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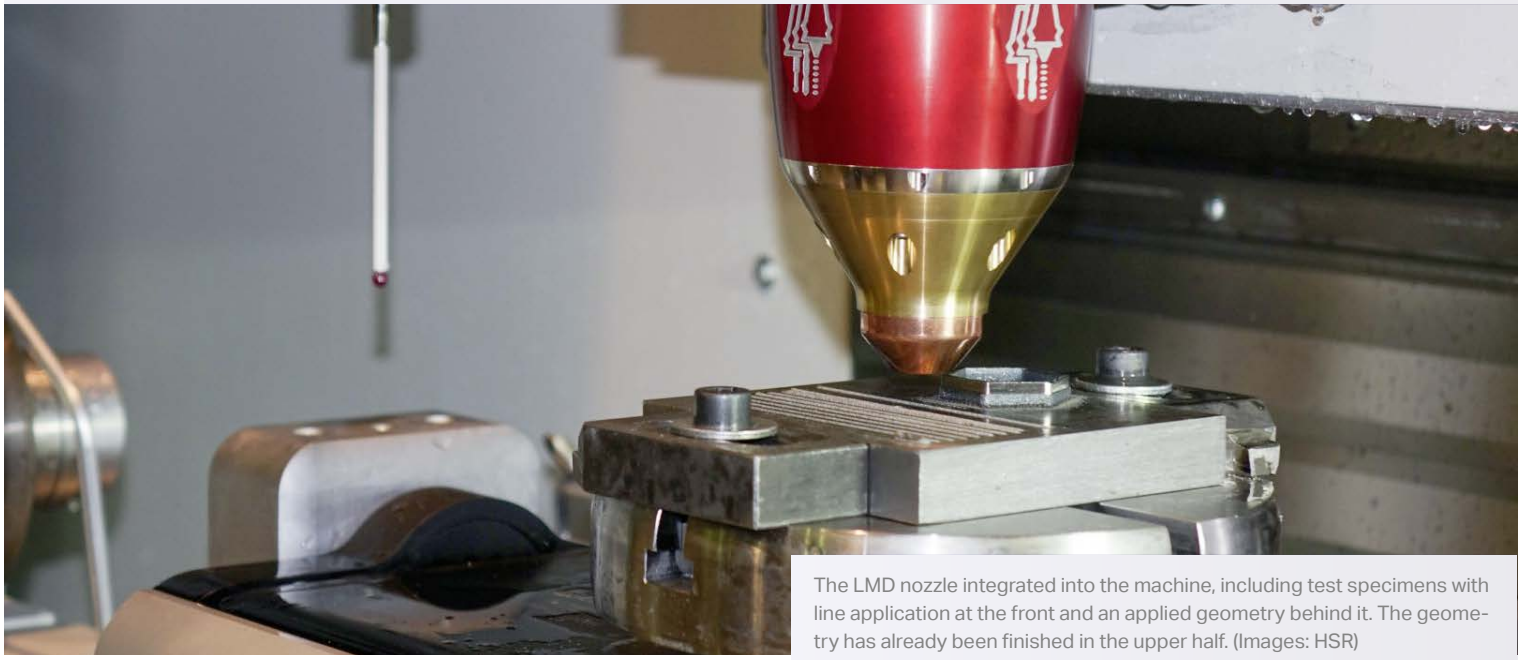
Swiss Rotary Table Technology

NEWSLETTER

LMD, milling, and grinding on a machine

T1-507510 TOP1



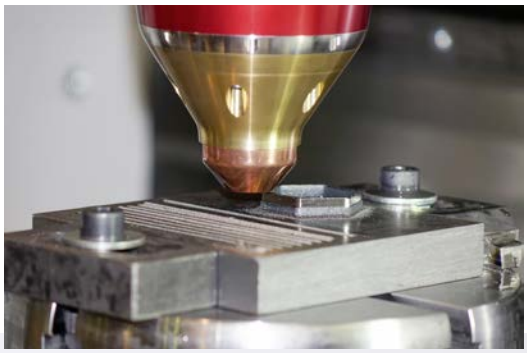
The LMD nozzle integrated into the machine, including test specimens with line application at the front and an applied geometry behind it. The geometry has already been finished in the upper half. (Images: HSR)

Additive metalworking with a unique hybrid machine tool

With a new, unique hybrid machine tool from the German machine tool manufacturer Elb, the technical university Rapperswil HSR is taking the step towards additive metalworking.

