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TEM₀₀ high efficiency surface emitting laser diode longitudinally pumped Nd:YVO₄ laser

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The laser diodes are the solid-state lasers most efficient pump sources. Monolithic Surface Emitting Laser Diode (M-SELD) has been validated with laser diode structures grown on an engraved GaAs substrate [1,2]. The groove edges are 45° etched to form an integrated mirror which reflects the output beam normally to the epitaxial plane. We report first results on Nd:YVO₄ laser longitudinally pumped by a M-SELD. This pumping scheme allows higher conversion efficiency than the transverse one (M-SELD side pumped Nd:YAG slab results have already been published [3,4]). The Nd:YVO₄ high absorption coefficient minimise the pump power deposition volume.

The M-SELD was made by Thomson-CSF Semiconducteurs Spécifiques (TCS). The output energy is 3.8 mJ (respectively 6.8 mJ) per 100 μs (200 μs) long pulse at 50 Hz repetition rate on a 3 × 3.2 mm² surface (120 emitters). The spectral width is about 4 nm. The optical beam divergence is ~15° (FWHM) in each direction with a pedestal due to light unreflected by the integrated mirrors. A small concavity of these mirrors induces the reduction of the currently large divergence (~50°) in the direction perpendicular to the epitaxial plane. The M-SELD light is concentrated into the laser material by two aspheric lenses (1/3 magnification). The coupling efficiency defined as the ratio between the energy incident on the laser crystal and the M-SELD emitted energy is 60 %, limited by the optical beam pedestal and the laser cavity mirror (M₁) 90 % transmission at 808 nm.

The AR coated 1 % at. a-cut Nd:YVO₄ crystal is 3 mm long. The pump beam is π polarised. The 90 mm long laser cavity is formed by a 10 m radius of curvature high reflector M₁ and a 7 % transmission flat output mirror M₂. The laser material is placed 2 mm above M₁. Output energy of 0.74 mJ was obtained with a 2.3 mJ incident pump energy (100 μs long pump pulses). Slope and optical/optical efficiencies are 35 % and 32 % respectively. The mode was found to be nearly diffraction limited with a M² value of 1.1.

In conclusion, we have demonstrated what is to our knowledge the first Nd:YVO₄ laser longitudinally pumped by a Monolithic Surface Emitting Laser Diode. Works are being carried on to increase the coupling efficiency through energy distribution characteristic improvements. The authors would like to thank B. Groussin, A. Parent, T. Fillardet and C. Carriere from TCS for providing the M-SELD and for their technical assistance. This work was partly supported by the French Ministère de l'Enseignement Supérieur et de la Recherche.

- [1] S. S. Ou, M. Jansen, J. J. Yang, L. J. Maws and T. J. Roth, *Appl. Phys. Lett.*, **59**, 2085 (1991).
- [2] B. Groussin, F. Pitard, A. Parent and C. Carriere, *Electron. Lett.*, **29**, 370 (1993).
- [3] C. Larat, M. Schwarz and J. P. Pocholle, *Electron. Lett.*, **28**, 1630 (1992).
- [4] C. Larat, M. Schwarz, G. Feugnet and J. P. Pocholle, in Proceedings of the 1993 Advanced Solid State Lasers and Compact Blue-Green Conference Lasers, (Optical Society of America, Washington DC, 1993).