

► Our technology. Your success.

Pumps • Valves • Service



Additive Manufacturing

Consulting – Manufacturing – Testing



“Additive Manufacturing is changing the world.”

KSB has always been a pioneer in developing technical innovations. This also applies for Additive Manufacturing: many years of research and a wealth of practical experience have positioned us at the forefront in this area.

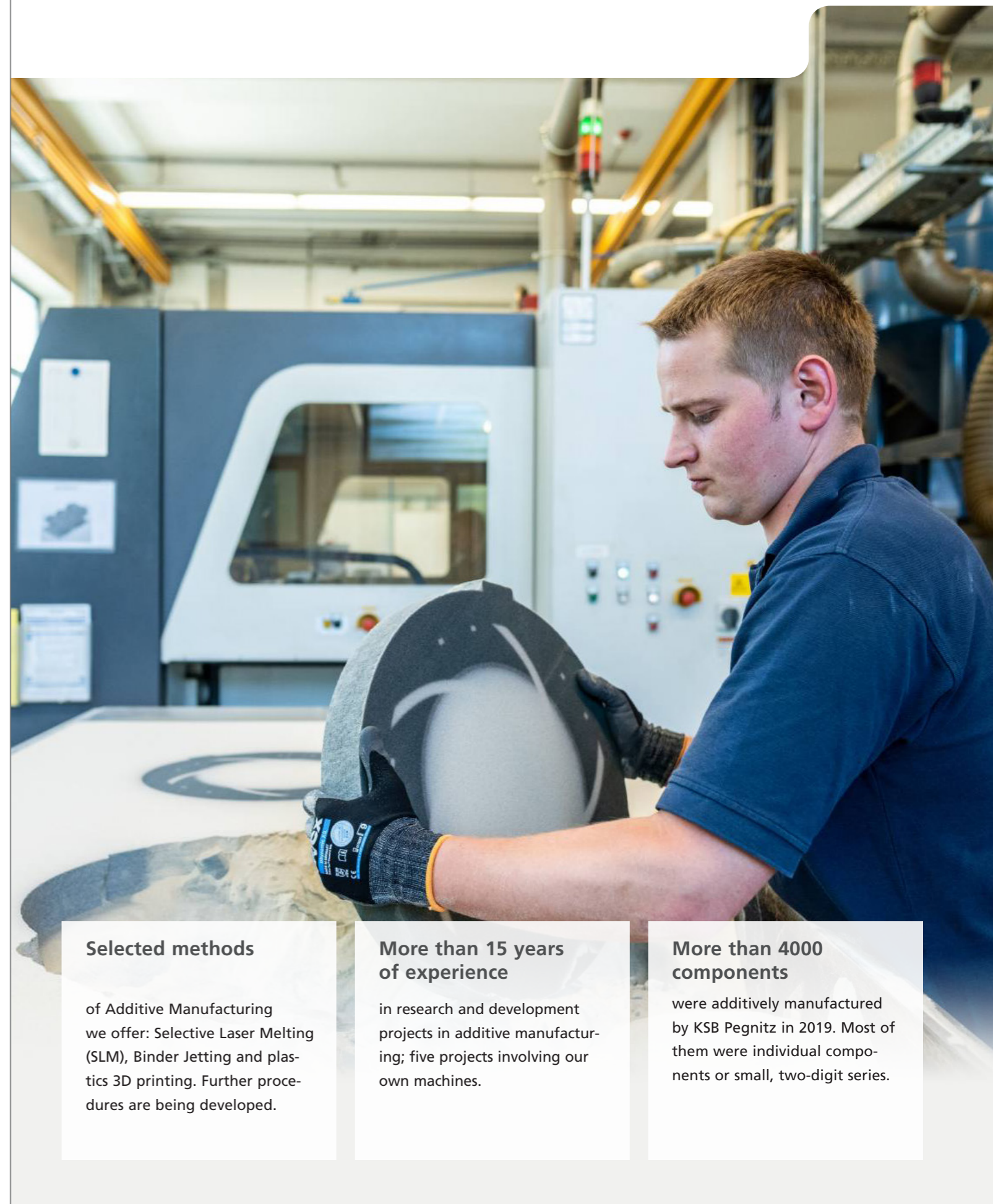


The benefits of Additive Manufacturing are plain to see: components are faster to produce, more flexible in design and can be individualised like never before. Additive Manufacturing complements conventional manufacturing methods and has provided new momentum in many industries.

