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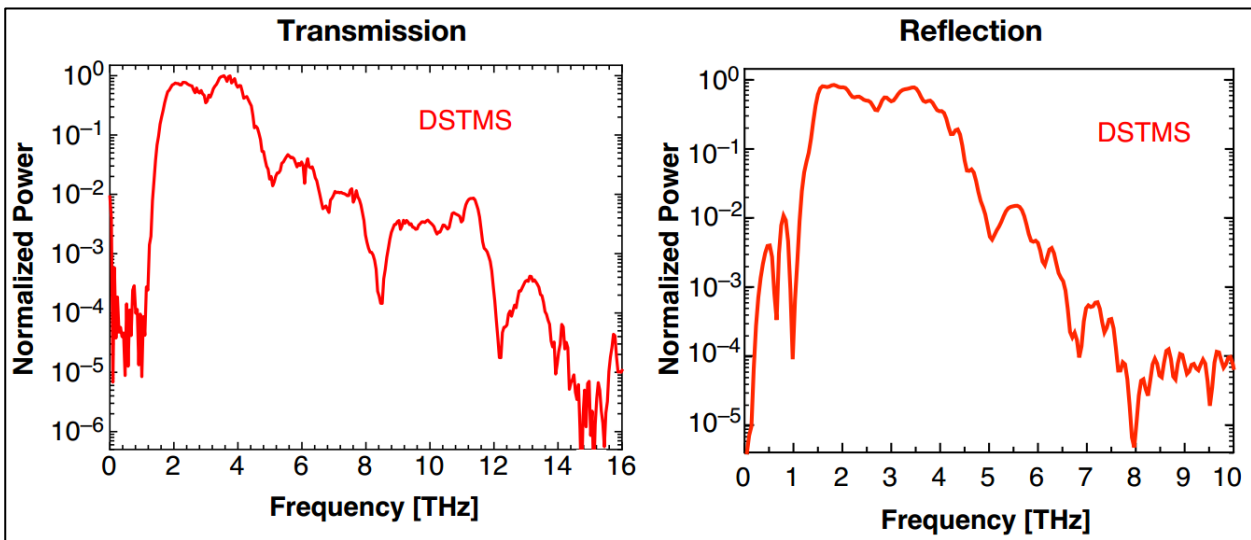
STRP-TeraSys - AiO

The **STRP-TeraSys- AiO** provides a flexible solution for laboratory THz spectroscopy and imaging. It offers maximum flexibility with measurement capabilities in transmission and reflection without realignment of the optics. It is based on organic crystals, to allow access to terahertz frequencies not available with conventional antennas. The **STRP-TeraSys- AiO** includes all optical, mechanical and electronic components for the generation and detection of THz waves such as delay line, terahertz generator, terahertz detector, pump source optics, electronics, humidity sensor, purge chamber, dedicated software, and laptop.



STRP-TeraSys - AiO (55 cm x 45 cm x 28 cm)

Specifications



STRP-TeraSys - AiO	Transmission	Reflection
Spectral range	0.3 - 14 THz	0.3 - 8 THz
Dynamic range	> 70 dB	> 40 dB
Signal to Noise (@4 THz)	> 60 dB	> 35 dB
Scan range	up to 60 ps	up to 60 ps
Frequency resolution	< 100 GHz	< 100 GHz
Dimensions (including the pump source)	55 cm x 45 cm x 28 cm	
Pump Source (high power ultrafast Erbium fiber laser)		
Pulse length	< 20 fs	
Total average power	> 200 mW	
Peak power	>120 kW	
Central wavelength	1565 nm	
Repetition rate	80 MHz	

Options

THz imaging with a scanning range of 50 x 50 mm² for transmission for reflection operation. Frequency domain spectrum measured with the **STRP-TeraSys - AiO** using DSTMS as terahertz generator/detector in transmission and reflection.

