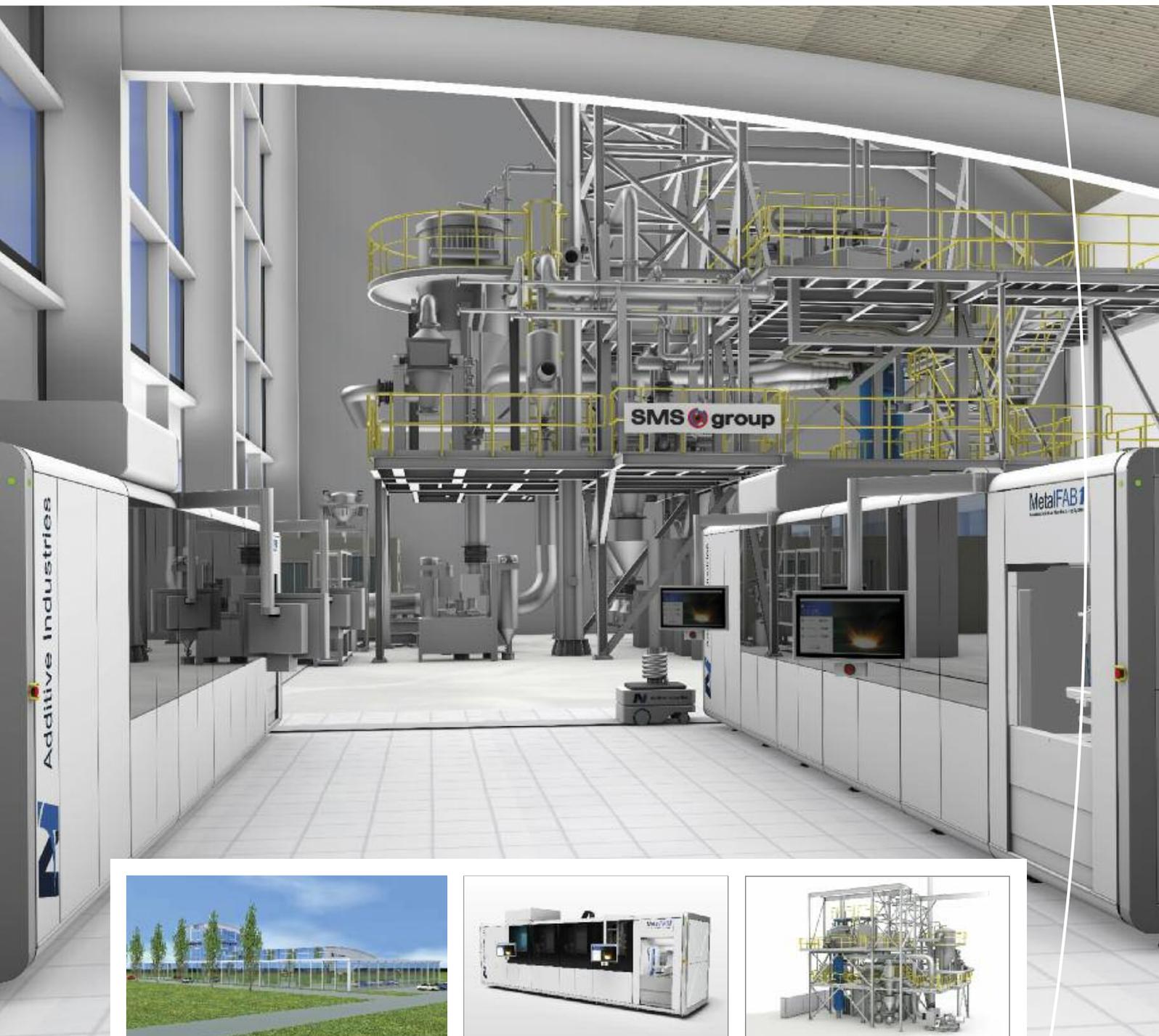


## Scale4Series

The breakthrough in additive manufacturing series production



# Our concept for additive manufacturing series production

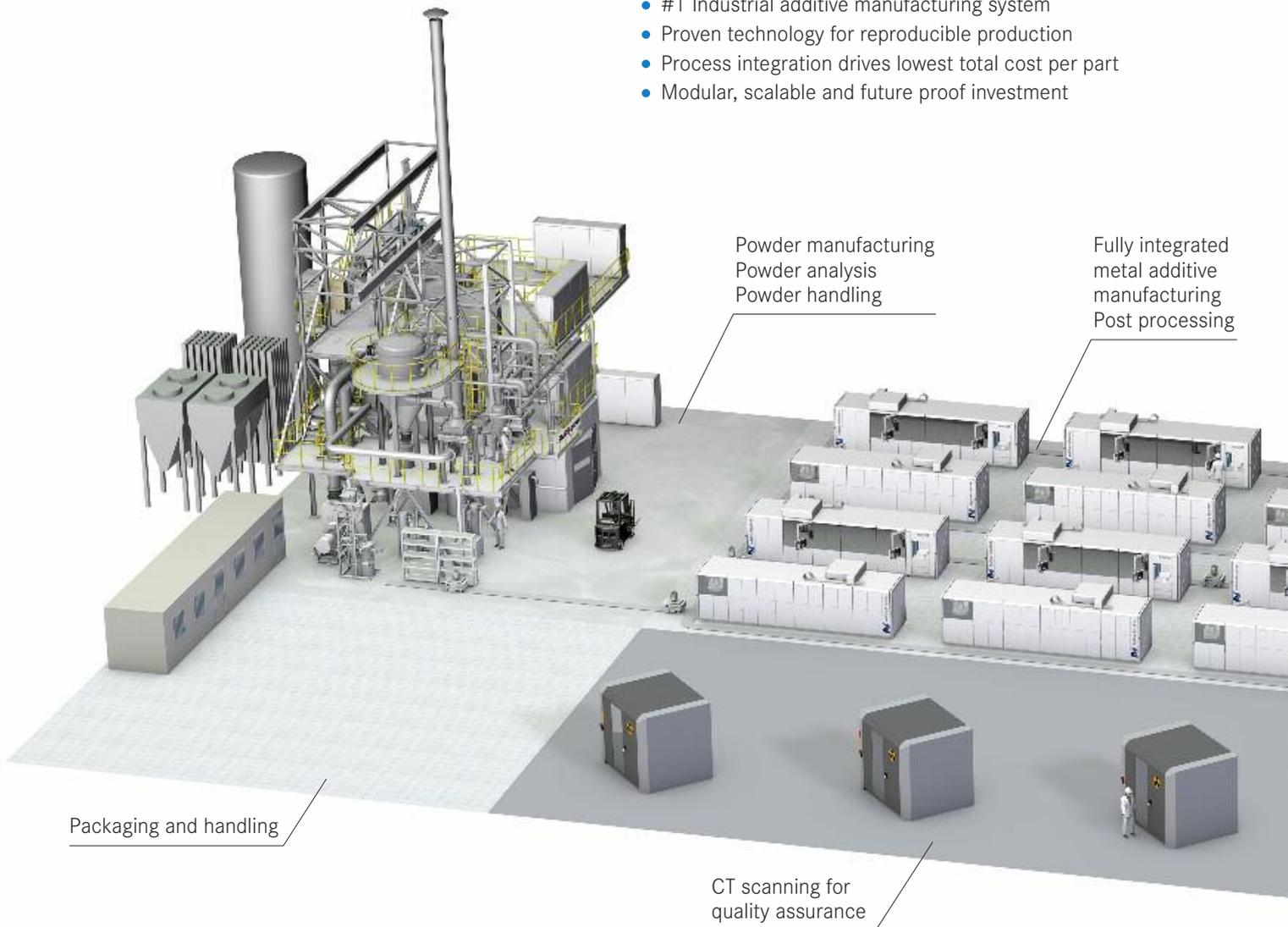
## Powder atomization plant Production of metal powder of highest quality and purity

- Induction melting of metals in crucible under vacuum
- Atomizing of liquid metal by means of pure argon
- Integrated powder analysis and classification
- Industrial-scale pilot plant for fast progress in powder production

## MetalFAB 1

MetalFAB1 is the first integrated metal additive manufacturing system designed for high end industrial applications in demanding markets like aerospace, medical, high tech equipment, tooling and automotive. The MetalFAB1 uses powder bed fusion with multiple lasers. In addition to the core 3D print process, heat treatment, product removal, automated build plate handling and storage are also integrated into one industrial grade production system.

