wavelengths much longer than in the initial demonstration (3.3-3.78 µm). We report also extensive damage studies of LISe with the same pump source.

7582-14, Session 4

3.2-watt single-frequency CW source at 790 nm based on frequency conversion of a fiber laser

A. J. Henderson, P. Esquinasi, Lockheed Martin Aculight (United States)

Many promising demonstrations of single pass frequency doubling of fiber lasers have recently been performed, providing a simple, robust method to generate multi-Watt power output in the green and near-infrared. However such sources are limited to operating wavelengths within the relatively narrow gain bandwidths defined by the fiber dopants. For many applications in spectroscopy and atomic physics, a fiber-laser based source with similar output providing continuous tunability in the 700 nm to 1000nm range would be highly attractive to provide a source of comparable capability to single frequency Ti: Sapphire lasers. We have demonstrated 3.2 Watts of single frequency output by single-pass frequency-doubling of a fiber-laser-pumped CW OPO. 25% efficient frequency doubling was demonstrated by focusing 13 Watts of 1580nm input into a 50mm length MgO:PPLN crystal. The single frequency 1580nm input was generated as the resonant signal wavelength in a CW OPO based on MgO:PPLN. The OPO was pumped by a 30 Watt Ytterbium-doped fiber laser operating at 1064nm, with a spectral bandwidth of ~0.6nm. 300mW of output at 980nm was also generated by the same technique using MgO:PPLN crystals of different poling periods.

7582-15, Session 4

Synchronously pumped at 1064 nm OPO based on CdSiP2 for generation of high-power picosecond pulses in the mid-infrared near 6.4 µm

A. Peremans, D. Lis, F. Cechet, Facultes Univ. Notre Dame de la Paix (Belgium); P. G. Schunemann, K. T. Zawilski, BAE Systems (United States); V. P. Petrov, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany)

Synchronously pumped optical parametric oscillators (SPOPOs) are potentially efficient sources of high repetition rate (~100 MHz) ultrashort pulses at wavelengths not available from conventional mode-locked lasers. The use of chalcogenide crystals, transparent in the mid-IR, has been reported only in a few cases but preserving the high repetition rate was possible only by cascaded operation of two SPOPOs.

The only chalcogenide crystal directly pumped at 1064 nm, remains AgGaS2 (AGS), but it exhibits poor thermo-mechanical characteristics like thermal conductivity, anisotropy of thermal expansion and damage threshold. In all cases the pump systems were pulsed (either by using a modulator, Q-switching or pulsed excitation).

The recently discovered CdSiP2 (CSP), is a negative uniaxial chalcopyrite that allows 1064 nm pumping without two-photon-absorption and possesses a useful transparency up to 6.5 µm. It outperforms all other mid-IR nonlinear materials that can be pumped near 1 µm in almost every aspect and is the only material which allows non-critical phase-matching, with a maximum effective nonlinearity of 84.5 pm/V.

In the present work CSP is employed in a picosecond SPOPO pumped at 1064 nm, to produce quasi-steady-state idler pulses near 6.4 µm with an energy as high as 2.8 µJ at 100 MHz. The train of 2 µs long macropulses, each consisting of 200 (picosecond) pulses, follows at a repetition rate of 25 Hz. This corresponds to an average power of 14 mW. The pump depletion (conversion efficiency) exceeds 40%. Without intracavity etalon, the 12.6 ps long mid-IR micropulses have a spectral width of 240 GHz.

7582-16, Session 4

A high peak power compact eye-safe optical parametric oscillator system

F. F. Wu, MetroLaser, Inc. (United States); J. W. Pierce, JP Innovations LLC (United States)

We report the operation of an optical parametric oscillator (OPO) at 1574 nm using KTP, with output peak power of more than 5 megawatts, output pulse energy of up to 30 mJ per pulse, and pulse width of less than 6 nanoseconds at full width half maximum (FWHM). The OPO was pumped by a diode pumped Nd:YAG Q-switched laser, with pump energy of about 95 mJ and pulse width of approximately 7 ns. The conversion efficiency from 1064 nm Nd:YAG laser to OPO output at 1574 nm is more than 30%. The whole system including the Nd:YAG laser was compactly packed inside a case measuring 15” x 9” x 5.3”. The complete Nd:YAG / OPO system was tested over an operating temperature range of -20 C to +35 C and a storage temperature range of -40 C to +50 C without significant power or performance variations, which makes it suitable for field operation.

7582-17, Session 4

Excitation of individual Raman Stokes lines of up-to 10th order using rectangular shaped optical pulses at 530nm

K. Chen, S. Alam, C. A. Codemard, A. Malinowski, D. J. Richardson, Univ. of Southampton (United Kingdom)

We demonstrated the selective excitation of individual Raman Stokes lines of up-to 10th order pumped by 100ns, rectangular-shaped optical pulses at 530nm. The rectangular shaped optical pulses were generated through frequency-doubling of an adaptively pulse shaped fiber MOPA operating at 1060nm. This form of pulse shape is optimal for Raman conversion processes since all parts of the pulse experience the same Raman gain. As a result, it is possible for a single pulse to transfer all of its energy through sequential Raman frequency shifts to successive order Stokes lines along a length of fiber - yielding a pulse at a single selected Raman-order at the fiber output. A high extinction ratio between the selected line and all other Raman-orders can be achieved by an appropriate choice of the input peak power. We have achieved extinction ratios as high as 15 dB between primary and adjacent Stokes lines using this approach in a 1 km long SMF-28 fiber and launched pump powers of up to 5 W at 100 kHz repetition frequency, obtaining wavelength tuneable output at discrete wavelengths in the range 530-780 nm. Sources based on such an approach have potential applications in the areas of material processing and bio-medical science amongst others.

7582-18, Session 5

Tunable nonlinear-optical devices for laser-spectroscopic sensing

B. J. Orr, Y. He, Macquarie Univ. (Australia)

Generating coherent light via nonlinear optics drives many of our laser-spectroscopic sensing applications [1]. For instance, narrowband tunable pulsed optical parametric oscillators (OPOs) controlled by injection seeding are used extensively for cavity-ringdown and coherent-Raman spectroscopies [1-4]. In a high-precision OPO-based spectroscopic system [5-7], we employ a long-pulse (>25 ns) pump laser with optical-heterodyne diagnostics to log instantaneous frequency and chirp on a pulse-by-pulse basis. In other work, we use photorefractive media for narrowband wavelength control of tunable diode lasers and pulsed OPOs [8-10]. Prospective applications of pulsed OPOs include mid-infrared sensing of explosives or post-blast residues and coherent-Raman micro-spectroscopic screening, e.g., of pathogens.

[1] B.J.Orr, Y.He, R.T.White, “Spectroscopic Applications of Tunable