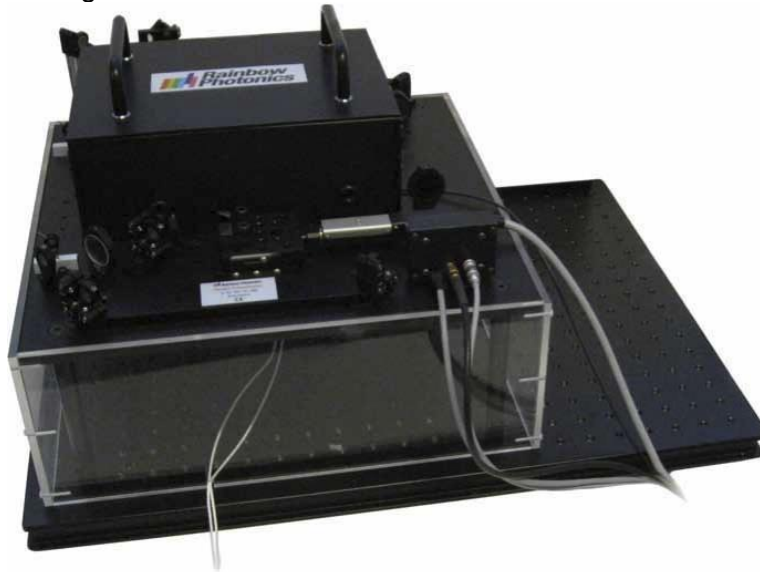
Applications

Spectroscopy and analysis of materials in the THz range up to 20 THz.

STRP-TeraIMAGE

The flexible solution for THz spectroscopy and imaging

The **STRP-TeraIMAGE** offers a flexible solution for laboratory THz spectroscopy and imaging. It is based on organic crystals, to allow access to THz frequencies not yet available with conventional antennas. The **STRP-TeraIMAGE** includes all optical, mechanical and electronic components for the generation and detection of THz waves such as delay line, THz generator, detector, optics, electronics, dedicated software and laptop. It also features a scanning mechanism for the measurement of phase and full-spectrum images. As the **STRP-TeraKit**, it can also be used with various telecom wavelength lasers.



STRP-TeraIMAGE optical board (Scanning range: 50x50 mm²)

Specifications

THz generator / detector	Organic crystal
Spectral range	1-14 THz
Best phase matchable wavelength	1300-1600 nm

Options

Scanning range of 100x100 mm²

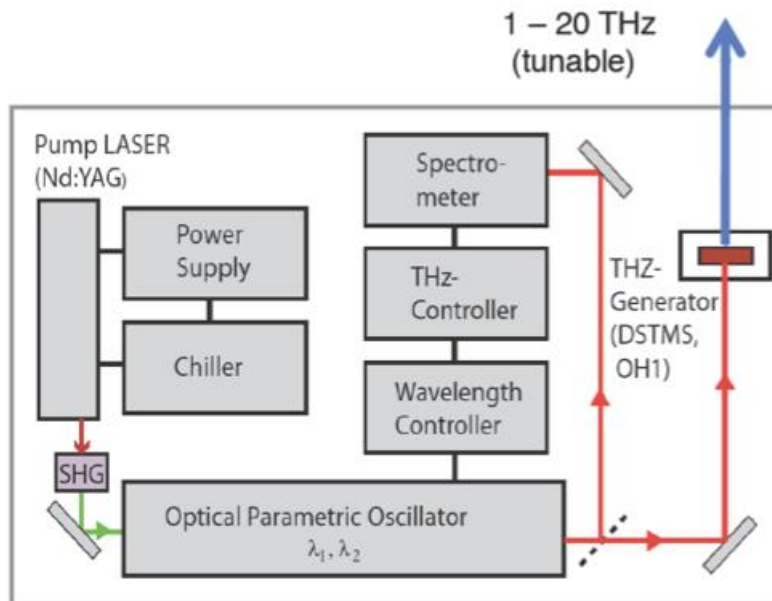
Applications

Spectroscopy and imaging of various materials. Ideal for identification and detection of dangerous substances and biomedical materials, as well as for materials testing of plastic, special polymers and semiconductors. The scan area is 5 x 5 cm². We also offer systems that allow imaging of larger areas.

STRP-TeraTune

The **STRP-TeraTune** provides a tunable narrowband terahertz source with a tuning range from 1.5 to 20 THz and a bandwidth of less than 100 GHz. The basic **STRP-TeraTune** is based on a flash lamp pumped laser (repetition rate 50 Hz to 200 Hz) with a special optical parametric oscillator (OPO) where one wavelength is tuned electronically with a special design to keep the bandwidth below 100 GHz. Other diode pumped laser systems can be offered. The variable wavelength is calibrated and the THz difference frequency is computer controlled (tuning range 1 to 20 THz). Terahertz radiation is generated via frequency mixing in the novel organic nonlinear optical crystal **STRP-DSTMS**, ideally suited to achieve highest terahertz conversion efficiency.

