longitudinal-mode, the effect of pump power on the laser emission spectra for both wavelengths is addressed. The laser wavelength around 1030 nm shifts to short wavelength at low pump power region and then to red with increase of the absorbed pump power, while the laser wavelength around 1049 nm does not change with the pump power. Excellent laser performance indicates Yb:YAG ceramic laser materials could be potentially used in high-power solid-state lasers operating at 1030 nm, 1049 nm, or both wavelengths simultaneously.

6451-42, Session 11

Thermal and mechanical stress analysis of ceramic YAG crystals with different Nd concetrations

N. Kenar, G. Oke, A. Esendemir, Middle East Technical Univ. (Turkey)

Numerical heat and stress analysis of rod shaped laser crystals were performed. Relation between the Nd concentration and resulted stress in the crystal were investigated by considering laser diode pumping structure and mechanical boundary conditions of the crystal. Results of heat and stress analysis were used to calculate the focal length of laser crystal.

6451-43, Session 11

Modeling visible and infrared stimulated emission from Tb3+ in TbAlO3

K. L. Nash, J. B. Gruber, R. M. Yow, The Univ. of Texas at San Antonio; U. V. Valiev, National Univ. of Uzbekistan (Uzbekistan); D. K. Sardar, The Univ. of Texas at San Antonio

With recently developed diode-lasers to resonantly pump solid-state crystalline lasers, new opportunities arise for systems such as Tb^{3+} as an activator ion in different host matrices. For example the observed fluorescence from $^5D_4 \rightarrow {}^7F_5$ transition (540 to 560 nm) of Tb^{3+} in $TbAlO_3$ represents such a possibility. There is little fluorescence quenching in this crystal involving this transition, and the measured lifetime is approximately 4 ms, long enough to sustain sufficient population for stimulated emission. The quantum efficiency is better than 50 percent as measured in this material. For this same transition, others have reported room-temperature pulsed laser operation at 544 nm for Tb:YLF, where the lifetime is comparable. Mid- and long wavelength infrared laser emission has been observed for Tb^{3+} in chalcogenide glass fibers that complement our spectroscopic findings for Tb^{3+} in pedestal-grown Y_2O_3 and YAG fibers. We have identified the infrared transitions that lase as transitions between different manifolds within the ^7F_J multiplet. In the present study we first evaluate the various visible experimental findings with a Judd-Ofelt analysis of Tb^{3+} in $TbAlO_3$. We predict a radiative lifetime of 3.9 ms for the excited $^5D_4$ manifold to the ^7F_J manifolds with more than 50% of the emission represented by the $^5D_4 \rightarrow {}^7F_5$ transition. To account for the visible stimulated emission, we report transition probabilities for $^5D_4 \rightarrow {}^7F_J$ transitions and for diode-pumped infrared transitions we report similar spectroscopic properties for transitions within the ^7F_J multiplet. We comment on possible infrared transmitting hosts that have superior optical qualities in the wavelength region where the Tb^{3+} ion exhibits infrared stimulated emission.

Supported by NSF Grant No. DMR-0602649.

6451-44, Session 11

Continuous-wave diode-pumped Yb:LuVO4 lasers

J. Liu, V. P. Petrov, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); J. Wang, J. Wang, M. Jiang, Shandong Univ. (China); U. Griebner, F. Noack, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany)

We studied several crystals of Yb-doped LuVO4 with different orientations (a-cut and c-cut) in order to evaluate the potential of this new laser material for high power continuous-wave operation using simple hemispherical cavities, longitudinally pumped by a fiber coupled diode-laser module. We achieved substantial improvement of our initial results in terms of output power and slope efficiency. The highest output power and optical efficiency were obtained for the p-polarization using a-cut samples. Under certain conditions, polarization switching and/or bistability of the input-output power characteristics in terms of a hysteresis loop were observed. Both effects are associated with increase of the crystal temperature. Significant intensity fluctuations have also been observed in a small operational region near the critical point (up-threshold) of the bistable region. The heating of the crystal is less in the lasing state when stimulated emission keeps the part of the radiative relaxation high in comparison to the nonradiative relaxation processes.

6451-45, Session 11

Determination of Cr:LiSAF crystals ablation thresholds on the 20-ps regime using a diagonal scan

R. E. Samad, S. L. Baldochi, N. D. Vieira, Instituto de Pesquisas Energéticas e Nucleares (Brazil)

The usual method to determine the ablation threshold of solid samples by ultrashort laser pulses is done by focusing the laser beam on the samples surface by a known lens, requires the knowledge of all the geometrical parameters (lens focus, beam propagation parameters, beam quality, sample position), and a series of measurements for different pulse energies.

We present here a simpler method for determining ultrashort laser pulses ablation threshold for solid samples. The method uses a focusing lens, and requires only the knowledge of the pulse power, employing a diagonal translation of the sample through the laser beam waist, resulting in a pattern etched on the sample surface. The ablation threshold is obtained measuring only one dimension of this pattern and a straightforward mathematical relation, There is no need to know any other geometrical parameter of the laser beam or of the lens used.

The technique was employed to determine the ablation threshold of pure and Cr doped LiSAF samples for 20 picoseconds pulses, and a dependence with the Cr concentration was observed.

6451-46, Session 11

Time-resolved pump-probe measurements of new cerium-doped BaY2F8 UV materials

H. Liu, D. Spence, D. Coutts, Macquarie Univ. (Australia); M. Tonelli, A. Toncelli, Univ. di Pisa (Italy)

We present an results of an investigation of the spectroscopic properties of Ce:BaY2F8 (BYF), which is a potential laser material with emission wavelength range from 320nm to 360nm. The BaY2F8 single crystals, doped with various amount of Ce3+ ions, were grown by the Czochralski technique, in an oxygen-free high-purity Argon atmosphere.

Like other cerium doped UV materials (Ce:YAG, Ce:LiCAF, Ce:LiLuF, Ce:KYF), excited-state absorption (ESA) and color centres formation in Ce:BYF are the two main factors that can affect laser performance, and may even prevent laser action. We will present the results of experiments investigating the potential for laser action in Ce:BYF.

We have employed a time-resolved pump-probe technique to look for net gain in Ce:BYF. We used a Ce:LiCAF laser emitting 3 ns pulses at 290 nm to pump the crystal, and a Ce:LiLuF laser emitting sub nanosecond pulses at 327 nm to probe the net gain or loss in the centre of the Ce:BYF emission band. Measurements were made for all combinations of pump and probe polarisations; the effective emission cross-section and rate of colour centre creation are found to be strongly polarisation dependent. We observe strong absorption from colour centres with millisecond and second lifetimes that will certainly prevent high rep rate laser action with these