Abstract

In this work generation of the tunable coherent mid infrared radiation in the wavelength range between 2 and 4 μm has been discussed.

Fabrication of the compact and highly efficient optical parametric generators and oscillators based on low loss titanium indiffused waveguides in periodically poled lithium niobate was described.

For the first time bent waveguides, which can have twice the length of straight ones, have also been investigated for the MIR spectral range. Transmission losses in dependence from the waveguide curvature have been measured.

2D mode distribution in the MIR waveguide at λ = 3394 nm for the first time has been directly measured by using correspondent MIR camera.

Initial point for the investigation of nonlinear devices for the MIR spectral range was Optical Parametric Generator, where the pump photon of high energy decays into two photons (namely signal and idler) of lower energy under conditions of conservation of energy and momentum.

Optical Parametric Fluorescence (OPF) in the range of nine orders of magnitudes starting at nW and approaching 1 W of peak power level just for one throughput of the pump in the straight waveguides was reported. OPF in the bent MIR waveguide has been characterized.

Optical Parametric Oscillators allow to generate power, which is orders of magnitude larger, than OPGs. External and for the first time deposited mirrors for the MIR range have been investigated and quantitatively compared.

For the first time synchronously pumped integrated OPO for the MIR spectral range has been investigated.

The measured autocorrelation functions of the generated MIR radiation has shown, that in case, when the repetition rate of the MLL is adjusted to the signal round trip time, several idler pulses will be generated and travel simultaneously according to the dispersion properties of the material. Experimental results here are in a good agreement with the modelling.