

Nanosecond Lasers For Spectroscopic Applications

Laimutis Jacinavičius, Saulius Jacinavičius, Andrejus Michailovas

EKSPLA UAB
Vilnius, Lithuania

Abstract— In this presentation we describe the latest developments in nanosecond lasers made at Ekspla UAB for applications in scientific laboratories. Exploitation simplicity, serviceability, parameters stability and long lifetime were aimed while designing these nanosecond lasers.

Keywords—nanosecond lasers; laser diode pumping; harmonics generation

Introduction

One of the most widely used lasers in scientific laboratories is the nanosecond laser. It is due to versatility of this light source you can find it as in material science laboratory as in life science laboratory. It is mainly due unique set of the parameters. These lasers poses quite large amount of energy to perform material modification via melting, vaporization or plasma etching and quite high pulse peak intensity to convert wavelength efficiently by harmonics generation or parametric wavelength conversion. Short pulse durations permit to perform time scale measurements investigating dynamics of energy transfer in molecules, solid specimens, investigate liquids and gases flows, chemical reactions and etc. Due to nanosecond lasers simplicity and low price they are widely used in modern science and technology labs.

In this presentation we describe the results of many-years-long work resulted in development of simple and reliable nanosecond lasers for application in laboratories and industry.

Motivation

The first thing the typical user of nanosecond laser thinks is pulse energy. Pulse energy is main advantage of nanosecond lasers in comparison with mode-locked lasers emitting pulses of picosecond and femtosecond durations. Typical nanosecond laser with tens and hundreds of miliJoules output pulse energies is based on flash-lamp pumping technology. Up to recent time it was due to a high price of laser diodes (LD) and consequently high price of multimiliJoule laser diode pumped nanosecond lasers. But recent laser diodes technology achievements doubled and tripled output power from single emitter at nearly the same price as from laser diodes of previous generation significantly reduced LD pumping prices. High optical to optical power conversion efficiency of nanosecond laser pumped by LD means that thermal load to active rod is reduced in comparison with flash-lamp pumped case. This permit at the same thermal load level rise nanosecond laser repetition frequency up to hundreds of Hz.

Results

Elaborating low thermal load advantage of LD pumping two models of nanosecond lasers was developed. One with output pulse energy more than 100mJ from resonator running up to 100Hz repetition rate and another one compact air cooled operating at 10Hz emitting 10mJ pulse energy air cooled compact laser model. Thanks to LD pumping lasers are nearly noiseless assuring comfort in laboratory. Due to LD long life time (>1Gshot) laser can operate without service 8 hours every day nearly two years.



Fig.1. Baltic SP nanosecond laser. Pulse energy -10mJ; Pulse duration – 12ns; Repetition frequency – Single shot÷10Hz; Beam shape - Multi-mode.

High energy Laser is especially useful for harmonics generation with high conversion efficiency. E.g. for model running at 50Hz pulse energy is 150mJ at fundamental wavelength 1064nm; 70mJ at the second harmonic wavelength 532nm; 35mJ at the third harmonic wavelength 355nm and 15mJ at the fourth harmonics wavelength 266nm [1]. At all wavelengths laser features very good pulse energy stability, that is exceptionally attractive for nonlinear optical experiments.

This laser is especially attractive for pumping optical parametrical oscillators (OPO). The work on designing OPO pumped by nanosecond LD pumped laser is in progress with very promising preliminary results.

References

[1] www.ekspla.com