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2. Prize – Dr.-Ing. Martin Grabherr

"Vertical Cavity Surface-Emitting high-power Laserdiodes"

Diode lasers have been an extremely important part of laser technology since the mid-1980s. High efficiency, compactness and easy handling are all distinctive features of these lasers. The main areas of application so far have primarily been communication and information technology, from fiberglass networks and CD players to laser printers and professional printing systems. An entirely new type, the surface-emitting laserdiode, has been causing quite a stir since the mid-1990s. In his dissertation, Dr. Grabherr explored the possibilities of achieving higher laser power with this advantageous type of laser. High outputs of 100 watts to several kilowatts are primarily used in production technology.

In today's communication and entertainment technology as well as in information processing, diode lasers have made great strides since the mid-1980s.

The advantages of diode lasers have so far been scarcely used in production technology because the available power of individual diodes has lain far below requirements. To achieve high outputs of up to several kilowatts, many laser diodes are placed beside each other in lines and also stacked on top of each other. These so-called modules are then combined several times over for maximum output. The high integration depth of the tiny components and optimization of the characteristics of the laser light are however subject to high technological requirements. These have only been fulfilled over the past few years thanks to progress made in microtechnology, being available also outside the laboratory.

Micro-optical systems and adjustment work are important cost factors in the high performance of diode lasers, and have so far considerably limited their economic efficiency in production technology.

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The entirely new vertical cavity surface-emitting laserdiodes (VCSEL) are different from the so far predominant so-called stripe lasers (which emit light from the side) above all because of easier assembly and cooling as well as better beam characteristics. This reduces the elaborate adjustment work as well as the need for complex micro-optical systems.

Dr. Grabherr already worked on VCSELs for his diploma, and in his subsequent work in the research group led by Professor Ebeling at the University of Ulm he proved the potential of these laser diodes in high-powered applications for the first time.

Via optimized design and carefully planned setup, the outputs and the beam qualities he achieved have gained him an undisputed lead position internationally, as proven by numerous publications.

His knowledge is now used in a hived-off company "U-L-M Photonics", Dr. Grabherr being one of the partners, for commercially utilizing this technology.

Dr.-Ing. Martin Grabherr was born in Ulm, Germany in 1971, and studied electrical engineering at the University of Ulm, where he specialized in microelectronics. Since his diploma in 1995 he has worked on Professor Ebeling's team as scientific staff, and from 1997 onwards he supervised the technical implementation of the research project "High-Power Vertical-Cavity Surface-Emitting Laserdiodes" funded by the German Ministry for Education and Research. Since submitting his dissertation on high-power VCSELs in March 2000 he has been involved in the start-up company U-L-M Photonics.