- #1 Industrial additive manufacturing system
- Proven technology for reproducible production
- Process integration drives lowest total cost per part
- Modular, scalable and future proof investment



Packaging and handling

CT scanning for quality assurance

**Your benefits**

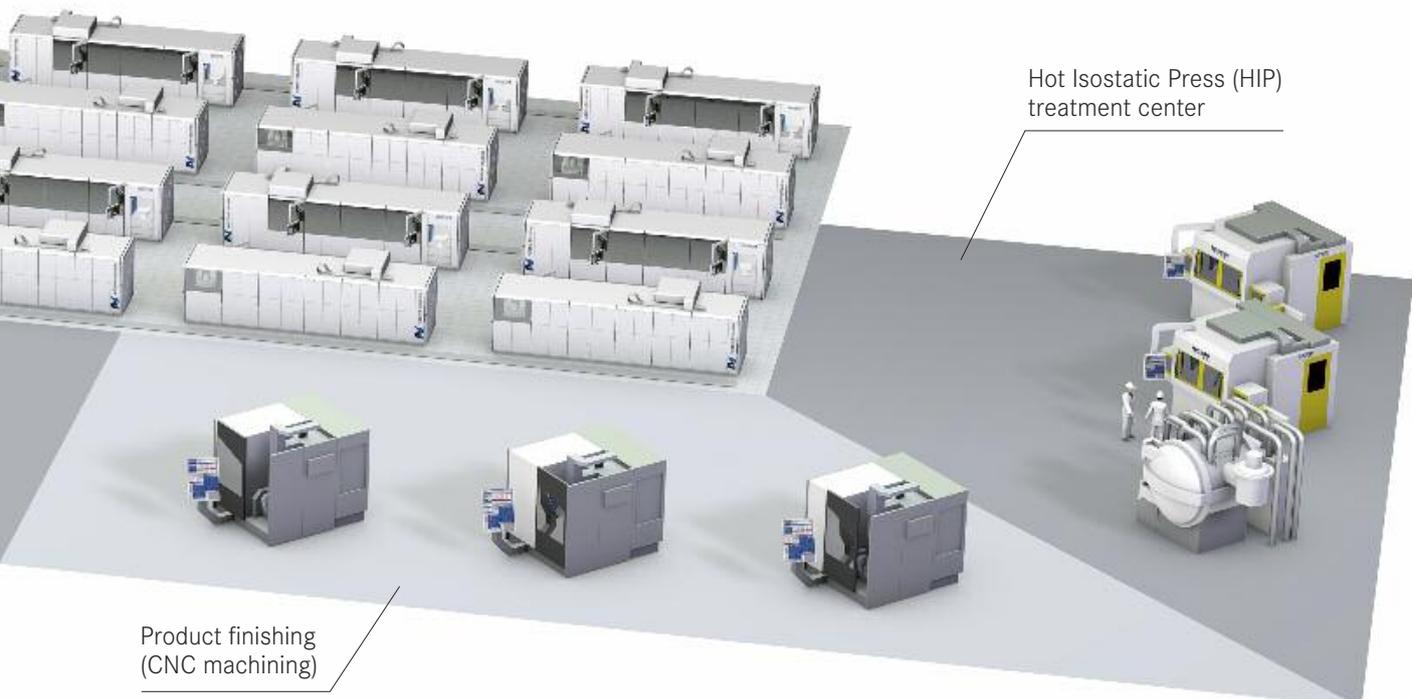
- Reproducible, high quality for series production due to control of integrated process chain from powder production to finished product
- Process optimized for maximum productivity and lowest total cost
- Modular and scalable concept
- Turnkey supply of complete additive manufacturing plant
- One point of contact
- Worldwide network for support

**SMS group**

SMS group is a globally leading partner for the metals industry. As a family-owned business headquartered in Germany, quality and innovation is in our DNA. SMS group has extensive know-how in design and process engineering of vacuum melting plants and transfers this expertise to powder production.

**Additive Industries**

Additive Industries is accelerating industrial additive manufacturing of high quality functional metal parts by offering a modular end-to-end 3D printing system, MetalFAB1, and seamlessly integrated information platform, Additive World Platform, to high end and demanding industrial markets. With substantially improved reproducibility, productivity, and flexibility, Additive Industries redefines the business case for series production of additive manufacturing applications in aerospace, automotive, medical technology and high-tech equipment.



