Institut für Strahlwerkzeuge
Universität Stuttgart

IFSW

Im Fokus

R&D successfully transfered to industrial application

One of the substantial objectives of the Institut für Strahlwerkzeuge IFSW (*Institute for Beam Tools*), which has been installed 1986 at the University of Stuttgart, has always been the effective transfer of the results of its scientific research and development to industrial application. With the foundation of the non-profit limited company of the Forschungsgesellschaft für Strahlwerkzeuge FGSW (*Research Company for Beam Tools*) in the year 1996 a further and particularly effective instrument is available for efficient know-how and technology transfer. As specified in a co-operation contract the FGSW is responsable for the further development of concepts-which have been elaborated at the institute - up to application and product-ripe and also to marketing. Below, examples of concrete products refering to to the three topic fields of IFSW and FGSW are presented. These products are promoted by the FGSW according to the mentioned co-operation, partly together with cooperating companies.

Laser Development

The thindisklaser is one of the most interesting developments of laser technology in recent time. It offers an extraordinary broadly varied application potential. This is documented among others by industrial application in a range of 10 W up to 1 kW and numerous co-operations of IFSW and FGSW with different research institutes on the field of metrology and medicine, e.g.. FGSW owns the licence for offering ***laser moduls*** and additional system technology to quickly customize a laser system for a laser or application development with certain specifications as

- mode of operation (cw, q-switch, utlrashort-puls, single-frequency, etc.),
- powerrange,
- beam quality.

The disk modul, developed as an ultra stabil design, has been tested successfully in a drop tower on high descellerations. The thindiskcrystal, qualified and mounted on the cooling finger, is placed in the resonator as a mirror and adjustable by the newly designed goniometric holder for highest stability. For driving the disk modul a **pump modul** is required, consisting of pump diodes with supply and homogenization and an optical couple device. For pump diodes with 50 W, 140 W, 200 W and lateral also 400 W the complete modul and coupling is offered.

With the diskmodul, the pump modul with the couple device and a designed resonator one can set up the complete laser system with the desired specifications within a few weeks. The moduls are distributed in Europe by the company L.O.T.-Oriel GmbH.

For regenerative amplifier (e.g., ns and ps pulses up to fs pulses) and for rapid optical switching the program will be accomplished by a ***high repetition pockels cell*** including driver and control unit at the beginning of 2004. Repetition rates of up to 50 kHz at an apertur of 6x6 mm can be achieved (rise time < 10 ns, hold time beween 300 ns and >100 µs).

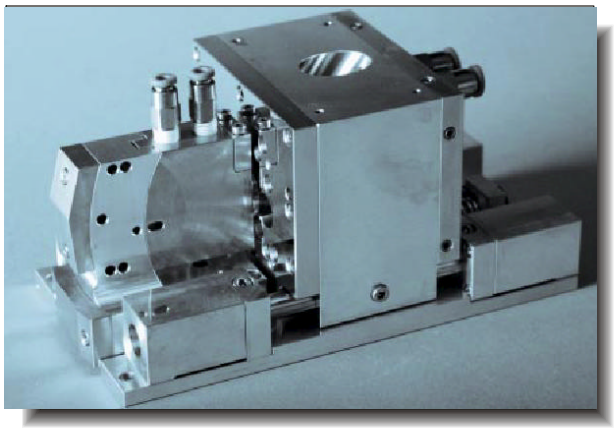

Fig. 1: Disk modul with goniometric fitting of the laser crystal.

Macroapplications

For effective Laser beam welding a ***process unit*** was realised including a

- crossjet,
- coaxial shielding gasnozzle,
- wirefeeder,
- monitoring of the shielding glass.

This concept is outstanding due to the Laval-nozzle of the cross jet, and its supersonic flow, which was calculated and evaluated in several steps and brought to an optimum shielding. The exchangeable adapter plate, including the collision shield makes the unit suitable for almost all commercial optic heads of laser suppliers (focal length 150 / 200 mm). The electronics of the monitoring device is supplied by Precitec KG, which also provides the marketing of the complete system.

Within the same cooperation a

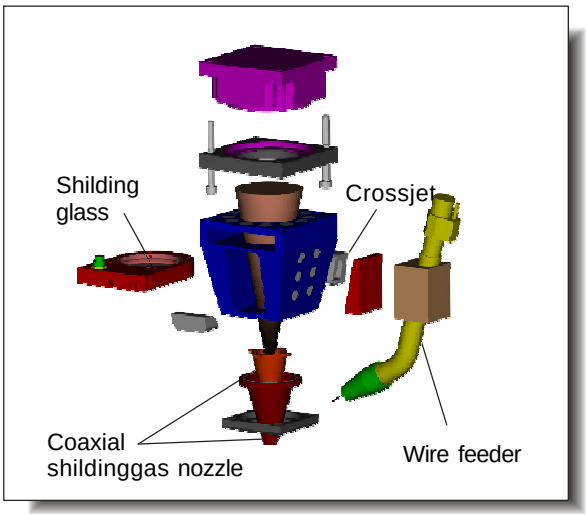

Fig. 2: Design of the process unit.

detector head for process monitoring of laser beam welding was developed. By integration of several sensors the back reflection ofthelaser beam and the temperatur radiation post mortem can be measured and analyzed even for difficult materials as aluminium in correlation for achieving a high accuracy. Sophisticatedspecificationsof the detector are besides the functionality the integration in commercial focusing optics without significant modification of the obstructive contour.

