FIBER AMPLIFIER PUMPED AT 1010 - 1030 NM

Task

Particularly in pulsed Ytterbium-doped fiber lasers, amplified spontaneous emission leads to losses in the temporal and spectral quality of the laser light due to the high amplification per round trip. This issue constitutes a limit pulse duration and repetition rate. In order to expand the possible parameter range of the fiber laser to lower repetition rates, the reduction of the amplified spontaneous emission should be investigated in pulsed fiber lasers by pumping at wavelengths in the range over 1000 nm.

Method

Through pumping Ytterbium-doped fiber lasers in the wavelength range from 1010 - 1030 nm, the inversion is limited to approx. 15 percent, in contrast to pumping at wavelengths of 915 nm or 976 nm. This inversion cannot be exceeded so that a homogeneous distribution of the inversion and thus the amplification are both reached, whereas the appearance of amplified spontaneous emission can be reduced significantly. In addition, through low and controlled inversion, the formation of color centers, the so-called photo darkening, is reduced.

Result

To investigate this concept, a fiber-integrated amplifier with pulse durations in the range of 10 - 100 ns and repetition rates of < 20 kHz was developed. This laser emitting at 1064 nm is core-pumped with a fiber laser at a wavelength of 1030 nm.

Limited by pump power, the polarized single-mode fiber amplifier reaches a signal peak power of 1 kW at a signal-to-noise ratio of over 50 dB. In comparison to conventional fiber amplifiers pumped at 915 nm with similar efficiency and same peak power, the signal-to-noise ratio can thus be improved by several orders of magnitudes at low repetition rates.

Applications

With its single-mode beam quality and adjustable pulse duration and repetition rate, the fiber laser can be used, with subsequent amplification, for applications in which a low thermal load is necessary, such as materials processing, medical and measuring technology and special communication-technical applications.

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1 Fiber amplifier pumped at 1010 - 1030 nm.