# Business Case Study

## Economical advantages of the AM spray head in this case:

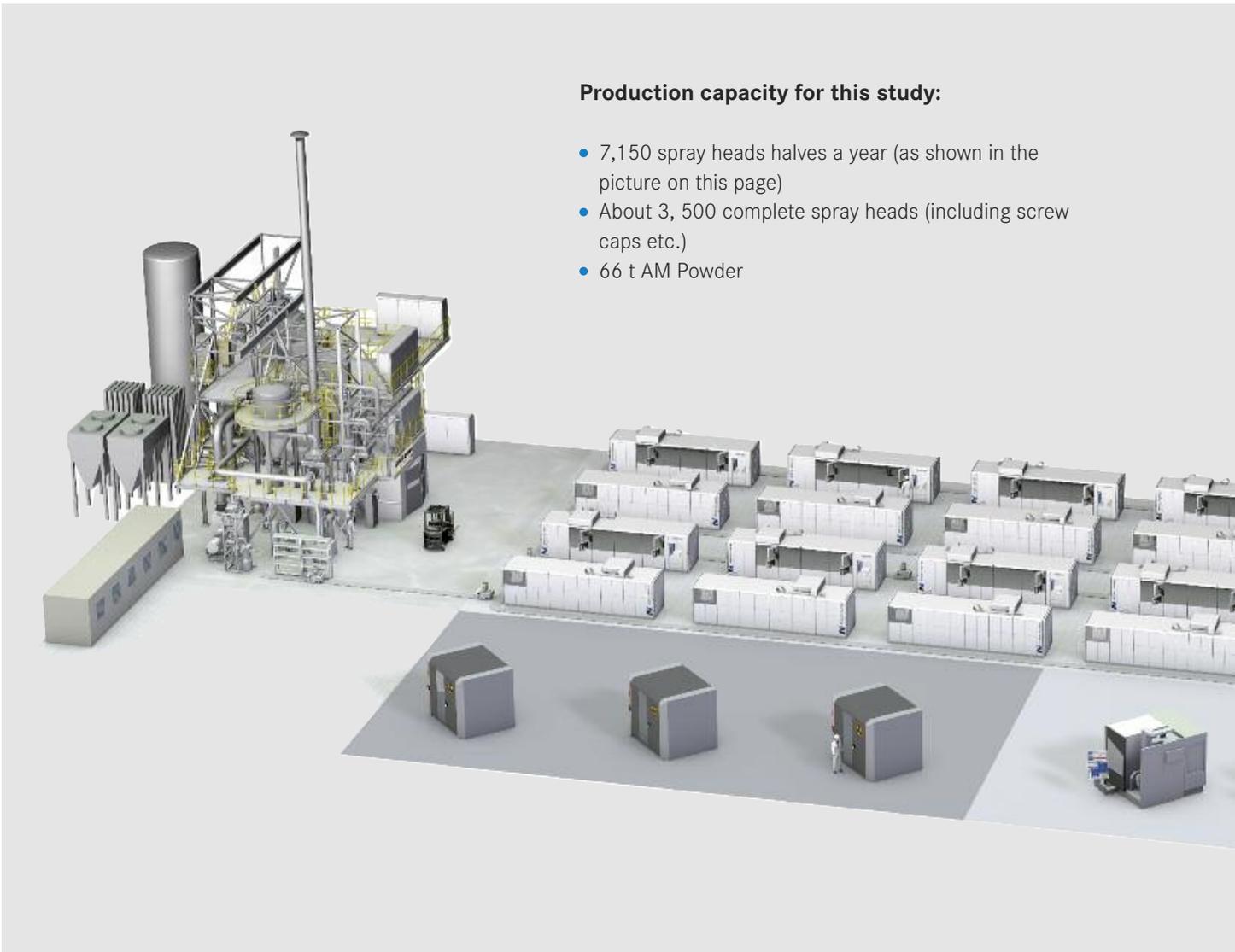
- Spray heads on demand
- Reduced lead time by 4 times
- Reduced engineering time by 5 times
- Customisation at low costs
- Weight reduction by 10 times

## Closed-die forging industry

- Worldwide there are more than 2,000 closed-die forging plants with one or more closed-die forging presses. For their several products they need different spray heads to have an optimized spray result.

## Production capacity for this study:

- 7,150 spray heads halves a year (as shown in the picture on this page)
- About 3, 500 complete spray heads (including screw caps etc.)
- 66 t AM Powder



**Information about the spray head halves:**

- 236 x 208 x 50 mm
- Weight 3,4 kg (based on 1.4404)
- 22 h printing time for one spray head halve



