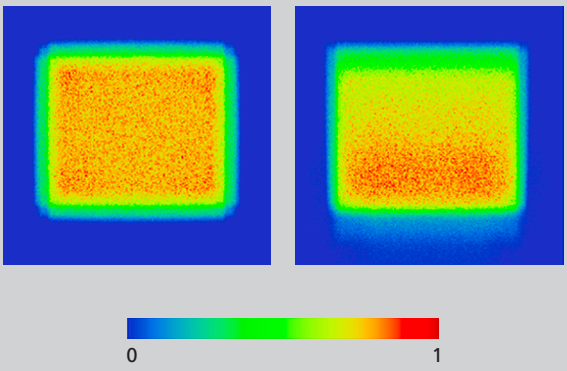

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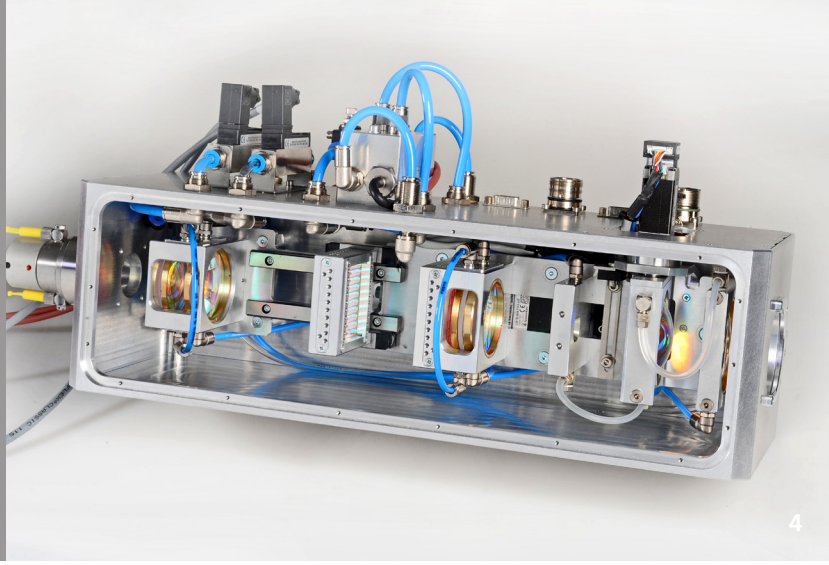

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OPTICAL SYSTEM FOR LASER-ASSISTED FRP-TAPE LAYING

Task

The increasing use of fiber-reinforced plastics (FRP) is making flexible production strategies for customers' individual requirements more and more significant. For such a flexible process, the processing optics is an essential component since the laser radiation is deliberately introduced through it to heat the tape. When the intensity distribution is adapted, the laser radiation can be introduced in an application-adapted and energy-efficient manner, depending on the material condition or winding geometry.

Method

To optimize the tape-laying process, research needs to develop an optical system that allows the laser beam to be shaped from a rotationally symmetrical input distribution to a homogeneous, rectangular intensity distribution in the working plane. In addition, a variable zoom and a function to generate linear intensity gradients are required. When several partial beams with cylindrical lens arrays are divided and superimposed, a homogeneous intensity distribution in the working plane can be produced. The zoom functionality is ensured when the cylindrical lens arrays are shifted. The generation of the intensity gradient is based on the Scheimpflug principle. When the focusing lens is tilted selectively, the desired intensity gradient can be set.

Results

Fraunhofer ILT has developed the optical system in cooperation with the Chair for Technology of Optical Systems (TOS) at RWTH Aachen University and the company IXUN GmbH. Since it can be adjusted flexibly, the system makes it possible to ideally introduce heat into the workpiece and thus to optimally process FRP.

Applications

In principle, all laser processing methods that profit from a change between a homogeneous and a linearly increasing intensity profile can also benefit from this newly developed optical system. The innovative system is particularly interesting in the field of laser hardening and softening. The newly gained degree of freedom of the variable intensity distribution opens up new possibilities for process control.

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3 Change in the intensity distribution in the working plane.

4 Laboratory setup of the optical system.