Fraunhofer IWS

FRAUNHOFER INSTITUTE FOR MATERIAL AND BEAM TECHNOLOGY IWS

PRESS RELEASE

Flexible fiber laser for rapid material processing

Fraunhofer IWS evaluates thousand times faster beam shaping

(Dresden, 07-21-2021) Laser experts from Saxony and Israel are jointly testing a novel laser for industrial use at the Fraunhofer Institute for Material and Beam Technology IWS in Dresden. The system is based on the "Coherent Beam Combining" (CBC) method, which is still new for high-power lasers. The 13-kilowatt laser can generate different energy distribution patterns particularly quickly during operation and thus process even demanding high-tech materials very precisely and quickly. The Fraunhofer researchers intend to make the innovative laser technology from Israel available to companies worldwide in the near future. Within a European network project, Fraunhofer IWS is already investigating the beam shaping, which is accelerated by a thousand times, for the first time for additive manufacturing together with the laser manufacturer Civan Lasers and A. Kotliar Laser Welding Solutions.

The "Dynamic Beam" laser from Jerusalem has by now been installed at Fraunhofer IWS in Dresden. The institute is thus the first research facility worldwide to employ such a laser solution. Together with the project partner Civan Lasers, the scientists hope that the testing in Saxony will provide new application scenarios. "This laser will push the limits of materials processing, for example in medical technology and aerospace," predicts Dr. Andreas Wetzig, who heads the Cutting and Joining technology field at Fraunhofer IWS. He refers to the Saxon-Israeli research project "ShapeAM" within the European network program "M-era.Net", in which this new laser will play a central role and which started in July 2021.

This measure is co-financed with tax funds on the basis of the budget passed by the Saxon state parliament.

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A thousand times faster

In use is Coherent Beam Combining, in which the "Dynamic Beam Laser" from the Israeli company Civan Lasers combines tens of individual beams into a powerful laser beam with high quality. Through small phase shifts (Optical Phased Array = OPA) of the wave troughs and peaks in the partial beams, the laser can quickly generate completely different energy distribution patterns in the resulting processing laser beam: While a classic laser releases most of its energy only in the center of the beam, the system from Israel can generate energy patterns on the workpieces for instance in the form of a ring, a figure eight or a horseshoe. In principle, this was already possible in the past with beam-deflecting optics or fast oscillating mirrors. But even the fastest oscillating mirrors still need milliseconds to realign the energy patterns in the beam. The

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"Dynamic Beam Laser", on the other hand, accomplishes this a thousand times faster, within microseconds.
This speed makes it possible for the first time to use dynamic beam shaping for additive manufacturing of metals. As part of "ShapeAM", researchers are testing the new CIVAN system to achieve improved material properties. Specifically, the aim is the additive manufacturing of titanium and aluminum alloys, such as those needed for space components, implants and lightweight components for mobility. In doing so, the partners plan to use dynamic beam shaping to eliminate defects and thus achieve higher quality 3D printing results. Dr. Eyal Shekel, CEO of Civan, is excited about the project: "ShapeAM makes it possible for us to explore the benefits of dynamic beam shaping in metal additive manufacturing." Dr. Elena Lopez, department head of Additive Manufacturing at Fraunhofer IWS, adds: "We plan to use novel beam shapes and control frequencies that are not achievable with other methods to overcome challenges in crack-sensitive materials."

Lively exchange between Dresden and Jerusalem

The joint project is expected to develop into a fruitful scientific and personnel exchange between Israel and Saxony: Fraunhofer IWS will forward the test results to Jerusalem. Also, it is planned to temporarily send exchange scientists to Israel. In return, the Civan experts are expected to conduct their own tests in the laser laboratory in Dresden.
The tests at the Dresden institute are intended to determine the possibilities and limits of the "Dynamic Beam Laser". Basic tests with various beam profiles, materials and processes are initially planned. After that, the researchers will evaluate concrete applications, such as how well the system can cut, join or additively manufacture diverse workpieces from materials and material composites that are otherwise difficult to process.

"Dynamic Beam" doubles working speed

It is already predictable that the new laser will allow faster and more precise control of the melt pool dynamics in many additive and joining processes – and not only across the surface, but also in depth. Fraunhofer IWS also expects advantages in laser cutting in terms of burr-free cuts with high edge quality – at twice the working speed compared to conventional fiber lasers.
The test phase in Dresden will show whether the new laser will also meet these expectations in practice. In any case, the quality and speed advantages that are already becoming apparent make the technology highly interesting for use in metal-working industry, medical technology and electromobility, as well as in aerospace industry.

