Generating mid-IR octave-spanning supercontinua and few-cycle pulses with solitons in phase-mismatched quadratic nonlinear crystals - DTU Orbit (09/11/2017)

Generating mid-IR octave-spanning supercontinua and few-cycle pulses with solitons in phase-mismatched quadratic nonlinear crystals

We discuss a novel method for generating octave-spanning supercontinua and few-cycle pulses in the important mid-IR wavelength range. The technique relies on strongly phase-mismatched cascaded second-harmonic generation (SHG) in mid-IR nonlinear frequency conversion crystals. Importantly we here investigate the so-called noncritical SHG case, where no phase matching can be achieved but as a compensation the largest quadratic nonlinearities are exploited. A self-defocusing temporal soliton can be excited if the cascading nonlinearity is larger than the competing material self-focusing nonlinearity, and we define a suitable figure of merit to screen a wide range of mid-IR dielectric and semiconductor materials with large effective second-order nonlinearities deff. The best candidates have simultaneously a large bandgap and a large deff. We show selected realistic numerical examples using one of the promising crystals: in one case soliton pulse compression from 50 fs to 15 fs (1.5 cycles) at 3.0 μm is achieved, and at the same time a 3-cycle dispersive wave at 5.0 μm is formed that can be isolated using a long-pass filter. In another example we show that extremely broadband supercontinua can form spanning the near-IR to the end of the mid-IR (nearly 4 octaves).

General information

State: Published
Organisations: Department of Photonics Engineering, Ultrafast Nonlinear Optics group
Authors: Bache, M. (Intern), Guo, H. (Intern), Zhou, B. (Intern)
Pages: 1647-1657
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information

Journal: Optical Materials Express
Volume: 3
Issue number: 10
ISSN (Print): 2159-3930
Ratings:
Web of Science (2017): Indexed yes
Scopus rating (2016): SJR 1.082 SNIP 1.287 CiteScore 2.74
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 1.406 SNIP 1.411 CiteScore 3.07
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.546 SNIP 1.653 CiteScore 3.17
Scopus rating (2013): SJR 1.761 SNIP 2.378 CiteScore 3.42
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 1.625 SNIP 1.831 CiteScore 2.58
Web of Science (2012): Indexed yes
Web of Science (2011): Indexed yes
Original language: English
Electronic versions:
ome_3_10_1647.pdf
DOIs:
10.1364/OME.3.001647

Bibliographical note

Source: dtu
Source-ID: n::oai:DTIC-ART:swets/392145726::32380
Publication: Research - peer-review › Journal article – Annual report year: 2013