The **STRP-TeraTune** includes all optical, mechanical, electronic components for the generation of THz waves and software control.

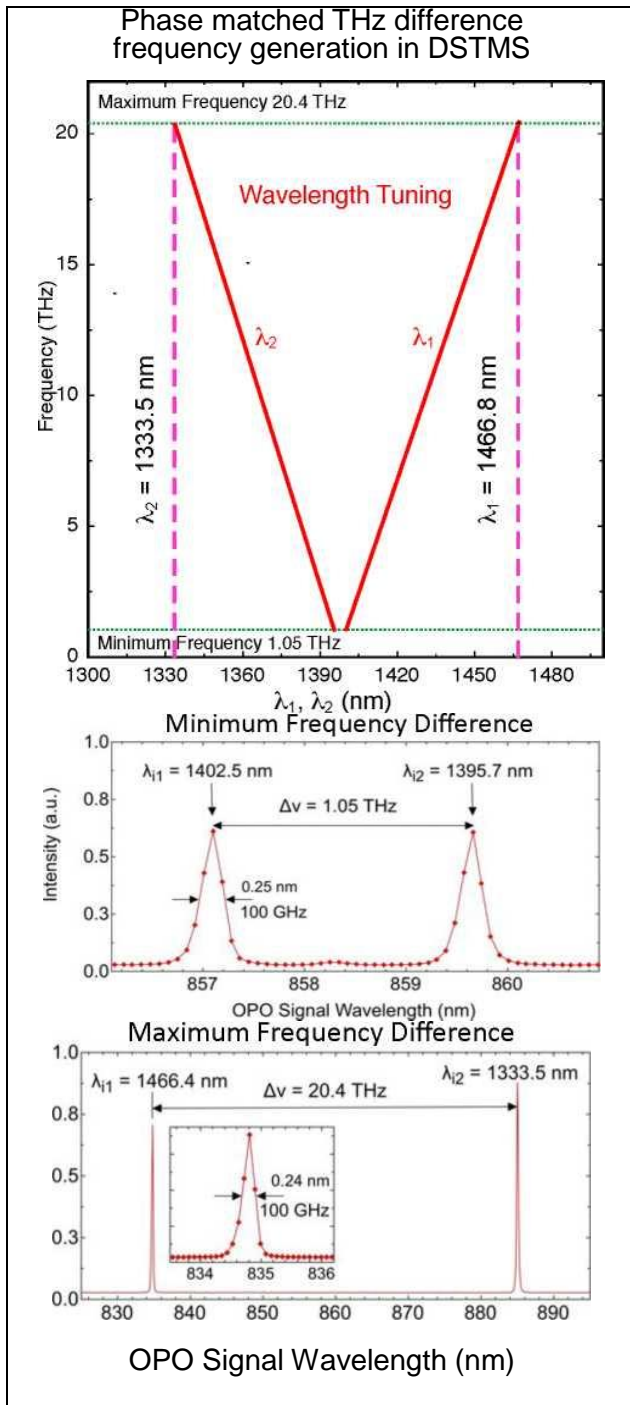


STRP-TeraTune (pump laser, OPO: optical parametric oscillator and THz difference frequency generator, dimensions: 900 x 500 x 180 mm), laser power supply (300 x 450 x 450 mm)

Specifications

- THz frequency tunable 1–20 THz
- Output THz pulse bandwidth < 100 GHz
- Average THz power 1–10 μ W

- THz pulse energy 10–100 nJ
- Linear polarization



Tunable frequency

Output frequency	1 - 20 THz
Pulse bandwidth	< 100 GHz
Repetition rate	100 Hz
Average power	1-10 pW
Pulse energy	10-100 nJ
Polarization	linear

OPO: Optical Parametric Oscillator

Tuning range	1330-1480 nm
Linewidth	< 100 GHz
Repetition rate	100 Hz
Pulse duration	7- 10 ns
Energy per pulse	> 10 mJ
Peak Power	> 1.4 MW

