INDUSTRIAL MANUFACTURING, MATERIAL AND TRANSPORT Technology Offer

Single shot broad band detection of THz fields

(10 FR 38m7 3G6X)

Abstract

A French laboratory specialized in: Biophysics, Theoretical chemistry, Ions in the gaseous phase, Transfer of electrons in a condensed medium, Experimental and statistical thermodynamics of condensed matter, has developed a detector for THz time domain spectroscopy and imaging.

This French institute is looking for partners for licensing agreements and other partnership such as technological cooperation.

Description

A French physical and chemistry laboratory has developed a detector for THz time domain spectroscopy and imaging.
THz waves, lying in the gap between microwaves and infrared radiation,
penetrate non-conductive media and allow a contactless, non-ionizing analysis for applications as non-destructive testing or security screening.

Amplitude but also phase and time information can be obtained with THz time domain techniques. After passing the material under investigation, the THz electric field is sampled by ultrashort visible pulses via the electro-optic effect. Unlike bolometers, this detection is instantaneous and not influenced by thermal fluctuations.
By Fourier transformation the spectrum is extracted, it covers a broad spectral range according to the short pulse duration. Thickness, composition, density or shape can be determined also for media opaque in the visible or infrared - even when enveloped by paper or plastic.
Conventional THz time-domain spectroscopy uses a mechanical translation
stage to delay the optical relative to the THz pulse. For a positioned delay a
small part of the Picosecond THz signal is recorded by the distinctly shorter optical pulse; repeating such a measurement for ~ 1000 sequential delays allows reconstructing the whole THz waveform. During this serial acquisition the THz
field, the investigated sample and its position should be stable to avoid signal distortion.

The presented technology for the detection of THz fields avoids the delay line
and the repetitive measuring: The whole THz waveform can be recorded for
a single pulse with a sensitivity and bandwidth comparable to state of the art
solutions. This opens the route to applications in industrial surrounding where
stable micro-positioning is often hard to achieve. It enables diagnostics on fast moving or evolving systems (production lines, physical/chemical processing).

The technical characteristics of this technology are follows:
• dynamic range: 200 in a single shot, >1000 over 25 shots
• sensitivity of phase retardation: <0.004 in 1 shot, < 0.001 over 25 shots
corresponding to < 100 V/cm, 25V/cm in 500 µm thick ZnTe
• detection range tuneable within 0.01 to 10 THz with bandwidth up to 3 THz
• repetition rate in the kHz range

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Innovations and advantages of the offer

Advantages:
• single shot acquisition: interaction time equal to time window (picoseconds)
• not sensitive to vibrational/thermal distortions and fluctuations of the THz
• compatible to state of the art ultrashort laser used for THz generation
• applicable on fast evolving/moving systems, in industry surrounding
• compact and stable solution, stand alone realisation possible
• reduced cost and recording time
• bench scale prototype

Current and Potential Domain of Application

• THz time domain spectroscopy and imaging:

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non-destructive, non-ionizing and contactless measurement for
security screening, product or process control in various fields
(thickness measurement, humidity level testing)

• diagnostics for relativistic charged particle bunches and related radiations

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