In KSB's consulting, manufacturing and testing centre for Additive Manufacturing in Pegnitz we are working on special, holistic solutions for our customers; we offer all related services and expertise from a single source – from initial advice to quality assurance of the end product. TÜV Süd Industrie Service and KSB have jointly developed a certification process. In this context KSB was the first company worldwide to become certified for Additive Manufacturing of materials and semi-finished parts for pressure equipment.

It is our pleasure to support you with our expertise.

Dr.-Ing. Stephan Bross
Chief Technical Officer, KSB SE & Co. KGaA



Selected methods

of Additive Manufacturing we offer: Selective Laser Melting (SLM), Binder Jetting and plastics 3D printing. Further procedures are being developed.

More than 15 years of experience

in research and development projects in additive manufacturing; five projects involving our own machines.

More than 4000 components

were additively manufactured by KSB Pegnitz in 2019. Most of them were individual components or small, two-digit series.

Additive manufacturing: Innovation that comes in layers

Additive Manufacturing refers to the process of creating a three-dimensional object by depositing materials in layers. The fusion process of the layers takes place through melting and hardening processes of input materials (e.g. powder). Additive Manufacturing has opened up a new freedom of design that surpasses the possibilities of conventional manufacturing methods.

It is now possible to design components or assemblies focussing on the function they are to fulfil as even complex geometries can be produced without incurring any additional time or costs. This aspect is also known as “complexity for free”. And since the entire manufacturing process is completed in one step, no additional assembly or welding work is required, which saves time and costs.

“Additive Manufacturing has opened up new opportunities for us to enhance existing products, for example when designing new pump components.”

Marco Linhardt, Development Engineer at KSB



The Additive Manufacturing centre in Pegnitz operates full-featured, state-of-the-art manufacturing facilities.

Example of an SLM procedure: KSB is right behind you, throughout the

entire process, from the preparation stage through to quality assurance.

1 Preparation

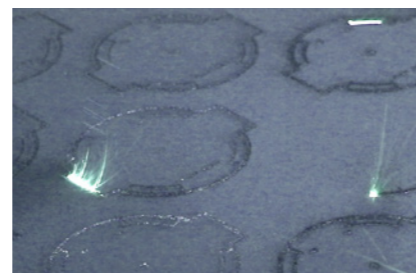


First, the data for the required component is prepared for the manufacturing process. To this end, the complete component is transferred to the computer with a software program, where it is shown as a detailed CAD model.

2 Manufacturing

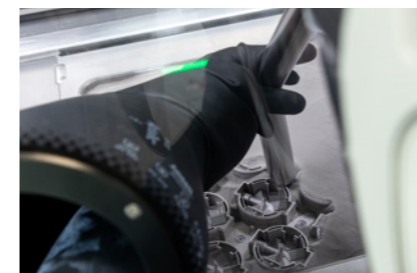


Then, the machinery and laser parameters are assigned; the data is transferred to the system for production.



In the SLM procedure the component is then built by adding layer after layer (20 - 100 µm thin, depending on the parameters) of the finest metal powder being deposited on a baseplate. A laser melts the metal powder only in places where structures have been designed.

3 Post-processing



Loose powder that has not been laser-melted will be shaken out of the inner parts after the manufacturing process. The steps of sawing the manufactured components off the baseplate and sieving the loose powder so it can be re-used are carried out automatically in a closed system.



The requirements on components made by Additive Manufacturing vary strongly depending on their applications and tasks. For a high tolerance accuracy and high-quality surface finish KSB offers a large range of post-processing options.

4 Quality assurance



After its completion, the component is subjected to thorough quality testing. The quality assurance accompanying the process comprises powder analyses, comprehensive mechanical and chemical testing as well as dimensional inspections.



Optimised using additive manufacturing: weight savings of 57 % were achieved by manufacturing this casing in a powder bed fusion process.

