Optical Velocimetry: 29 May-2 June, 1995, Warsaw, Poland

SPIE Vol. 2729, Optical Velocimetry, 29 May-2 June 1995, Warsaw, Poland, pp. 42-47
0-8194-2110=3/96/$6.00

Properties of crystals for diode pumped solid state laser devices

K. Kopczyński, Z. Mierczyk, S. M. Kaczmarek

Institute of Optoelectronics, Military University of Technology,
01-489 Warsaw, 2 Kaliski St., Poland
tel. (0 22) 685 9205, fax (0 22) 36 16 50

ABSTRACT

Investigations of spectroscopic properties of yttrium-aluminum garnet $Y_3Al_5O_{12}$ (YAG) doped with Ce, Pr, Nd, Sm, Eu, Ho, Er, Tm, Yb ions and Nd:YAP, Nd:$SrLaGa_3O_7$, Nd:$SrLaAlO_4$, Nd:YVO_4, Nd:$LiYF_4$, Nd:$PbMoO_4$, Nd:LGS, Nd:GGG, Nd:SVAP monocrystals have been realized. Absorption spectra of the monocrystals in the range 200nm - 20μm and the luminescence spectra in the range 200-800nm for Pr:YAG, Pr:YAP and Pr:$SrLaGa_3O_7$ were determined. Except for Pr:YAG, Sm:YAG, Eu:YAG and Pr,Yb:YAG in all other materials an appearance of strong absorption bands in the range of 780 - 840 nm has been stated what enabled to carry out an efficiency analysis of selective pumping with the use of GaAlAs laser diodes.

Keywords: coherent optical velocimetry, diode pumped lasers, laser crystals, absorption spectrum, luminescence spectrum

1. INTRODUCTION

Since 1984 when Spectra Diode Labs has introduced on market GaAlAs laser diodes working in the CW-mode with 100 mW output power, solid state lasers pumped with semiconductor laser diodes has became the most dynamical laser group with wide potential applications in industry, medicine, telecommunication and scientific research work, and optical velocimetry. They offer considerable advantages over flashlamp pumped lasers such as long life, compact size, high efficiency, lower heat dissipation and solid state reliability. Diode pumped lasers are considered be the most perspective laser sources in coherent optical velocimetry.

Among diode-pumped lasers, Nd:YAG and Nd:YLF active media with frequency multiplication possibilities are the only commercially available. Even though YAG and YLF are both good hosts, they can be doped with a maximum of only about 1 at.% Nd^{3+} without unacceptable degradation of crystal quality. As a result, the pump light absorption is weak and long samples (about 6-10mm) are needed for effective diode pumping. Long samples require more complex focusing optics due to the poor beam quality of diode laser pump light. The result is increased complexity and products cost. To further improve diode pumped laser design, there is a need of higher Nd doping host. The potential range of active materials for such applications is very broad [1-10].

2. SAMPLES AND EXPERIMENTAL PROCEDURES

Optical homogeneity of the crystals measured was investigated by the plane-polariscope and Mach-Zehnder interferometer. Samples with diameters of 10 mm and thickness of 1-2 mm were cut out from the most homogeneous parts of the crystals made in the Institute of Electronic Materials Technology, Warsaw and Institute of Materials, Lvov. These samples has undergone spectroscopic and luminescence investigations.

In order to calculate the absorption coefficient of investigated crystals, transmission measurements were carried out using LAMBDA-2 PERKIN-ELMER spectrophotometer in the spectral range of 200-1100 nm, BECKMAN ACTA MVII spectrophotometer in the spectral range of 1100-1400 nm and FTIR 1725 PERKIN-ELMER Forier-spectrophotometer in the spectral range of 1.4-25 μm. In the range of 750-850 nm investigations were made with 0.1 nm accuracy.

Dispersion of the absorption coefficient $\alpha(\lambda)$ was calculated from transmission $T(\lambda)$ measurements with the consideration of multiple reflections within a sample. The absorption spectra for investigated crystals, in compared to Nd:YAG one, are shown in figures 1 to 4 in the range of 750 - 850 nm. The biggest value of the peak absorption coefficient equal to 33.6 cm^{-1} appear for Nd:$SrLaAlO_4$ crystal and 808.4 nm line, but the other most interesting crystal for diode pumped laser devices is Nd:YVO_4 with the value of peak absorption coefficient of 16.8 cm^{-1} for 808 nm.

42

[PDF] Freddies Fast-cash Getaway: The Parable Of The Prodigal Son
[PDF] Second Nature: Economic Origins Of Human Evolution
[PDF] The Great Societys Poor Law: A New Approach To Poverty
[PDF] Australian Coastal Shipping, The High Price Of Protection