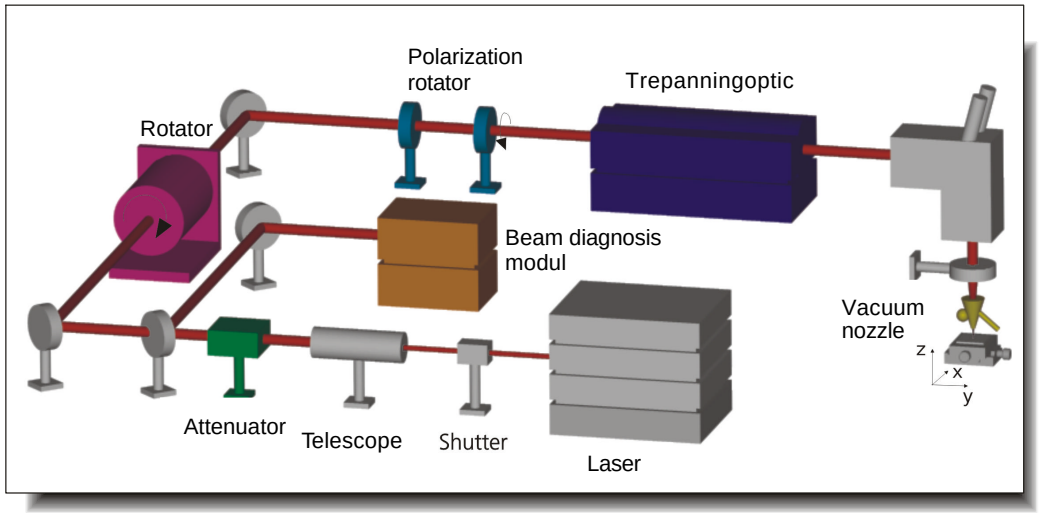

Fig.4: Process technology for realization of precise drillings ofdifferentgeometries.

MicroApplication

For high precision laser beam drilling, e.g. injection nozzles or spinnerets, FGSW developed - with financial support of the German federal ministy for education and research (BMBF) - a ***trepanning optic*** which allows to produce holes even with negativ conicity. For the first time inclination of the conus and drilling diameter can be adjusted independently and also on the fly via numerical control. Due to the inclined beam the whole beam diameter hits the bore wall even at the negative conical exit and yields to higher efficiency of the ablation process. Thus efficiancy can also be increased for cylindrical drillings and the drillingtimecanbehalved. Polarization can be aligned to the process by an integrated ***polarisation rotator*** to avoid any defects of ovality. The control unit of the complete drilling system also allows integration of a beam attenuator and thus defining the process by choosing the trepanning radius, the beam inclination and the pulse energy insitu.

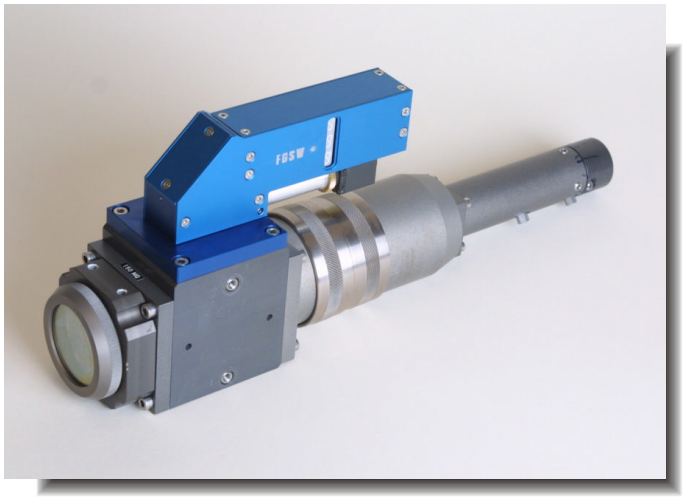

Fig. 3: Detectorheadforprocess monitoring of laser beam welding.

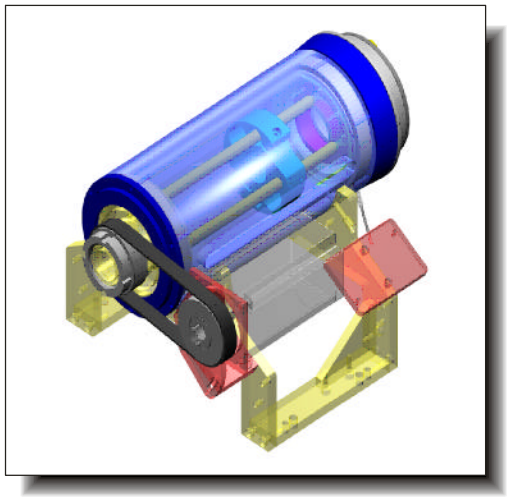

Fig.5: Design of the trepanning optic.

The realization of the described innovations was only possible by public funding and industrial cooperations - we would like to thank all participated parties, especially the German federal ministry for education and science BMBF and the VDItechnologycentre.

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