



Introduction

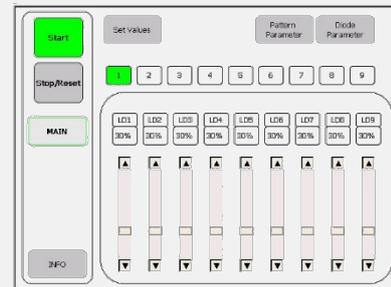
This whitepaper introduces a diode-based MULTISPOT laser system for flexible and on demand laser beam shaping. The system is used for thermoplastic as well as metal and plastic connections and demonstrates excellent welding properties.

The MULTISPOT idea

For new applications in laser transmission welding, wide weld seams are needed. For straight welds a homogenizer optic can be used to obtain a homogeneous temperature distribution. If the welding contains small radii the weld seam overheats at the inner radius while the outer part of the radius remains solid. To achieve a maximum weld seam strength the temperature differences within the welding area should be reduced to a minimum. In order to generate an adapted intensity distribution for optimized temperature homogeneity, MULTISPOT was developed.

Technology

Within the MULTISPOT project (1) neolASE developed a diode laser system with 9 individual controllable laser spots and up to 1kW of output power to control the intensity distribution within the laser focus. Therefore, an innovative beam guidance system mapped the spots from the laser diodes in the processing plane in a way that a desired temperature field is generated within the joining zone. The software allows programming a set of different intensity profiles related to the welding geometries. Due to a fast switching laser electronic the profiles can be changes on millisecond time scales and therefore adapted on the fly.



Performance

To determine the laser intensity profiles a bead on plate welding was performed for different welding radii to optimize for an almost constant temperature distribution over the width of the weld seam. In a second step these intensity profiles were transferred to a laser transmission welding process. Investigations of the seam strength are performed and showed that the two parts did not fail within the weld seam. Cross sections of the weld were prepared in order to determine the weld seam quality and no defects could be found.



The results confirmed a high welding quality and demonstrated the advantage of the MULTISPOT welding technology compared to conventional homogeneous intensity distributions (2).

In addition to the welding of purely thermoplastic connections, the technology was used to join hybrid structures made of metal and plastic, which are of particular interest for the connection of plastic components in automobiles. Further potential applications are large area 3D printings.

Summary

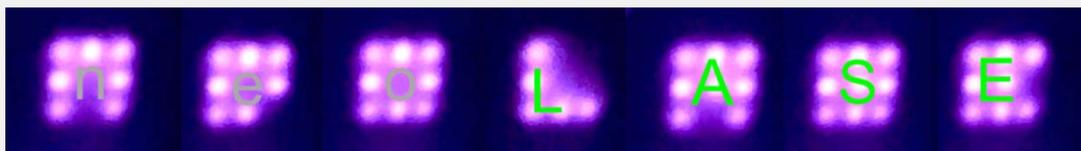
The MULTISPOT laser system enables the control of the laser intensity distribution within the laser focal plane. This enables to partially adapt the temperature in the weld seam and therefore allow for a homogenous temperature distribution. The technology enables high strength and quality welding of thermoplastics as well as metal and plastic connections for light weight constructions.

Design

The MULTISPOT laser system is build up in a compact rack with dimensions of 60x55x85 cm. The standard fiber connection allows different fiber length between laser system and the applications. The system is equipped with the neoCON software to control the individual intensity distributions, different intensity distributions and monitoring of the system. For the calibration of the laser intensity distribution an automated calibration program is included. Remote control is realized with an OPC-UA interface.



True to our motto "brilliance in customized laser solutions", we look forward to your inquiry on www.neolase.com or info@neolase.com.



A MULTISPOT Intensity distribution example out of the focal plane. Watch the video on neoLASE Blog 07/21.

- 1) <https://www.photonikforschung.de/projekte/kmu-und-start-ups/projekt/multispot.html>
- 2) V. Wippo et al. „Laser Transmission Welding With A Multi-Focal Optic“, International Congress on Applications of Lasers & Electro Optics (ICALEO), 19.-22. Oktober 2020