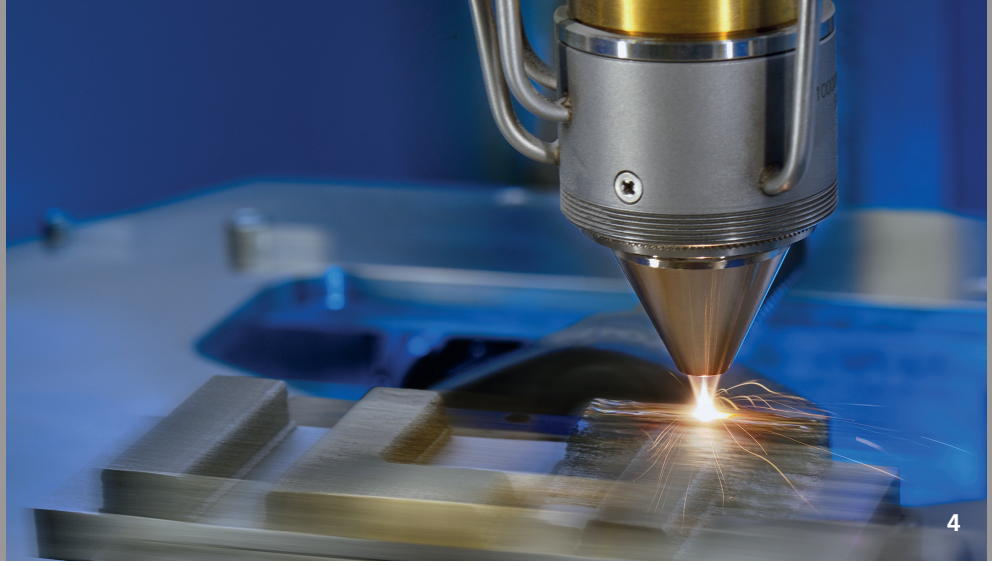

EHLA 3D – EXTREME HIGH-SPEED LASER MATERIAL DEPOSITION FOR ADDITIVE MANUFACTURING

Task

Economical build-up rates are mandatory for the industry to begin using additive manufacturing processes. Currently, increased build-up rates in Laser Material Deposition (LMD) are primarily achieved by increasing the dimensions of the manufactured weld beads (track width and height). This results in an inherent conflict of goals: between fast build-up rates, on the one hand, and precise, near-net-shape build-up, on the other hand. EHLA 3D solves this dilemma for the first time by applying precise, small weld beads with layer thicknesses in the micrometer range at speeds that are orders of magnitude higher than those of conventional LMD. This way, components can be produced in a shorter period of time and require less post-processing.

Method

Up to now, Extreme High-Speed Laser Material Deposition (EHLA) has been used primarily to apply wear and corrosion protection for rotationally symmetric components. To make this process usable for additive manufacturing at feed rates in the range of several 100 m/min, Fraunhofer ILT, in cooperation with Ponticon GmbH, developed and built a highly dynamic machine system. Based on the principle of a tripod type parallel manipulator, it allows either the build platform or the processing head to be moved very quickly and precisely.

Results

With a path and repeat accuracy of approx. 100 µm in all spatial directions, the system makes precise build-up possible. The maximum acceleration of 50 m/s² allows fast direction changes with low dead time. The institute has proven that the EHLA process principle can be transferred to additive manufacturing by demonstrating it for iron, nickel and aluminum-based materials at feed rates of up to 50 m/min. The material characteristics are on par with conventional laser material deposition. The tripod machine is currently used to explore the process regimes from 50–200 m/min. In the future, Fraunhofer ILT aims to further increase the degree of automation by process monitoring, capturing the component geometry and using path-planning software.

Applications

Since it can be used to process a wide range of material combinations, the EHLA 3D process finds broad application across the industrial sectors of surface coating and repair as well as in hybrid additive manufacturing.

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4 Construction of ILT characters out of several materials with EHLA 3D.