Solid State Lasers for Micro-machining

Xiaoyuan Peng
Enlight Technologies, USA
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This course provides an overview of solid-state laser and the application in micromachining such as via drill, laser dicing, laser link processing, laser glass cut and laser nanostructuring. The requirements of solid-state lasers for micromachining will be discussed, including nanosecond (ns) and picosecond (ps) lasers with different wavelengths (IR, Green, and UV). The design, performance characteristics and the current state of the art of solid state lasers and devices will be discussed. The course will cover the fundamental design consideration for power, energy and beam quality for solid-state laser with different pumping arrangements and provides an overview of the state-of-the-art of solid-state lasers. The course will focus on the design and performance of bulk solid-state lasers, and give the comparison with fiber laser and amplifier. A design example of diode end-pumped solid-state laser will be given, which includes basis design consideration, power scaling, and characterization of thermal lensing effects. Technical discussion of frequency conversion, such as harmonic generation used in solid state lasers will be present. Applications in micromachining of solid-state lasers will be overviewed. Especially the topic will be focused on ultrafast laser applications. Moreover, technical advances and challenges (such as ultrafast laser, diode pump developments), which push the advanced laser to industrial market will be introduced.

Learning Outcomes

This course will enable you to:

- understand the key requirements on solid-state lasers in the application of micromachining
- learn an up-to-date technology of bulk solid state lasers and fiber lasers
- acquire the technical skills of characterizing key laser parameters
- learn about the thermal lensing effects of solid-state laser
- follow up a step-by-step design of diode end-pumped solid-state laser
- be acquainted with the development of ps laser, including bulk solid-state laser, fiber laser, and hybrid laser.
- be become familiar with the micromachining application

Intended Audience

This course is intended for graduate students, engineers, scientists, technicians and managers working in solid state laser research or laser industrial applications.

Instructor

Xiaoyuan Peng is R&D Director for Enlight Technologies, Inc. He has more than 20 years experience in solid state laser and laser applications. Previously held positions include Member of Technical staff at ESI (2005-2010), Scientist at LightAge, Inc.(2003-2005), Senior Laser Engineer at Photonics Industrial International, Inc. (2000-2003) and various university positions. He received his PhD in Physics from Nanyang Technological University in 2001. Dr. Peng has been invited by universities as visiting scholar, such as Stevens Institute of Technology, Guizhou University, etc. Dr. Peng has authored over 50

publications and conference presentations and own 5 issued and 1 pending US patents, and 7 WO pending patents.