

THz spectroscopic imaging using optical parametric generator

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Abstract— In this study, the spectral imaging system that we built using injection-seeded THz parametric generation and detection can successfully identify reagents through thicker material than the previously used thin envelopes.

In 2003, we reported the first-ever development of a spectral imaging system using THz-wave parametric oscillator (TPO) [1]. At that time, the TPO had a dynamic range below four orders of magnitude, which enables it to identify reagents only through thin (0.1mm) envelopes using spectral imaging. Recently, we have succeeded in the development of high power and high sensitivity THz wave spectral imaging system using injection-seeded THz parametric generation (is-TPG) and detection [2] as shown in Fig. 1. A dynamic range of 100 dB has been obtained, which is much higher than that of the 2003 TPO. The peak output power of is-TPG approached 50 kW by introducing a microchip YAG laser with shorter pulse width of 420ps. In the detection section of our system, THz-wave was converted back into near infrared beam by nonlinear optical wavelength conversion. We have realized ten orders of dynamic range using commercially available near infrared photo detector. Now we can detect drugs under much thicker obstacles than before using evolved is-TPG spectroscopic imaging system as shown in Fig. 2. Our evolved is-TPG system has potential applications in spectroscopic sensing and imaging of chemicals through obstacles [3] and non-destructive CT imaging of plastic/ceramic products [4]. We have also compared our is-TPG spectrometer and TDS (THz Time Domain Spectroscopy) for the purpose of drug detection through thick envelopes.

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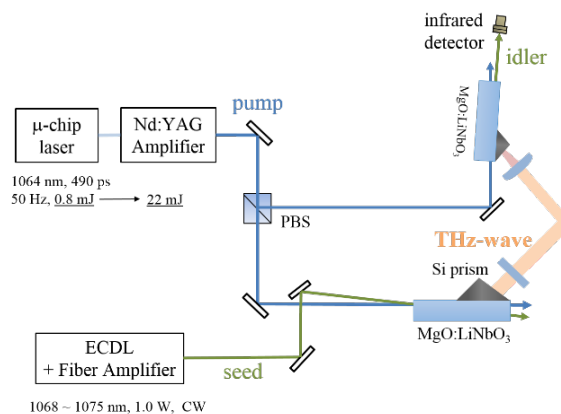


Fig.1. Experimental set up for THz spectrometer using is-TPG

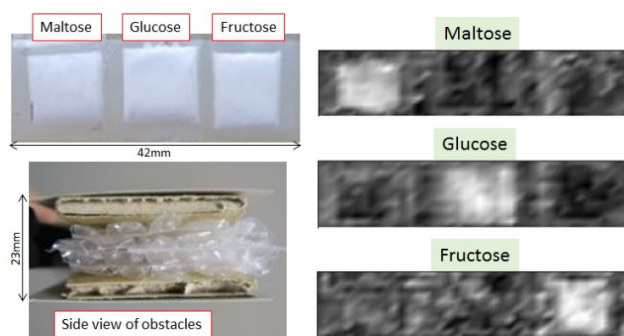


Fig. 1 THz spectroscopic imaging of powder samples in 2 Cardboards + 4 bubble wraps + 2 corrugated boards

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