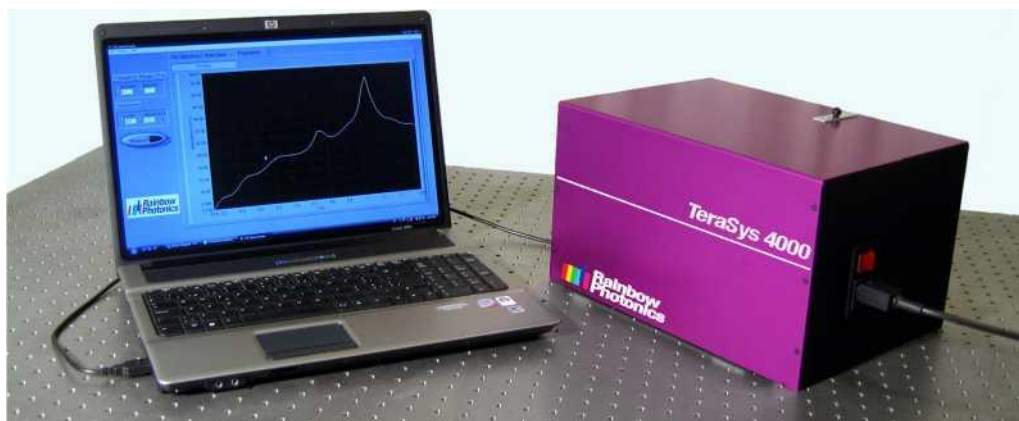
Nd:YAG Pump laser 100-Hz

Pulse width	10 ns
Pulse energy	> 125 mJ @ 532nm
Divergence	0.5 mrad
Beam quality	$M^2 < 2$
Energy stability	< 1%
Beam diameter	5 mm
Linewidth	90 MHz
Power consumption	< 2.5 kW

STRP-TeraSys 4000

THz System for THz Spectroscopy, Detection and Inspection of Materials

STRP-TeraSys 4000 is a Terahertz spectrometer that operates in the frequency range of 0.3 - 4 THz and has a spectral resolution < 0.01 THz. This turn-key operation system is all solid state, compact and maintenance free. It includes a software package and database for the detection and identification of dangerous materials. It is ideal for applications in spectroscopy, production technology and security.



Specification ⁽¹⁾

Frequency range	0.3 - 4 THz
Output power	> 50 nW
Spectral resolution	< 0.01 THz
Polarisation, linear	$> 100: 1$, vertical
Input voltage	110V/ 240V, 50 or 60 Hz
Power consumption	< 60 W
Warm-up time	15 min.
Operating ambient temperature	18°C - 30°C
Dimensions	40x25x18 cm ³

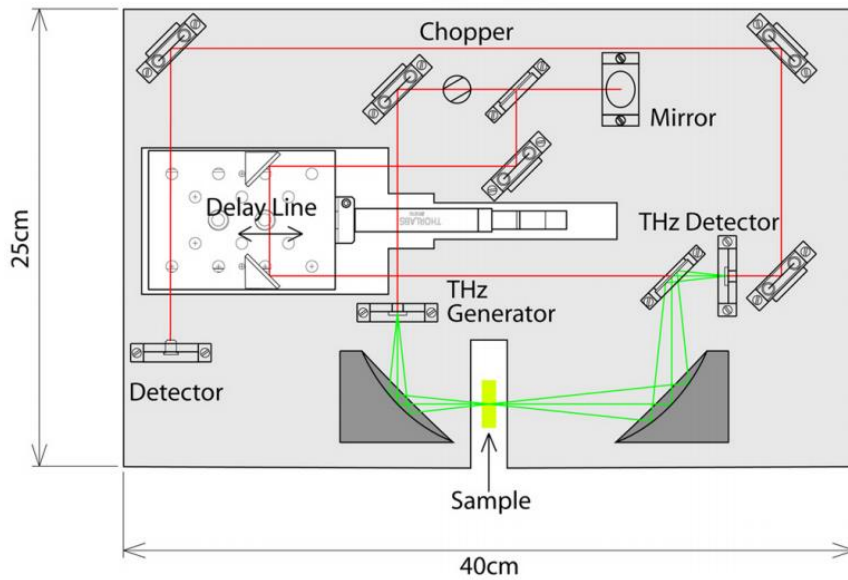
Applications

- Security
 - Explosives detection
 - Bio agents
 - Mail inspection
- Materials inspection
 - Defects in plastics, artificial joints
 - Organic materials
- Spectrography
- Identification of pharmaceuticals, drugs etc.