Consulting, manufacturing, testing: KSB is right behind you **throughout** **the entire process.**

KSB not only uses its highly modern, fully equipped manufacturing facilities in Pegnitz to produce components for its own products. Drawing on many years of expertise in metal processing, KSB also manufactures components of the highest quality for other companies in these facilities. KSB is always there for its customers, from start to finish, offering them the entire process chain from a single supplier: from a customised demand survey through to comprehensive quality control of all manufactured components

Overview of **the services we offer:**

Consulting

- Business case assessment
- Technology screening
- DfAM: Design for Additive Manufacturing
- Optimising process steps to save costs
- Training and workshops for production specialists
- Research and development projects around the world



Manufacturing

- Design for Additive Manufacturing
- Reverse engineering
- Powder bed fusion and material extrusion process to produce precise and intricate geometries in a layer-by-layer fashion
- Post-processing to meet critical dimensions and/or surface finishes required
- Processing iron-based materials, nickel-based materials and plastics



Quality assurance

- Powder analysis
- Customised testing
- Dimensional inspections
- Light and scanning electron microscopy
- Comprehensive mechanical and chemical tests and inspections in KSB's materials testing laboratory (accredited according to DIN EN ISO/IEC 17025)



More than just an innovative technology: Additive Manufacturing offers new solutions

For many industries Additive Manufacturing has opened up new solutions. Especially in product development where development cycles are continuously shortened, speed and flexibility are essential for manufacturing prototypes. Unlike conventional production methods, Additive Manufacturing does not require any tools or moulds, making the production of prototypes and end products considerably faster and more flexible. This is referred to as rapid prototyping and rapid manufacturing. It is also an advantage for spare parts management: where growing storage costs give rise to a demand for fine-tuned just-in-time logistics, Additive Manufacturing helps respond to supply shortages, quickly and flexibly.

Additive Manufacturing is also attractive for companies watching their energy and material costs. Generally, in the SLM process, up to 95 percent of the unmelted, loose powder can be re-used. Current manufacturing methods can also be supplemented or supported by Additive Manufacturing – for example by rapid manufacturing of necessary tools.

Get in touch: KSB will be pleased to provide you with comprehensive advice and show you the benefits Additive Manufacturing can have for you – highly individual, tailored specifically to your requirements.

“The new manufacturing technologies allow us to create components that are almost impossible to produce with conventional methods.”

Dr. Alexander Böhm, Head of Materials Engineering and Additive Manufacturing at KSB

Inspecting a (complete) pump set with an additively manufactured casing.



Our experts accompany you throughout the creation of every component – from its initial planning through to quality testing.

Benefits at a glance

Geometric freedom

Designs that used to be considered complex, hard or impossible to produce are now easy to implement (complexity for free).

Optimised performance

Best properties are achievable for designs with few components and a low mass.

Rapid implementation

It is faster to create, test and develop product innovations.

Cost-effective product development

No time-consuming production of costly prototypes.

Tailored production

Fast production of small quantities at comparatively low costs per unit.

