difficult-to-weld materials, high productivity, good surface quality and cost-effective production.

Sinter-based additive technologies process metal powder without complete melting. This reduces thermal gradients and the formation of residual stresses as well as susceptibility to cracking and the formation of harmful phases.

This offers a great potential for high-strength nickel-based superalloys in particular, as these alloys cannot be processed crack-free using laser-based processes. These alloys are particularly characterized by high strength and corrosion resistance at high temperatures, which makes them the first choice for high-temperature applications in the energy, transport and hydrogen industries.

The lower degree of maturity of sinter-based additive processes compared to laser-based processes is causing reservations on the part of the industry with regard to the achievable properties such as proximity to the final shape and material microstructure. There is, therefore, a need to digitally predict the sintering shrinkage of complex structures and the adjustment of material properties in particular.

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Development of the Process Chain from Design to Actual Component

Within the project, a continuous process chain is to be designed: from component design to sintering simulation, the adjustment of material properties through to the real part. In addition, new materials and processes are to be established to be able to offer future industrial partners a broader range of solutions. The goal is to reach TRL 5 at the end of the project. The development is also focused on resource efficiency. The partners are aiming to save two to three development cycles and accelerate the calibration of new materials by a factor of five. In the long term, the project will also serve as the nucleus for a regional network for sinter-based additive processes. Based on the results of this project, other material classes, such as tool steels and cobalt-based alloys, are also to be investigated in the future.

Invitation to Exchange Ideas within a Network

Manufacturers and users of high-temperature materials are invited to an initial network meeting on November 27 and 28, 2024, in order to incorporate the specific requirements, needs and applications of the industry into the developments right from the start. The exchange is to be continued within this network in the future to jointly advance the cost-effective production of components using 3D printing.

With the Saxon scientific institutions Fraunhofer IFAM, Fraunhofer IWS and HTW Dresden, three research partners with distinctive expertise and in-depth experience in aviation, energy technology, additive manufacturing and powder metallurgy are available on the development side.

About the Partners

Fraunhofer IFAM Dresden has 30 years of experience in the development of powder metallurgical materials and has extended its expertise to five different sinter-based additive manufacturing processes, all of which are concentrated in the Innovation Centre Additive Manufacturing ICAM. The focus of the process development lies on the optimization of heat treatments.

Further information on Additive Manufacturing at Fraunhofer IFAM Dresden.

The employees of the Chair of Materials Engineering at HTW Dresden have extensive expertise in the field of high-temperature materials, thermodynamic and kinetic simulation and mechanical materials testing. The project focuses on metallographic material analyses of sintered nickel-base superalloys and the simulation of microstructural components. The aim is to develop a model for predicting the microstructure and mechanical properties of a sintered component.

Further information on the activities of HTW Dresden.

Fraunhofer IWS contributes many years of experience in the additive manufacturing of metals with a focus on material and process development. It has close collaborations in sintering simulation and a strong network in additive manufacturing.

Further information on Additive Manufacturing at Fraunhofer IWS.

Funding Notice

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Sintered part of an impeller, manufactured with GelCasting.
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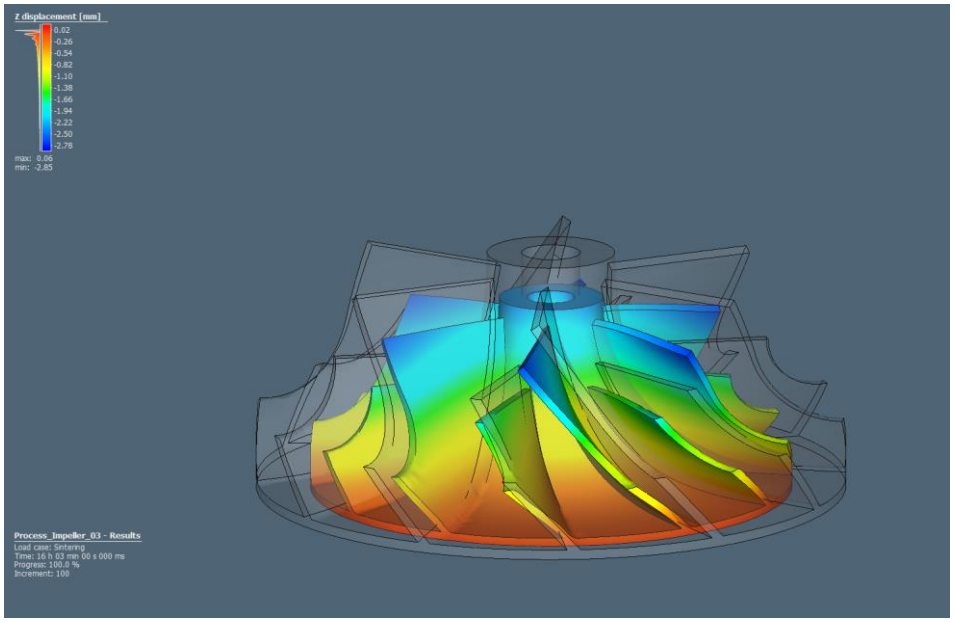

Holds Simulation of sintering shrinkage and distortion with Hexagon Simufact Additive software.
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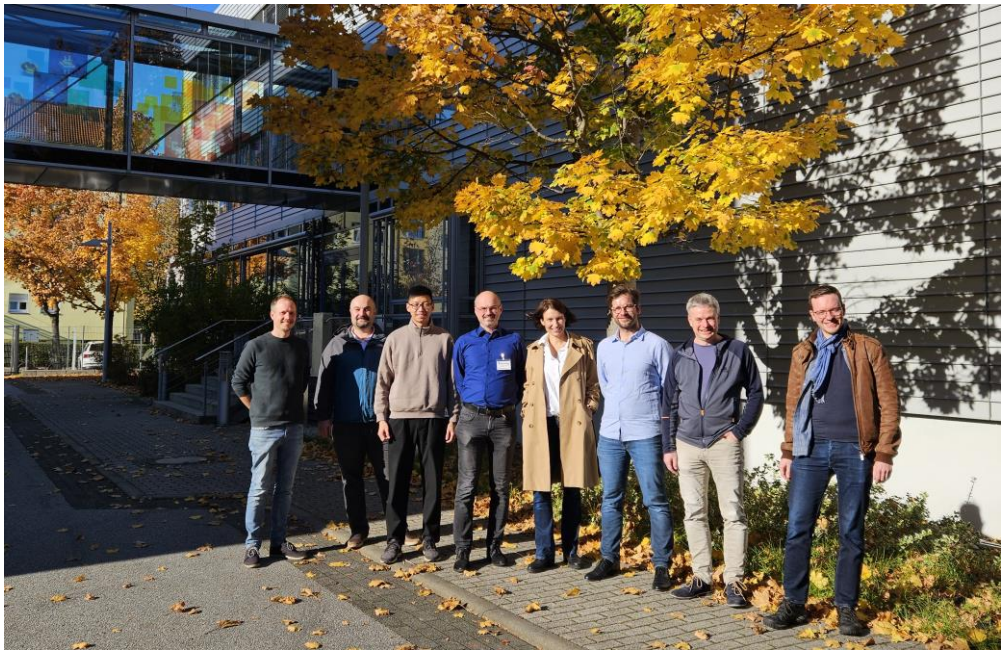

Kick-off meeting for the project »Simsalabim« on October 25, 2024.
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