HIGH POWER DIODE-PUMPED Nd^{3+} FIBRE LASER

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In the medical field high power fibre-coupled AlGaAs diode lasers operating around 800nm are already making an impact in surgery but for more specialised applications high powers at other wavelengths are required. It is an attractive idea to develop active fibres as add-ons to such fibre coupled diode systems increasing the range of applications of such devices at little extra cost and minimal additional complexity.

Rare-earth-doped optical fibres exhibit the traditional advantages of a glass laser host of broad emission and absorption spectra but without the usual associated thermal problems. With fibre lasers wavelength selection and temperature stabilisation of the pump diode is unnecessary, and the emission spectra allows for broad tuning. Double-clad fibres comprising a doped core, usually single-moded located within a large multimode waveguide enable efficient pumping of fibre lasers with diode arrays or diode bars. Fibre lasers can thus be considered as simple wavelength convertors and brightness enhancers for the high power but poorly specified output of diode sources.

In the this paper we describe a multiwatt Nd^{3+} fibre laser pumped via a second cladding by the DIOMED 25 laser diode unit. This multi diode array source is designed for coupling up to 25 Watts of diode power into a plastic-clad silica fibre of 400μm diameter. The laser fibre which is a double-clad structure fabricated from lead-silicate glasses is interchangeable with the normal PCS delivery fibre. The device operates at 1.058μm with a slope efficiency $>50\%$ and a 150 times brightness enhancement. This laser though useful in itself is also a key intermediate laser for generation of high powers at other wavelengths. Tandem pumping of Tm^{3+} and Er^{3+}/Yb^{3+} fibre lasers at 1.058μm enables efficient generation of 2.0μm and 1.55μm radiation respectively. In addition the Nd^{3+} laser can be operated close to 1.3μm and there are prospects for in-fibre frequency doubling of the 1.06μm line to generate a high power source in the green.

High power diode-pumped Nd^{3+} fibre laser.

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High power fibre-coupled AlGaAs diode lasers operating around 800nm are already making an impact in surgery but more specialised medical applications require high powers at other wavelengths. Lasers based on rare-earth doped fibres can be developed as add-ons to such fibre coupled diode systems increasing the range of applications at little extra cost and minimal additional complexity. Efficient longitudinal pumping with diode arrays or diode bars is achieved by confining the pump light in a large multimode waveguide surrounding a smaller doped core which is usually single-moded. In this paper we describe a multiwatt Nd^{3+} fibre laser pumped via a second cladding by the DIOMED 25 laser diode unit. This multiple diode array source is designed for coupling up to 25 Watts of diode power into a plastic-clad silica fibre of 400μm diameter. The double-clad laser fibre is interchangeable with the normal PCS delivery fibre. The device operates at 1.058μm with a slope efficiency $>50\%$ and a 150 times brightness enhancement. This laser though useful in itself is also a key intermediate laser for generation of high powers at other wavelengths. Tandem pumping of Tm^{3+} and Er^{3+}/Yb^{3+} fibre lasers at 1.058μm enables efficient generation of 2.0μm and 1.55μm radiation respectively. In addition the Nd^{3+} laser can be operated close to 1.3μm and there are prospects for in-fibre frequency doubling of the 1.06μm line to generate a high power source in the green.