Prompt delivery

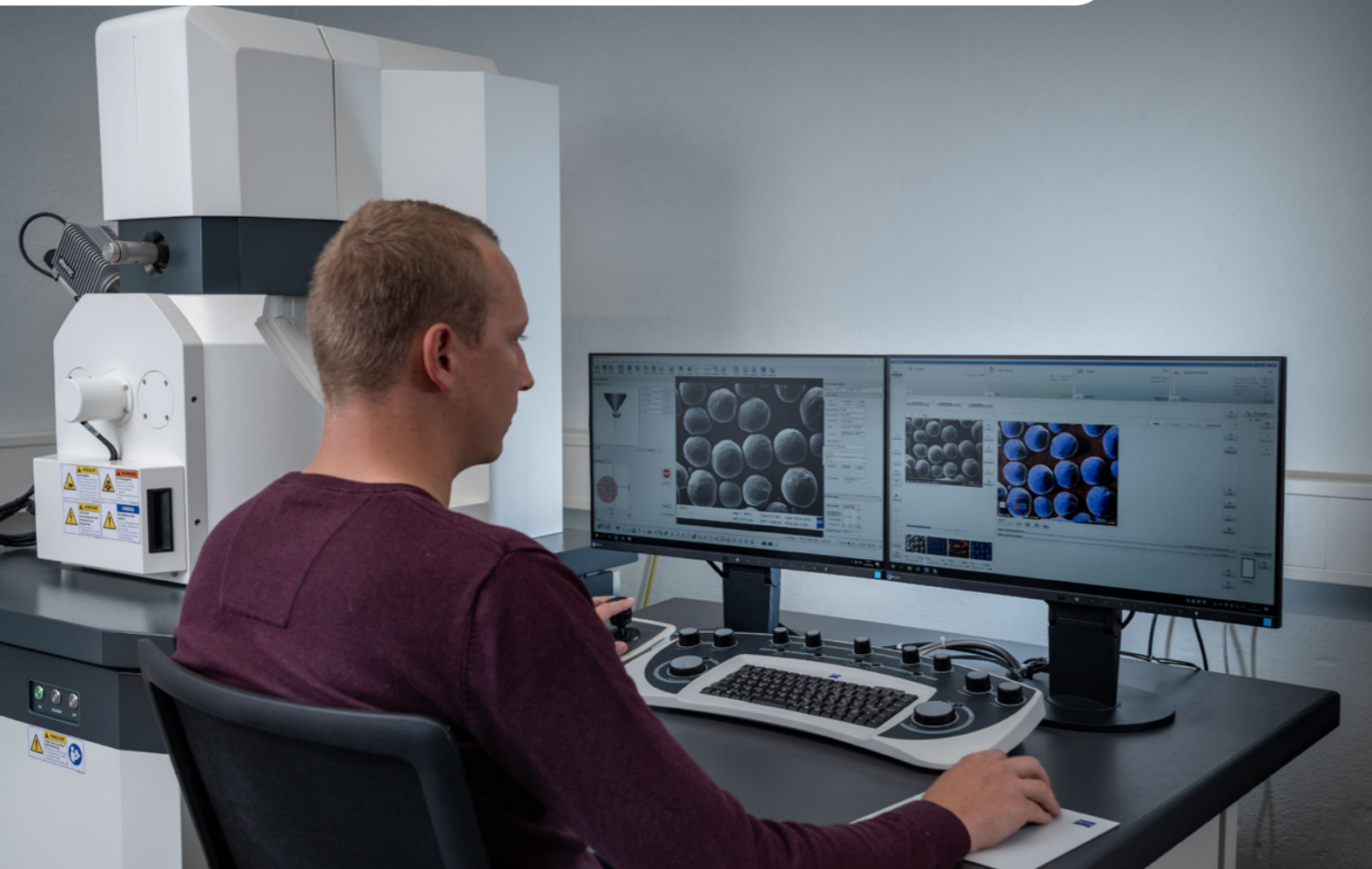
Just-in-time manufacturing of components makes stockkeeping redundant.

Trust is good. Testing to **accredited methods** is better

In our own, accredited materials testing laboratory KSB experts subject the most diverse of materials and components to testing methods at the highest international level. The testing laboratory is tightly interlinked with the research and development, production and consultation departments. They are all located right next to each other on the same premises. This guarantees a continuous exchange of know-how as well as positive synergy effects.

By the way, not only KSB's internal departments benefit from the many years of experience and modern facilities of the testing laboratory. The testing laboratory also regularly carries out tests and inspections as a service provider for external customers, also from other industries. In research and development of materials engineering, the laboratory has been working closely with research institutes, universities, different funding bodies universities and different funding bodies for many years.

Looking over the expert's shoulder: powder analysis using a scanning electron microscope.



The team: Competent, motivated, creative

Test methods procedures accredited according to ISO/IEC 17025 not only place high demands on laboratory equipment, they also require the staff to have special competence. KSB's materials' testing team is made up of experts who have all been working in their specific fields for years, if not decades. KSB's customers benefit from the experts' comprehensive know-how, their drive, pioneering spirit, teamwork and perfectionism.



KSB carries out all tests in-house in accordance with the latest international standards.

Technical equipment: Functional, advanced, comprehensive

Its large range of state-of-the-art equipment enables KSB to conduct all inspections and tests in-house, meeting the latest international standards. KSB continuously enhances and extends its facilities – to be ready for any changes in requirements that may incur when new materials and manufacturing methods are developed.

Service range

- Testing the most diverse of steel grades in cast, forged or welded form
- Testing materials on a nickel, cobalt and copper basis
- Testing ceramics, polymers as well as organic and inorganic coatings
- Mechanical and analytical testing using accredited test methods
- Metallographic testing according to international standards
- Non-standard test methods on request
- Comprehensive chemical laboratory services
- Competent consultation and information on all materials topics
- Conducting failure analyses

KSB's materials testing laboratory, reg. No.: D-PL-19609-01-00

- Internationally recognised, accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS)* according to DIN EN ISO/IEC 17025
- Certified according to ISO 9001
- Certified according to ASME Code Section III NCA-3800



* DAkkS is the national accreditation body for the Federal Republic of Germany. It acts in the public interest and as the sole provider of accreditations in Germany. It is a member of the European co-operation for Accreditation (EA) and the International Laboratory Accreditation Cooperation (ILAC).

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