

wavelengths were used in the phase-matching diagram in Fig. 5. The idler corresponding to the signal shown in Fig. 7 tunes between 6.27 μm and 8.12 μm . The average spectral width of the RISTRA OPO is about 750 GHz, a parameter which is not critical for the applications in laser-tissue interactions.

4. Summary and conclusion

We employed a commercially available diode-pumped Q-switched single-frequency Nd:YAG MOPA as a high-stability and high-energy pump source for a cascaded parametric scheme to obtain tunable radiation between 6.27 μm and 8.12 μm aimed at applications of minimally invasive surgery. The system operates at 100 Hz and produces 193 kW of peak power in 5 ns pulses at the wavelength of 6.45 μm where amide-II protein vibrational absorption bands overlap with the absorption band of liquid water. The cascaded system exploits large aperture PPRKTP crystals for parametric MOPA at degeneracy, VBG locking for spectral bandwidth narrowing at 2 μm and a ZGP OPO in nonplanar RISTRA configuration for high-spatial quality output beams generation in mid-infrared. The efficiency of the ZGP OPO is to large extent limited by relatively long RISTRA cavity and short pulse duration at 2 μm . Therefore, the rather low pulse energies used in a two crystal MOPA scheme could allow for higher efficiencies at a comparable beam quality, however under the expense of the need for two ZGP crystals and a more complex alignment than in case of a single RISTRA. Nevertheless, the generated energies are about four-times higher than the reported tissue ablation thresholds at 6.45 μm .

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