Highlight

Kaegiswil,
July 4, 2012

Versatile laser beam shaping for simultaneous polymer welding

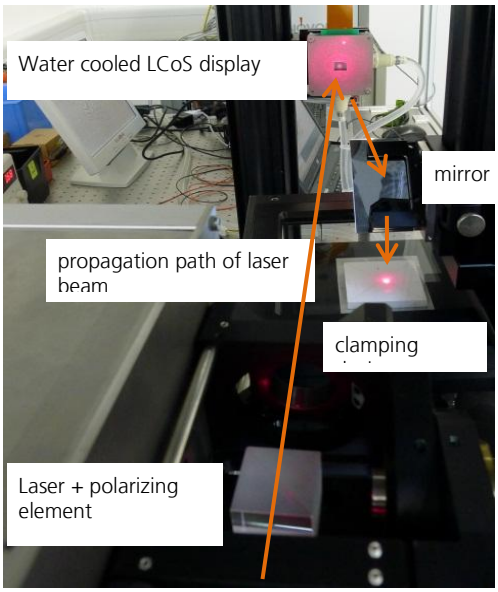

Figure 1: Optical setup featuring LCoS component for simultaneous welding

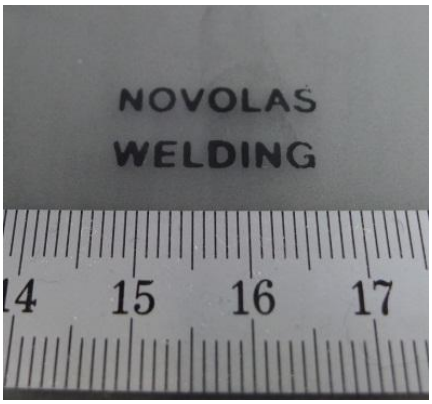

Figure 2: Lettering welded by using a LCoS component together with fiber laser radiation.

In the process of simultaneous polymer laser welding, optical elements like refractive and diffractive optical elements are arranged in such a way, that well-defined beam shapes are generated on work pieces allowing polymer laser welding in a one-shot approach. Since the optical setup is usually highly work piece specific, a modification or change of the work piece comes along with the exchange of the optics. This procedure is normally time-consuming and expensive. Therefore, a variable beam shaping system is preferred for frequently changing weld contours. Within the frame if this European Polybright research project, a prototype setup featuring a spatial light modulator has been realized by which the shape of a fiber laser beam can be quickly and easily adapted to changing small-sized weld contours.

Spatial light modulators (SLM) are devices for imposing spatially varying modulation of light beams. In our case, the phase of a fiber laser beam is spatially modulated by a display which is formed by pixels of liquid crystal on silicon (LCoS). By monitoring a computer-generated hologram on the LCoS display, the spatial light modulator acts as a multi-level diffractive optical element allowing the generation of any 2D laser contour within a diffraction angle given by the pixel size. Since the hologram on the display can be rearranged within seconds, the shape of the laser beam can be modified within seconds as well.

In this prototype setup, a linear polarized fiber laser beam featuring a power up to 50 W is pointed to a water-cooled LCoS display. The display is arranged behind a steel aperture and applied in a reflective approach. The reflected beam is finally directed to a clamping device by an additional mirror. The optical setup is depicted in Figure 1.

Welding of "NOVOLAS WELDING" lettering with black and transparent Polymer foil has been successfully demonstrated using the spatial light modulator (see Figure 2). The weld seam could be achieved within 1.3 seconds at a laser power of 45 W. In addition

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to different weld experiments, a compensation technique for different shape sizes of aiming and working laser beam could be developed.

For any further questions our experts will be pleased to provide you assistance:

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