

Multi-industry

Hoedtke

Hybrid additive manufacturing transforms production of high-quality metal parts

Products

NX, Sinumerik

Business challenges

Manufacture complex components that cannot be produced with conventional methods

Speed up processing and setup time

Reduce time to delivery

Keys to success

Adopt hybrid additive manufacturing technology

Use NX Hybrid Additive Manufacturing software

Leverage postprocessing and machining simulation for integrated laser powder cladding and milling

Optimize components and processes prior to manufacturing

Effectively drive a hybrid machine using advanced Sinumerik 840D controller

Implement integrated CAD/ CAM/CNC process chain Hoedtke uses innovative technology to improve productivity using additive and subtractive processes in one setup

Hybrid multitasking machine integrated in the process chain

Hoedtke GmbH and Co. KG (Hoedtke) has always considered itself an innovator in the industry – the company was an early adopter of laser machining during the 1970s and benefited from the knowledge it acquired. "When we became aware of the laser, it had not yet been used in the metalworking sector," says Joachim H. Hoedtke, managing director. "First of all we used the laser cutting procedure, then the laser welding process. The next step is the additive manufacturing process, in which a metal powder jet is melted in three-dimensional space using a laser."

Since the end of 2014, Hoedtke has been using a Lasertec 65 3D laser deposition welding and milling machine from DMG MORI, equipped with a Siemens Sinumerik® 840D controller. The machine is a specific form of a multitasking machine, combining additive and subtractive processes, in particular generative laser powder cladding (directed energy deposition - DED) and 5-axis simultaneous milling in one setup. The machine is part of an integrated computer-aided design and manufacturing (CAD/CAM) and CNC process chain that uses NX™ software for hybrid additive manufacturing. NX software is used to prepare the complete manufacturing process using a digital twin of the workpiece, fixtures, and entire machine. The system calculates laser paths for additive manufacturing and cutting toolpaths for subtractive machining.

Additive and subtractive processes in one setup

On the Lasertec 65 3D, DMG MORI has integrated the new laser powder cladding technology into a well-proven milling machine concept to create a new generation of hybrid machines capable of manufacturing large-size parts. With the development of this hybrid machine, the company combined the benefits provided by the additive DED process, such as high material deposition rates and the ability to



The combination of additive and subtractive manufacturing processes on one machine enables production of highly accurate functional parts in one setup.

Results

Manufacture complex parts using multitasked additive and subtractive manufacturing process in a single setup

Achieve accuracy required for functional parts

Shorten delivery time

Continued company tradition as industry innovator

build-up material on existing components with the features provided by advanced, highly complex 5-axis milling.

"The laser powder cladding process allows us to apply a high amount of material within a very short time," explains Vanessa Seyda, technology expert for additive manufacturing at Hoedtke. "Thus we can quickly produce three-dimensional components by applying a highly productive process."

"The fascinating aspect of the combination of additive and subtractive machining processes is that we manufacture workpieces by applying a relatively coarse additive process, and then achieve highly accurate milling results," Hoedtke adds. "This means that functional surfaces can be processed in a single setup, thus achieving highly precise results."

The Sinumerik controller on the Lasertec machine has an open architecture, in terms of both the operator interface and the real-time range, and is ideally suited for the efficient linking of different technologies in multitasking processes such as those that combine several manufacturing technologies in one machine. The hybrid additive concept at Hoedtke that combines milling and laser powder cladding is one such leading-edge multitasking process.

The benefits provided by the hybrid machine concept are obvious. "Depending on the nozzle used, the result of a laser powder cladding process is currently a maximum three-millimeters-wide melting trace with a rough surface," Seyda says. Five-axis milling is used in combination with the laser cladding to achieve the accuracy required for the functional surfaces of complex components. The machine can switch between laser powder cladding and milling, enabling finishing of regions on the workpiece that would be inaccessible on the final shape of the part. In addition, the 5-axis kinematics of the Lasertec 65 3D allow precise positioning of parts during the additive process so complex shapes can be easily built. Because components can be positioned using the machine's rotary tilt table, additional support structures that are typically required for powder bed-based laser processes can be omitted during the DED process.

Integrated CAD/CAM/CNC process chain for additive and subtractive processes

Advanced design and analysis capabilities are necessary to take advantage of the hybrid manufacturing process. Sometimes a part that was previously manufactured using traditional machining can require a complete redesign for hybrid additive manufacturing. It is important to select



suitable processing strategies for the additive and subtractive processes, and to use a CAD/CAM system that has been tailored to the hybrid process for tool path planning.

NX Hybrid Additive Manufacturing software offers capabilities for hybrid additive manufacturing in a fully integrated designthrough-CNC programming solution, including postprocessing and machining simulation for integrated laser powder cladding and milling. "Of course it is advantageous to work with a single software solution – from the design to programming through to production," says Seyda. "Siemens NX uniquely enables us to prepare the data both for the additive and subtractive processes."

Hoedtke can optimize the component and the process prior to manufacturing by using the broad range of simulation and analysis functions of NX. "The machining simulation capabilities are very important, as the smallest vibration at the spindle or laser head would cause enormous damage," says Steffen Heitmann, who operates both NX software and the Lasertec machine at the company. In addition to additive development steps from 3D design optimization, setup analysis, and assessment of thermal influences and mechanical properties to creation of laser paths, the Hoedtke team uses NX to simultaneously create all of the process steps required for CNC machining.

Once the CNC program is generated using NX, it is transferred directly to the machine. "The Siemens Sinumerik controller accesses the server, and as soon as the postprocessing program has been completed, the machine can load the program immediately," says Heitmann. The Sinumerik 840D then controls Sinamics S120 drives and the related motors to precisely perform the tool and part movements.

Full benefit of industry-standard complete solution

Continuing its tradition as an industry leader, Hoedtke is one of the first companies that uses the seamless CAD/CAM/CNC process available with the Lasertec 65 3D and NX to manufacture production-quality parts on a powerful hybrid machine. "The laser powder cladding process allows us to apply a high amount of material within a very short time. Thus we can quickly produce three-dimensional components by applying a high productive process."

Vanessa Seyda Technology Expert for Additive Manufacturing Hoedtke GmbH and Co. KG

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Solutions/Services NX www.siemens.com/nx Sinumerik www.siemens.com/sinumerik

Customer's primary business

For more than 75 years, Hoedtke GmbH and Co. KG has been an innovationoriented service provider in the metal and laser technology sector. The company's portfolio comprises the development and manufacture of parts, modules and complex mechatronic systems for numerous industry sectors such as handcraft, industry and research. More than 250 employees, including physicists, chemists and engineers as well as numerous technicians and foremen, work at the company's locations in Pinneberg and Kiel, Germany. Hoedtke uses its experience, combined with state-of-theart manufacturing technologies, to implement customer products. www.hoedtke.de

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NX CAD/CAM software with hybrid additive manufacturing capabilities offers a consistent design and programming solution including postprocessing and simulation for laser powder cladding and milling.

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Joachim H. Hoedtke Managing Director Hoedtke GmbH and Co. KG

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