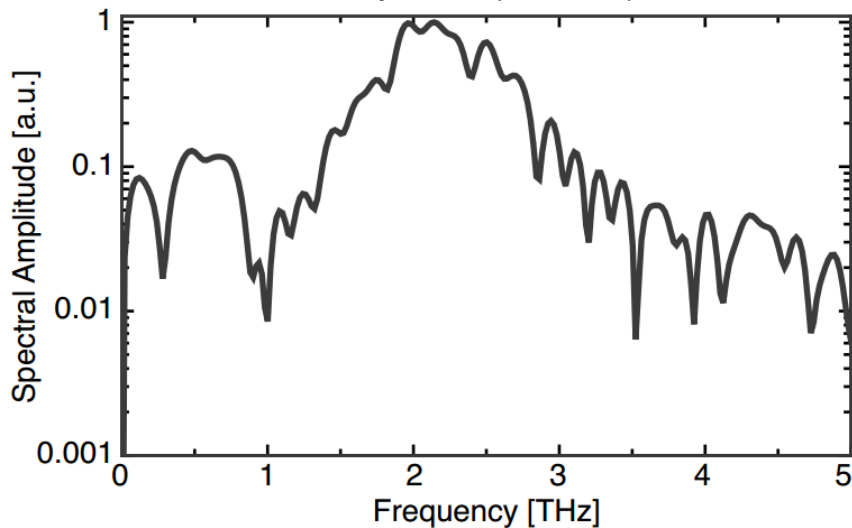
Features

- Turn key operation

- All solid state
 - Maintenance free
 - Software package and database for the identification of dangerous materials
- ¹ Specifications are subject to change without notice



STRP-TeraSys 4000 optical set-up



STRP-TeraSys 4000 frequency response.
Other frequency responses are available upon request

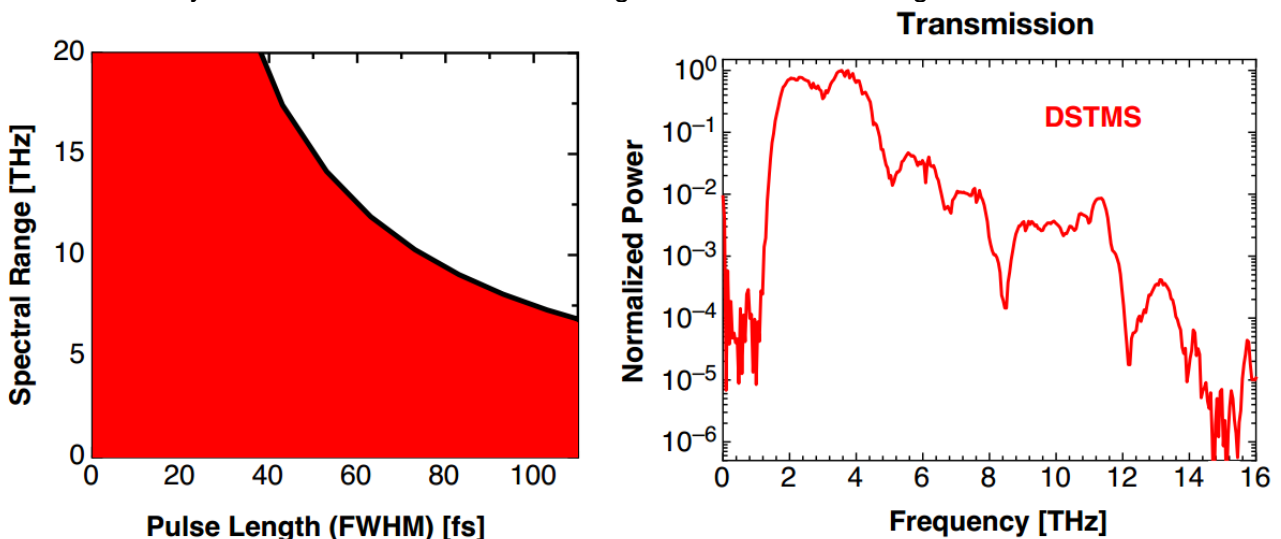
STRP-TeraKit

The **STRP-TeraKit** provides a flexible solution for laboratory terahertz spectroscopy. It is based on organic crystals, to allow access to terahertz frequencies by optical down conversion yielding THz frequencies and efficiencies not available with conventional antennas. The **STRP-TeraKit** includes all optical, mechanical, and electronic components for the generation and detection of THz waves such as delay line, terahertz generator, terahertz detector, optics, electronics, lock-in, custom made Er based femtosecond fiber laser, dedicated software and laptop.