The machine goes beyond conventional standards because its combination of laser metal deposition (LMD, also called direct metal deposition) and machining processes such as milling and grinding on the same machine in one and the same clamping opens up completely new application and geometry possibilities, especially in the area of complex and high-quality components.

T1-507510 TOP1 rotary table from pL LEHMANN.



The LMD nozzle integrated into the machine, including test specimens with line application at the front and an applied geometry behind it. The geometry has already been finished in the upper half.

The laser is located in the center of the LMD device, with the powder and inert gas feeds located radially. As in familiar inert welding processes, the inert gas prevents possible oxidation processes and the possible intrusion of unwanted foreign particles into the process.

The laser generates a melt bath with pinpoint accuracy, into which the powder is sprayed and where it is melted. This welds the base body to the powder material. The result is a new homogeneous body with outstanding properties. Compared to conventional manufacturing methods such as milling, the LMD process offers higher energy efficiency. In addition, it enables a massive reduction in waste quantities.

The standard procedure begins with the LMD process, followed by milling, in which the applied layers are finished. The final step is grinding. The process chain itself remains variable. These coordinated functions enable the machine to perform four tasks as a continuous process. Firstly, there is the generation of structures in additive manufacturing for the targeted application of reinforcements or structural elements, such as reinforcing ribs, and secondly, joining is also possible by connecting several parts by welding, for example, to bridge gaps. Coating is also possible, for example, when applying wear- and corrosion-resistant coatings. And finally, repairs can also be carried out using targeted laser application, for example by reconstructing worn component or tool locations. All these possibilities relate to the LMD process, which is the starting point.

The clamped milling cutter is used for surface finishing of the layers applied by LMD.

According to its designers, however, the hybrid machine tool of HSR plays off its actual advantages over competing products in the subsequent processes. Although other machines are also capable of having the milling process follow the laser application, the HSR machine goes the decisive step further in terms of final processing and also integrates the grinding process. This enables the machine to combine the advantages of the different processes and to carry out the complete processing in one machine.

Used grinding wheel with 300 mm diameter, including two dressing points. The rear part for flat dressing and back-dressing of the grinding wheel, at the front a forming roller for profile dressing.

The machine is currently unique. Its users at the IWK Institute for Materials Technology and Plastics Processing at the HSR Hochschule für Technik Rapperswil see themselves on the one hand as service providers and want to use it further for scientific investigations. If the project is successful, ELB could commercialize it, says IWK. Possible areas of application are seen primarily as the automotive, mechanical engineering and toolmaking, hydraulic, rolling bearing, and tool industries, but other branches of industry are also possible.

At a glance
Technical data
ELB Smartline N10 KGT 840D

Basic machine
ELB Smartline N10 KGT 840D

Installation dimensions
1000 x 400 x 500 mm (L x W x H)

Laser power
1 kW

Layer thickness in the LMD process
min. 0.1 mm, otherwise unlimited

Number of LMD layers after which milling is performed
Variable

Possible grinding processes
Currently software-limited to 4-axis machining (face and external cylindrical grinding), with software update for 5-axis machining possible (internal cylindrical grinding)

Possible shape accuracy
± 3 µm

Possible surface quality
Rz 0.1

Possible powder materials
Powder-type-independent

Already processed
Metal powder stainless steel 316L-A LMFF

LMD unit
Hybrid Manufacturing Technologies

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