PRESS RELEASE

Additive Manufacturing and Laser Welding Solutions presented at IMTS Chicago 2018

(Dresden, August 31, 2018) The Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS Dresden will present solutions for Additive Manufacturing and laser welding at IMTS Chicago 2018. The German engineers will show a rocket engine with aerospike nozzle for space travel, the "smart head" COAXwire 4.0 for laser build-up welding and the modular laser welding optics concept remoweld®FLEX together with Arnold Ravensburg.

Rocket Engine with Aerospike Nozzle Manufactured by Selective Laser Melting

In cooperation with the Chair for Space Systems of Technische Universität Dresden (TUD), Fraunhofer IWS scientists investigated a novel approach for using the capabilities of Additive Manufacturing (AM) in the field of rocket engine development. Within the scope of the project "AerodynamiC Thrust Vectoring – ACTiVE" TUD engineers developed a new 16 kN rocket engine based on an aerospike design using liquid oxygen and methane. This approach is expected to significantly increase the engines efficiency by using features such as conformal cooling of the combustion chamber and the aerospike, secondary fuel injection for thrust vector tailoring and internal stabilizing lattice structures. However, due to the high complexity of the features the novel design cannot be manufactured conventionally. Therefore, AM experts at the Fraunhofer IWS adapted the developed component according to IWS design guidelines in order to overcome restrictions of conventional manufacturing. The scientists successfully integrated all functionalities into the engine. By using the AM process Selective Laser Melting (SLM) the part was then manufactured layer by layer. The overall manufacturing took approximately 48 hours. The next steps within this collaboration are the abstraction, further development and testing of single features such as the secondary fuel injection. Furthermore, the current demonstrator part (Ti-6Al-4V) shall be manufactured using nickel-based superalloys.

Smart heads – laser build-up welding for "Industrie 4.0"

The current practice of laser build-up welding is no longer conceivable without laser processing heads from the modularly structured COAXwire 4.0. End users from the vehicle assembly, aircraft, oil production, mining, machine building, and die- and moldmaking industries, as well as laser technology use the "smart head" for coating

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processes, functionalization, repair and Additive Manufacturing, from micro-sized structures up to areas of several square feet. 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. The new coaxial powder nozzle is characterized by a fluidic-optimal design and guarantees a powder focus of minimally 600 µm. The nozzle tip, which is interchangeable, and the integrated media connections make it operator-friendly and low maintenance. The head is also direction independent and 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. In the case of significant obstacles processes are stopped immediately. The data are transmitted to a microcontroller, 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 enables new functions, such as online-cross-linking, visualization of process data, access to parameter databases, and control functions for the machine as well as the laser.

removeld®FLEX – Laser Welding Optics

At the stand of Arnold Ravensburg, Fraunhofer IWS will also present a highly modular laser welding optics concept. For welding materials that are difficult to join the "removeld®FLEX" operates with high-frequency beam oscillation and perspectively with integrated process monitoring. Driven by the requirements of lightweight construction in mobile applications, increased efficiency of thermal processes and the latest developments in electromobility, ever more demanding weld joints are being produced from various materials. The researchers at Fraunhofer IWS have developed a corresponding modular welding head concept, whose HF scanner as the core enables scanning frequencies of up to 4 kHz at a maximum power of 4 kW. "removeld®FLEX" paves the way for permanently storing data for quality assurance or forwarding production progress to higher-level organizational units for manufacturing planning in line with the "Industry 4.0" guiding principle. The modular concept offers versatile welding optics for a wide range of applications. Laser beam welding with high-frequency beam oscillation creates new potential for combining the complex variables of design, material, process, manufacturing and costs into a high-quality welding result.