Online webinar and conference offer insights into first results

In a webinar on September 14, 2021, Fraunhofer IWS will present the "Dynamic Beam Laser" to partners from industry and research who are interested in the project. It will subsequently be possible to test the use of the CBC fiber laser

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for their own applications at Fraunhofer IWS. First findings from their test series the Fraunhofer scientists will present to a broader expert audience at the combined online event Laser Symposium/ISAM 2021 in Dresden from December 7 to 9, 2021.

About CIVAN

Civan Advanced Technologies Ltd. was established in 2008 and is the only company to offer Dynamic Beam Lasers. Civan's Dynamic Beam Laser allows manufacturers to control beam shape, frequency, sequence, and focus steering to eliminate spatter, increase welding power and speed. Through their advanced capabilities, Dynamic Beam Lasers open the door to countless new applications.
More Info: https://www.civanlasers.com/

The "Dynamic Beam" laser from Jerusalem has now been installed at Fraunhofer IWS in Dresden. The institute is thus the first research institution worldwide to utilize such a laser solution.
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Currently, Fraunhofer IWS laser experts are testing the novel Israeli laser "Dynamic Beam" for industrial use.
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The **Fraunhofer Institute for Material and Beam Technology IWS Dresden** develops complex system solutions in materials and laser technology. We define ourselves as idea drivers developing customized solutions based on laser applications, functionalized surfaces as well as material and process innovations – from easy-to-integrate custom solutions to cost-efficient solutions for small and medium-sized enterprises to industry-ready one-stop solutions. Our research focuses on aerospace, energy and environmental technology, automotive, medical and mechanical engineering, toolmaking, electrical engineering and microelectronics, and photonics and optics sectors. In our five future and innovation fields of battery technology, hydrogen technology, surface functionalization, photonic production systems and additive manufacturing, we are already creating the basis today for the technological answers of tomorrow.

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Thanks to "coherent beam combining", the 13-kilowatt laser can generate energy distribution patterns thousands of times faster during operation compared to conventional mirror-based methods. This speed makes it possible for the first time to use dynamic beam shaping for additive manufacturing of metals.
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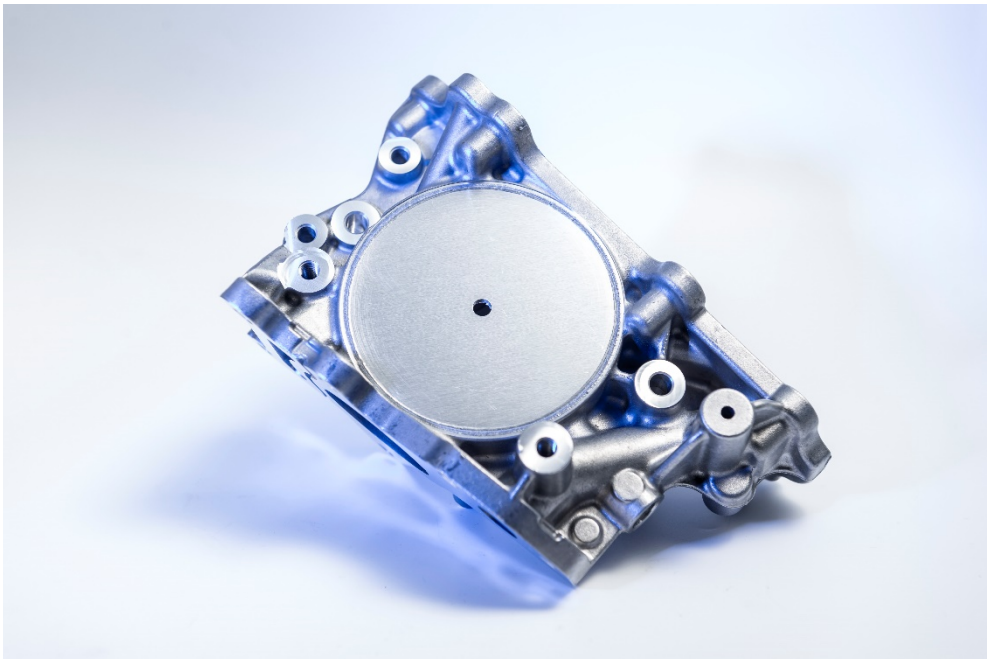

The international team of researchers will investigate welding applications, including how to use the new laser system to achieve advantages in terms of processing speed and quality for comparable components such as the one pictured.
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