A Prototype of a Laser Material Processing Center

N.D. Vieira Jr., W. de Rossi, G.E.C. Nogueira, N.U. Wetter, J.R. Berreta, J.T. Vidal, E. Gallego
Supervisão de Óptica Aplicada, Instituto de Pesquisas Energéticas e Nucleares, São Paulo, Brasil
nilsondv@baitaca.ipen.br

A prototype of a Laser Material Processing Center was developed at IPEN. It is composed by a computer controlled milling machine, with three linear axes and one rotating axe, a pulsed Nd laser and a beam delivery system. The laser delivers an average power up to 100 W , with maximum pulse energy of 6 J, variable pulse duration between 0.2 and 10 ms, with a repetition rate up to 100Hz. With this capability, the laser system is suitable for cutting and drilling ceramics and metals up to 3mm of thickness and, besides soldering and surface treating metals. All this processes can be assisted by reactive or protective gases. The system allows precise positioning of the pieces through the use of a CCD camera located along the beam delivery axis, besides allowing the diagnostic of the laser beam.

Ultrafast Diode-Pumped Solid State Lasers

Sérgio Tsuda
Bell Labs. Innovations - Lucent Technologies, Holmdel / NJ, USA; Present address: CPqD - Telebrás, Campinas - SP, Brazil stsuda@cpqd.br

Until recent years, sources of ultrashort optical pulses were almost always associated with lasers that took a lot of space and presented a reasonably complex operation. Now, with the development of high power diode lasers, new solid state laser materials, and mode-locking techniques, practical (turnkey operation) and compact ultrafast lasers are becoming available. We review and discuss ultrashort pulse generation with diode-pumped solid state lasers using a semiconductor saturable Bragg reflector (SBR) structure. This low loss mode-locking device can be used in combination with several solid state laser materials (Cr:LiSAF, Cr:LiSGAF, Cr4+:YAG, Ti:Sapphire, Erbium-doped fiber, etc) to generate self-starting optical pulses shorter than 100 fs. In the non-saturated regime it can also be used to start KLM operation.

Recent Developments in Technology, Frequency-Conversion and Applications of High Power Copper Vapour Lasers

Jim A. Piper
Centre for Lasers & Applications, Macquarie Univ., Sydney, Australia. jpiper@mpce.mq.edu.au

It is 30 years since copper lasers were first reported yet the last 5 years have seen quite spectacular advances in their technology, frequency conversion and applications. We have recently developed a technique called "kinetic enhancement" where halogen additives are used to greatly improve the power-scaling characteristics of otherwise conventional CVLs. Output powers of over 150 W have been achieved for 40 mm-diam CVL tubes which normally deliver only 50 W. Detailed studies of the output beam characteristics of CVLs with unstable resonators have resulted in major improvements in beam quality which have been used to achieve direct frequency-doubling to the ultraviolet with high optical efficiency. We have obtained uv powers up to 5 W at 255 nm by frequency-doubling in BBO from CVLs of bench-top scale. The high powers and high beam quality available in the visible and uv from new-generation CVL systems is very well suited to micromachining of metals, ceramics and polymers: characteristics of microdrilling and scribing with micron precision in variety of materials will also be presented.