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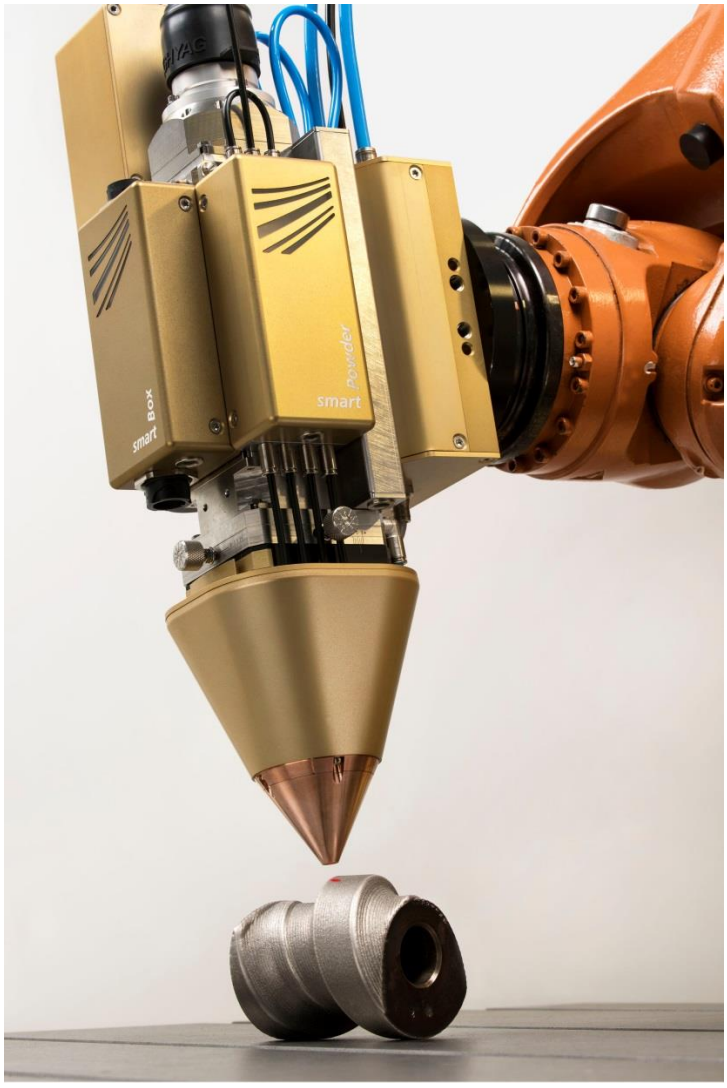

The "smart head" COAXwire 4.0 realizes coating processes, functionalization, repair and Additive Manufacturing, from micro-sized structures up to areas of several square feet.
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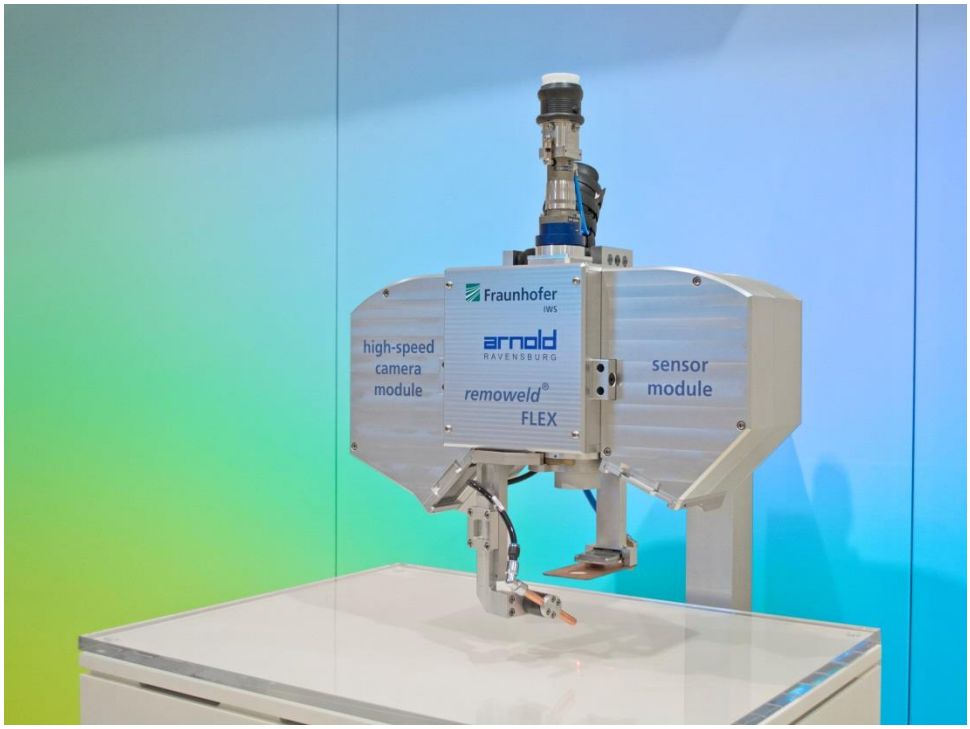
The **Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS Dresden** stands for innovations in laser and surface technology. As an institute of the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., IWS offers one stop solutions ranging from the development of new processes to implementation into production up to application-oriented support. The fields of systems technology and process simulation complement the core competencies. The business fields of Fraunhofer IWS include PVD and nanotechnology, chemical surface and reaction technology, thermal surface technology, generation and printing, joining, laser ablation and separation as well as microtechnology. The competence field of material characterization and testing supports the research activities. At Westsächsische Hochschule Zwickau, IWS runs the Fraunhofer Application Center for Optical Metrology and Surface Technologies AZOM. The Fraunhofer project group at the Dortmunder OberflächenCentrum DOC® is also integrated into the Dresden Institute. The main cooperation partners in the USA include the Center for Coatings and Diamond Technologies (CCD) at Michigan State University in East Lansing and the Center for Laser Applications (CLA) in Plymouth, Michigan. Fraunhofer IWS employs around 450 people at its headquarters in Dresden.



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