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Laser optics components for tooling machines

During the past three years Laserinstitut Mittelsachsen e.V. in cooperation with saxonian companies in the region of Chemnitz-Mittweida have investigated technologies of laser material processing and surface treatment with the ends of collecting process parameters und conditions of laser integrated production in the scope of a BMBF-initiative “InnoRegio”. Motive for these developments were simplification and availability of laser technologies in tool machining with aiming for technological complementarity in automatized production. Next to technological advantages as e.g. production in a single mounting, it promises above all a reduction in logistical effort. Employment of laser radiation as a source of thermal energy appears to be suitable for various treatments in tool production. In this context laser hardening, -cladding und laser cleaning were investigated.

In the present state of the project optical components are developed for site integration as well as for hand held laser material treatment.

Regarding site integration the emphasis is place on the analysis of the respective requirements concerning laser modules, the design of mechanical and optical interfaces in tooling machines and the development of adequate automatically insertable optical tools for laser machining. The following figures display an extract of the scope of results. Fig. 1 shows the construction view of the designed interface between laser and a milling arbor. It can be located inside a mill or implemented as a machining unit in a lathing center.

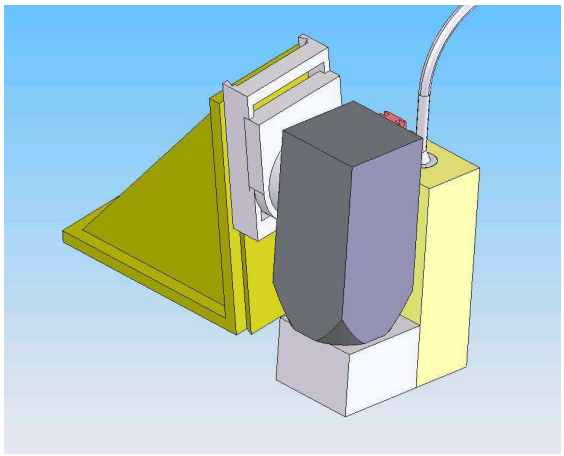

Fig. 1 Design of the arrangement of the laser optical at its interface with a milling arbor.

An automatically insertable laser tool is shown in Fig.2. To the right an optics can be seen that has been specifically developed for laser hardening. The advantage of this component is a smaller fluctuation in hardening depth and a broader track width at comparable process parameters. The effect obtained with this optics, is demonstrated in fig. 3. Fig. 4 shows a plot of the hardness profile for the optimized hardening track.

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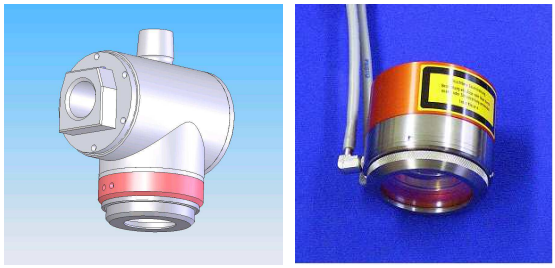

Fig. 2 Left: automatically insertable laser hardening tool, right: special optical unit for laser hardening and cladding

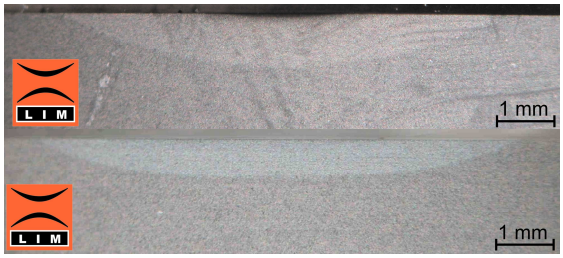

Fig. 3 Cross section view of laser hardening tracks in steel 1.2379: above: obtained by use of a conventional focusing optics; below: obtained with the specific optics (see text) that had been developed for laser hardening and cladding made with 80 % of laser power.

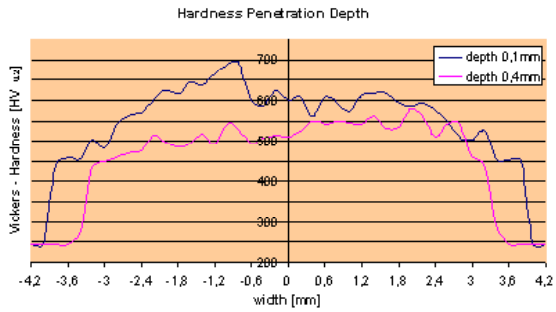

Fig. 4 Profile of the hardening track (Fig. 3 bottom)

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