STRP-TeraKit optical board (38 cm x 38 cm)

Terahertz spectral bandwidth as a function of the pump pulse length and frequency domain spectrum measured in dry air with the **STRP-TeraKit** using DSTMS as terahertz generator and detector.



Specifications

THz generator / detector	Organic crystal
Spectral range	1-14 THz
Best phase matchable wavelength	1300-1600 nm
Dynamic range	> 60 dB, (@4THz)
Scan range	up to 60 ps

Frequency resolution	< 100 GHz
Dimensions	30 x 38 x 17 cm
<u>Pump source (Er based femtosecond laser)</u>	
Pulse length	< 20 fs
Total average power	> 200 mW
Peak power	> 120 kW
Central wavelength	1565 nm
Repetition rate	> 80 MHz

Options

THz imaging with a scanning range of 50x50 mm² or 100x100mm²

Applications

Spectroscopy and analysis of materials in the THz range up to 20 THz (depending on the pump laser).

Other spectral ranges are available upon request.

Terahertz Generators and Detectors:

STRP-OH1 Crystals: (2-(3-(4-Hydroxystyryl)-5, 5-Dimethylcyclohex-2-Enylidene)Malononitrile)

THz generators/detectors are based on various organic crystals: DAST, DSTMS and OH1. They are optimized for operation at Terahertz frequencies from 0.3 - 20 THz. The organic electro-optical crystals (DAST, DSTMS, OH1) have high electro-optic coefficients and show ultra-fast electro-optical response for modulation frequencies up to 200 GHz. These crystals can also be used for electro-optic detection.



Example of an as-grown **STRP-OH1** crystal and organic crystals polished, coated and mounted for optical applications. **STRP-OH1** and other high-quality organic crystals are produced and optically prepared in the facilities of Rainbow Photonics in Switzerland.

Properties

- High quality crystals
- Cut and polished for various applications
- Large nonlinear optical susceptibilities
- Large electro-optic coefficients
- Phase matching for THz-wave generation between 1200 nm and 1460 nm

Features

- High quality crystals
- Cut and polished for various applications
- Large nonlinear optical susceptibilities
- Phase matching for THz generation between 1200 nm and 1460 nm

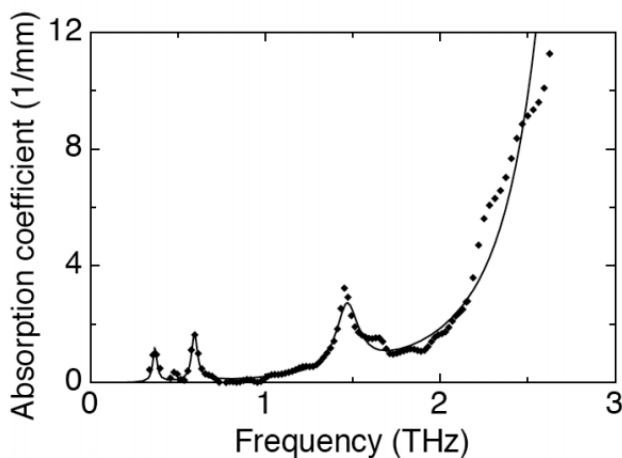
Applications

- Efficient THz generation and detection from 0.1 to >10 THz
- Fast electro-optic modulation
- Optical parametric generation
- Efficient frequency doubling of 1.55 μm radiation