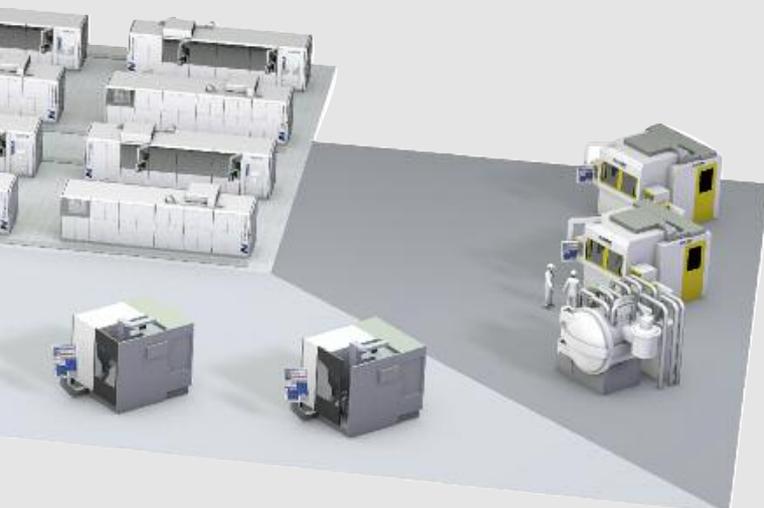
*3D spray head halves.*

**Scale4Series Plant equipment overview:**

- One Atomizer (250 kg crucible)
- 20 MetalFab1 Systems (configured with 2 Additive Manufacturing Cores and 4 lasers each – out of these six systems are equipped with a Heat Treatment Module)
- 2 Automated guiding vehicles
- 4 Automated part separation and support removal stations
- 1 Automated quality inspection station

**Economical benefits of the Scales4Series production roadmap:**

- Reduction of money tied up in stock for powder by approx. 50 %
- Reduction of costs for powder by about 30 %



# Engineering for Additive Manufacturing as a service

## Clear focus on the entire value chain

From powder production through part identification, analysis of potential, and additive manufacturing-compatible design, right up to the manufacture of the component itself, SMS group takes a holistic approach with know-how that covers the entire value chain of additively manufactured components.

How do you obtain an optimally designed component that is made using additive manufacturing technology? We are a team of experts who can help you find the answer to this question. Our areas of expertise include:

## Part identification and analysis of potential

What components are suitable for additive manufacturing? Our experience shows that components with reduced weight require less drive power, and the installation space can be used more efficiently by fitting a more compact design.

What is the cost/benefit ratio? We can help you find the answers to these questions using evaluation matrices and our extensive experience accumulated over many years.



Result of the process simulation of the CONTIROD®\* nozzles.

## Part design and optimization

In terms of their design, additively manufactured components differ fundamentally from those made using conventional production technology. Additive manufacturing requires a shift away from the conventional production-oriented to a function-oriented way of thinking and designing. After all, the function is ultimately what determines which geometry the part will have after the design process. The design process is supported by the versatile analysis and optimization tools we have at our disposal.

## Process simulation

With the laser-based powder bed technique for metals, the component is made in layers of fine metal powder. The high melting and cooling rates result in stresses that can cause distortion on the component and ultimately leads to wastage. To reduce the amount of wastage to a minimum, or even avoid it completely, we use software to simulate the buildup process. The simulation helps to identify critical areas before production of the component has even started.



Additively manufactured CONTIROD®\* nozzles.

# Successful applications

As a team of experts we have already realized a variety of application designs and integrated them into the relevant plants. The CONTIROD®\* nozzle is one example of this. The nozzle is installed in the cooling section for the production of copper wire rod. It is used to cool, clean, and dry the wire rod. The hot copper wire rod is cooled by the nozzle in the cooling section. The additively manufactured CONTIROD®\* nozzle, which is made of metal, has a monolithic design, meaning it does not require pre-assembly and adjustment before being installed in the plant, which in turn has a positive influence on the reliability and stability of the process. The nozzle is a typical wear part. With additive manufacturing, customers benefit from the fast delivery of customized spare parts.

Another application of additive manufacturing is a shell junction holder from a cold pilger mill. This component is a monolithic part made of plastic. A special feature is the integrated sensor locking device, which is manufactured together with the body as one part, so there is no risk of losing it.

The PSM® roll cooling ring is used to cool the work rolls in a bar mill. The bars are rolled to shape at a temperature of around 1,000°C. The hybrid PSM® roll cooling ring consists of a conventional bent stainless steel pipe and is supplemented with additively manufactured spraying elements made of plastic. A special feature of the spraying



Hybrid design of the PSM® roll cooling ring.



CONTIROD®\* nozzle installed in a copper wire rod mill.

element is the flow-optimized channel and integrated nozzle geometries, which are already perfectly adapted to the roll. Optimal cooling is ensured as a result. Another advantage of this approach is that parts can be procured quickly and cost-effectively.



Plastic shell junction holder with integrated locking device.



Additively manufactured spraying element of the PSM® roll cooling ring.

\* CONTIROD® is a registered trademark of Aurubis Belgium

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