

Broadband Fibre Devices

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Abstract

Fibre devices technology has reached a mature status over the last few years. It has been an important part of our experimental research at the ORC. Some interesting results have been obtained by various companies, which demonstrates their already commercial availability. For instance, 110 Watts from a CW fibre laser was reported by SDL in the USA. From a pulsed fibre laser, ~ 1kW of output power has been obtained by IPG. On the other hand, 2.3mJ and 7.7 mJ in Q-switched regime have been demonstrated at the ORC.

Among the main characteristics of fibre lasers we can mention its broadband, wide tunability, narrow linewidth and single polarisation. From their applications one can include: telecommunications (high power EDFA, Raman lasers and amplifiers), medical applications, remote sensing, and material processing. For these capabilities and applications fibre lasers are considered a viable alternative to high power bulk lasers, i.e. Nd:YAG replacement.

In this paper, we will describe cladding pumping scheme that is employed to increase launched pump power into double clad rare-earth doped fibres. Different pumping schemes have been proposed and will also be reviewed. With this technique, maximum launching efficiencies can reach up to 80%.

In our studies, Yb³⁺, Nd³⁺, Er³⁺/Yb³⁺ and Th³⁺-doped fibre lasers were developed with fibres made in-house. Initially, a maximum 22-W of CW output power and a slope efficiency of 83% from an Yb³⁺-doped fibre was demonstrated. A 70-nm tuning range was achieved using an external bulk grating as tuning device. For Nd³⁺ fibre lasers, an 80-nm

tuning range was demonstrated. In a co-doping scheme, an $\text{Er}^{3+}/\text{Yb}^{3+}$ -doped fibre laser was investigated. It provided 16.8 W of output power (CW) at 1050 nm and was tuned from 1530 to 1602 nm. The average output power was >5 W and showed a 0.2 linewidth over the entire range. Thulium-doped fibre lasers reached over 300-nm tuning range from two different fibres. Experimental set-ups, fibre characteristics and mentioned results will be briefly explained.

Finally, a review of GTWave™ fibre technology as a novel pumping scheme, a reconfigurable, multiport 32-dB amplifier and superior fibre Bragg gratings technology will also be discussed in this paper.