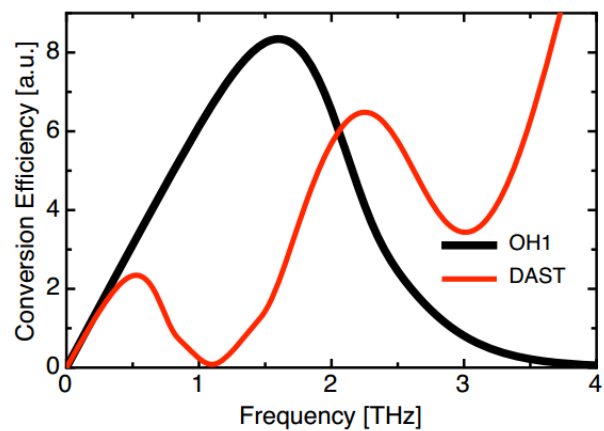
Physical Properties

Melting point	212 °C
Point group symmetry	mm2
Refractive indices	$n_2 = 1.58, n_3 = 2.15$
Nonlinear coefficients ($A=1.9 \text{ } \mu\text{m}$)	$d_{333} = 120 \pm 10 \text{ pm/V}$ $d = 13 \pm 2 \text{ pm/V}$ $d_{322} = 8.5 \pm 2 \text{ pm/V}$
Electro optic coefficients	$r_{333} (633\text{nm}) = 109 \pm 4\text{pm/V}$ $r_{333} (785 \text{ nm}) = 75 \pm 7\text{pm/V}$ $r_{333} (1064\text{nm}) = 56 \pm 2\text{pm/V}$ $r_{333} (1319\text{nm}) = 52 \pm 7\text{pm/V}$

Absorption Spectrum



THz Conversion Efficiency

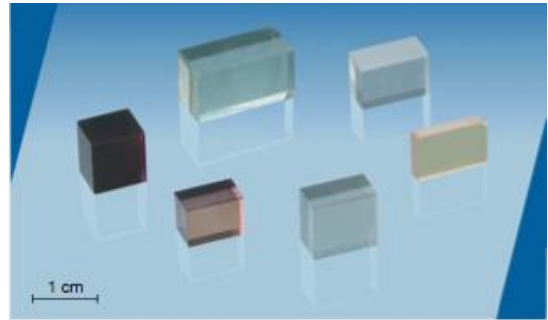


- 1) "Configurationally locked, phenolic polyene organic crystal OH1: linear and nonlinear optical properties"; C. Hunziker, S. Kwon, H. Figi, F. Juvalta, O. Kwon, M. Jazbinsek, P. Gunter, J. Opt. Soc. Am. B 5, 1678 (2008).
- 2) "A hydrogen-bonded organic nonlinear optical crystal for high-efficiency terahertz generation and detection"; F. Brunner, O. Kwon, S. Kwon, M. Jazbinsek, A. Schneider, P. Gunter, Opt. Express 16, 16496 (2008).
- 3) "Organic phenolic configurationally locked polyene single crystals for electro-optic and terahertz wave applications"; O. Kwon, S. Kwon, M. Jazbinsek, F. Brunner, J. Seo, C. Hunziker, A. Schneider, H. Yun, Y. Lee, P. Gunter, Adv. Funct. Mater. 18, 3242 (2008).
- 4) "Scaling submillimeter single-cycle transients toward megavolts per centimeter field strength via optical rectification in the organic crystal OH1"; C. Ruchert, C. Vicario, C.P. Hauri, Opt. Lett. 37, 899 (2012).

STRP-KNbO₃ Crystals

Standard Features

- High quality nominally undoped crystals for electro-optics and nonlinear optics
- High quality crystals doped with Rh, Fe, Mn, and Ni for photorefractive applications in the visible and infrared
- Very low scattering losses



Optional Features

- High photosensitivity up to 1000 nm wavelength
- Milliseconds response time

Applications

- Electro-optics and nonlinear optics
- Photorefractive applications with laser diodes

Dynamic holography and optical phase conjugation in the visible and near infrared

Photorefractive Grating Recording Times

(Selected STRP- KNbO₃ crystals at different wavelengths for $I = 1 \text{ W/cm}^2$)

	Wavelength [nm]	Recording time (typical) [s]
STRP-KNbO ₃ :Fe	488	1
STRP-KNbO ₃ :Mn	515	1
	860	3
STRP-KNbO ₃ :Fe reduced	488	0.01
	515	0.01
STRP-KNbO ₃ :Rh reduced	860	0.5
	1064	50

Absorption Spectra

