High-peak-power, short-pulsed fiber laser in the near-IR and mid-IR

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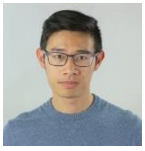
Abstract

Short pulsed fiber laser with high peak power have found application in various areas based on different wavelengths. Gain-switching of laser diodes offers the simplest and most practical method for generating picosecond (ps) pulses at a variable repetition rate, and has the capability of being integrated into stable, compact and all-fiberized amplifier system. At 1035 nm wavelength, by using optimized Ytterbium doped fibers, we have achieved ~100 W average power, ~200 kW peak power at 5.5 MHz repetition rate without serious nonlinear degradation. Such high-power, high-repetition-rate, short-pulsed fiber laser is of great interest for high-throughput material processing. By using periodically poled lithium niobate (PPLN), short pulses at 1μm are frequency shifted to long wavelengths with tunability from 1.4 μm to 3.7 μm, through optical parametric generation and amplification, and peak power as high as 25 kW is obtained. In the 2 μm regime, a high power fiber master-oscillator-power-amplifier is developed by employing direct amplification. 35-ps pulses with high peak power of up to ~300 kW at 1.95μm is achieved from a large-mode-area Thulium (Tm) doped fiber. Mid-IR pulses with wavelength tuning range from 2.5 μm to 8.3 μm are realized from Tm doped fiber laser pumped orientation-patterned GaAs through optical parametric process. The mid-IR pulses have high peak powers up to 13 kW and narrow spectrum linewidths (< 1.5 cm^{-1}) can be used for important applications such as chemical sensing and spectroscopy.

Recent publications

1. L. Xu, Q. Fu, S. Liang, D.P. Shepherd, D.J. Richardson, S.U. Alam, Thulium-fiber-laser-pumped, high-peak-power, picosecond, mid-infrared orientation-patterned GaAs optical parametric generator and amplifier, Optics Letters, 42 (2017) 4036-4039.
2. L. Xu, S. Alam, Q. Kang, D.P. Shepherd, D.J. Richardson, Raman-shifted wavelength-selectable pulsed fiber laser with high repetition rate and high pulse energy in the visible, Optics Express, 25 (2017) 351-356.
3. L. Xu, H.-Y. Chan, S.-u. Alam, D.J. Richardson, D.P. Shepherd, High-energy, near- and mid-IR picosecond pulses generated by a fiber-MOPA-pumped optical parametric generator and amplifier, Optics Express, 23 (2015) 12613-12618.
4. L. Xu, H.Y. Chan, S.U. Alam, D.J. Richardson, D.P. Shepherd, Fiber-laser-pumped, high-energy, mid-IR, picosecond optical parametric oscillator with a high-harmonic cavity, Optics Letters, 40 (2015) 3288-3291.
5. S. Liang, L. Xu, Q. Fu, Y. Jung, D.P. Shepherd, D.J. Richardson, S.-u. Alam, High Peak Power Picosecond Pulses From an All-fiber Master Oscillator Power Amplifier Seeded By a 1.95 μm Gain-switched Diode, in: Laser Congress 2017 (ASSL, LAC), Optical Society of America, Nagoya, Aichi, 2017, pp. ATh3A.4.
6. L. Xu, J. Feehan, L. Shen, A. Peacock, D. Shepherd, D. Richardson, J.V. Price, Yb-fiber amplifier pumped idler-resonant PPLN optical parametric oscillator producing 90 femtosecond pulses with high beam quality, Appl Phys B, 117 (2014) 987-993.

Biography



Lin Xu has his expertise in fiber lasers, nonlinear optics including Raman laser, supercontinuum generation and optical parametric oscillators. He obtained his Ph.D degree in laser engineering from Shanghai Institute of Optics and Fine Mechanics (SIOM), Chinese Academy of Science, China, in 2012. He has been working in the Optoelectronics Research Centre (ORC) at the University of Southampton, UK, since 2013. In the field of high power pulsed fiber lasers and mid-infrared lasers (optical parametric oscillators, Raman lasers and supercontinuum laser sources), his research and contribution are at the forefront. He is serving as journal reviewer of various international referred journals such as Optics Express, Optics Communications, Chinese Optics Letters, etc. He has more than 25 high-quality publications with more than 280 citations.

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Notes/Comments: