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Injection-seeded ring cavity resonant PPMgLN optical parametric oscillator with 3.3 μm output

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An injection-seeded, doubly resonant optical parametric oscillator (DROPO), based on a PPMgLN crystal (5% mol MgO doped), with the capability of emitting narrow linewidth infrared 3.3 μm wavelength laser is presented, see Figure 1. To utilize the maximum nonlinear coefficient (25 pm/V) of the PPMgLN crystal, and avoid beams walk-off effect inside the crystal, the OPO phase matching type of e→e+e is adopted in this experiment. A Q-switched single frequency 1064 nm Nd:YAG laser is used as the pump source. When the pump power is increased to 556 mW at 400 Hz repetition rate, and the temperature of the PPMgLN crystal, which has a grating period of 30.5 μm, is kept at 110°C, the output power of 1.57 μm signal laser and 3.3 μm idler laser from this PPMgLN DROPO cavity is 79 mW and 38.5 mW respectively, finally a total optical-to-optical efficiency of 23.8% is achieved. The spectral linewidth of the 1.57 μm signal laser pulse, detected by the optical heterodyne method, is less than 52 MHz (see Figure 2), which is significant narrower than that of 79 GHz without seeder injected, and the frequency stability of 1.57 μm signal laser is less than 141 MHz over 10 minutes. The spectrum profile of the idler laser detected by a spectrograph (Omni-λ500, Zolix) with detect limit of 1 nm is also illustrated in Figure 3, we find that the linewidth of the idler laser is less than 1 nm. The tunable spectrum range of this seeder injected DROPO is approximately 7 nm.

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