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Characteristics of Tm,Ho:YAG Laser with Tunable Range of 2.08-2.12 μm

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In recent advanced lasers, 2 micron solid-state lasers such as Tm:YAG and Ho:YAG laser are very attractive for laser radar remote sensing technologies, i.e. eye safety, realizations of all solid-state laser pumped by diode laser and smaller dimension, tunability of lasing wavelength, possibility of coherent detection etc. Featuring these advantages, 2 micron lasers have been candidated as laser transmitters for use in water vapor DIAL, laser altimeter, Doppler wind sensor, Mie lidar etc. This paper reports characterization of tunable Cr,Tm,Ho:YAG laser and its applications to spectroscopy concerning with absorption and reflectance.

The Holmium-YAG laser rod, fabricated by Airtron, was 74mm length with a diameter of 6.4mm. Dopant concentrations are Cr,0.85; Tm,5.9 and Ho,0.36, respectively. The Xe flash lamp was connected in series with a 220 μF capacitor. Maximum input energy to the flash lamp yields electrically about 200J. The laser cavity consists in a totally reflecting rear mirror and an output mirror. The cavity length is 80 cm.

Fig.1 shows an typical electrical input energy versus laser output energy. The output energy , when operated transversely multi-mode, could produce more than 2J with 260J of electrical input energy, while the highest slope efficiency obtained with the 85% reflecting output coupler was 1.3%. Experimental results of output energy versus repeatition rate were shown in Fig.2. The output enegy was decreasing with increasing the repetition rate. These are induced by temperature sensitive because of quasi three level laser.

Ho laser has a capability of tunability over the wavelength range 2.08-2.12 μm. Two uncoated fused quartz etalons as tuning elements were used. One of them has a 0.1mm thickness for a coarse tuning and the other a 1mm thickness for a fine tuning. The measured tuning spectrum is shown in Fig.3 . This figure shows that the laser could be tuned smoothly from 2.083 μm to 2.1 and 2.12-2.13 μm. The linewidth of laser was measured to be approximately less than 0.1nm.

In the presentation, we will provide additional experimental data.

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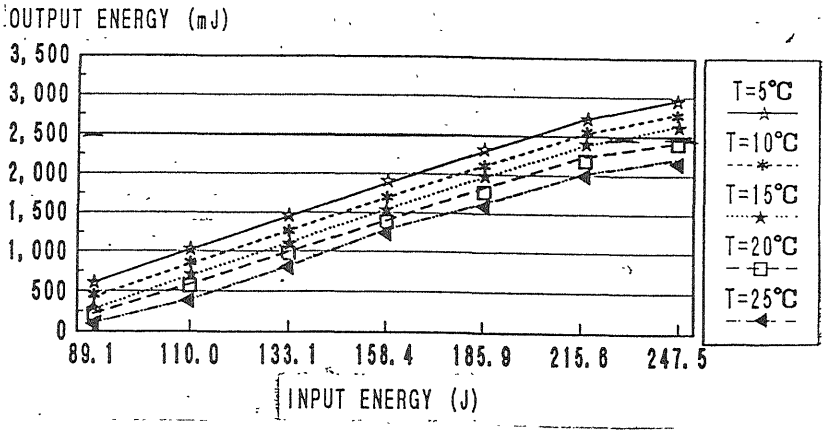

Fig.1 Electrical input energy vs output energy

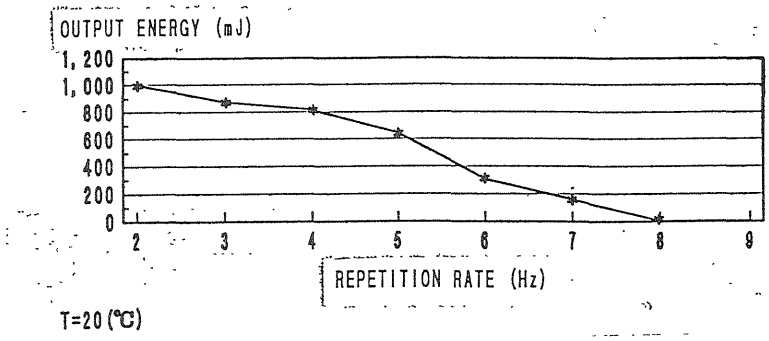

Fig.2 Repetition rate vs output energy

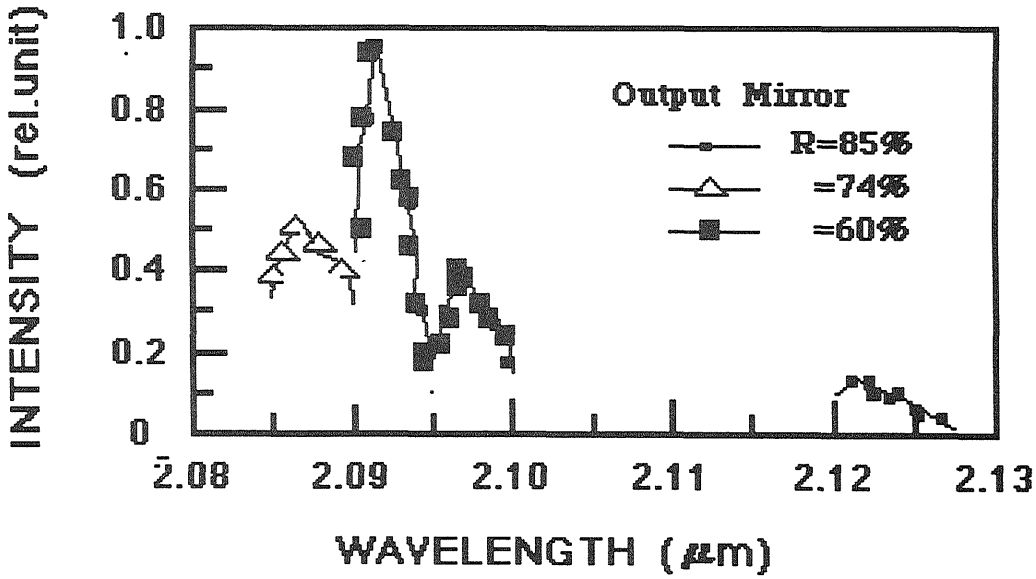

Fig.3 Lasing spectrum of Tm,Ho:YAG laser