



SMART HEADS

Laser build-up welding for Industry 4.0

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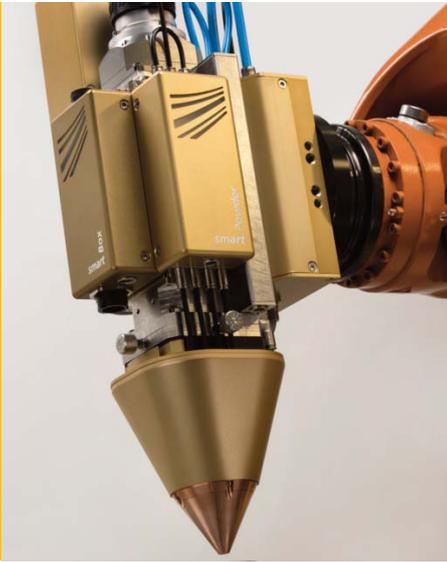
Digital laser material processing

Integrated digitization of processes for laser material processing provides customers with measurable results in industrial applications. Based on the IWS' comprehensive systems engineering know-how, cyber-physical laser material processing systems are being developed by means of new hardware and software solutions.

Depending on the case of application, these systems assist the machine operator in the performance of complex manufacturing tasks, they improve product quality, and they enhance the reproducibility of manufacturing results both for regular and frequently changing production sequences.

The upgrading of the IWS processing systems to full digitalization foregrounds our platform strategy. Development is sped up and introduced onto the market step by step – for hardening, cutting and joining technologies, and – particularly dynamically – for additive manufacturing and laser build-up welding.





Industry 4.0 – processing heads

The current practice of laser build-up welding is no longer conceivable without laser processing heads from the modularly structured COAXn group. With several hundreds of individualized systems configured over the last 20 years, we at the IWS are celebrating a jubilee together with our customers from the vehicle assembly, aircraft, oil production, mining, machine building, and die- and mold-making industries, as well as laser technology.

The heads are used for coating processes, functionalization, repair and additive manufacturing in many businesses, from small μm -sized structures up to areas of several m^2 . Rough environments and non-stop-24-hours-runs are the standard situation in production engineering practice.

This provides optimal preconditions for the next powder nozzle generation in the digitized world of the Industry 4.0 era. The influencing variables of the process – the material and the manufacturing system that determine the welding process reliability, the life of the manufacturing head and safeguarding of the final component characteristics – have been established in a wide variety of applications.

An innovative paradigm with integrated sensors, which are cross-linked in a structured approach, makes it possible to record relevant data online and put it into the context of the process very conveniently. This way, the manufacturing heads can be made more intelligent incrementally.

Sensor-integrated coaxial processing head

The new nozzle generation expands the proven COAXn line of products with heads that are equipped with sensors and cross-linked among each other in a system with application-specific optical systems to focus and shape the laser beam. The new coaxial powder nozzle is characterized by a fluidic-optimal design and guarantees a powder focus of minimally $600 \mu\text{m}$.

Exactly focused powder jet



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The nozzle is designed for maximal 6 kW laser power and dimensioned for tracks 0.6 to 6 mm wide.

The nozzle tip, which is interchangeable, and the integrated media connections make it operator-friendly and low maintenance, as always. The head is also, of course, totally direction-independent and even, within limits, 3D-suitable.

Sensors for temperature, pressure, flow rate, and acceleration are integrated at the active manufacturing head positions and cross-linked via software. When the nozzle is in use, this sensor network provides information about critical temperatures in relevant areas, flow rates through media, powder distribution, and possible damage to optical elements, and stops the process in the case of significant obstacles, such as collisions.

The data are transmitted to a micro-controller, which processes the measured data generated and forwards it to be used in process control and supervision, via the BUS system. Finally, the data management software that is under development enables new functions, such as online-cross-linking, visualization of process data, access to parameter databases, and control functions for the machine and the laser as well.

1 *Laser processing head for Industry 4.0*

2 *Laser build-up welding - procedure*