

## Significance of Terahertz Spectrometry for Detecting Molecular States of Chemicals

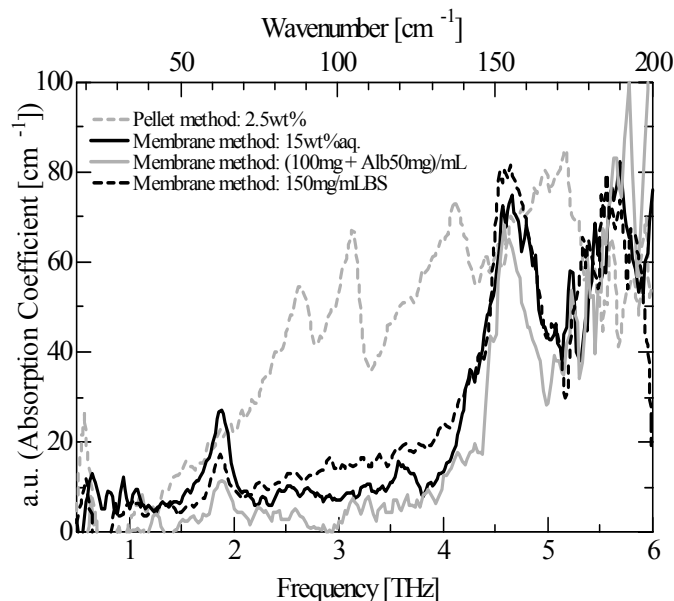
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In 1983, Suto and Nishizawa developed a semiconductor GaP Raman laser and generated a 12 THz wave with a peak power as high as 3W, using a GaP Raman oscillator containing a GaAs mixing crystal. In this experiments, we used Cr:Forsterite lasers for the frequency-tunable and high-power THz wave generation in GaP crystal and pyroelectric deuterium triglycine sulfate as a detector operated at room temperature.

In order to obtain the spectrometric profile of chemicals in aqueous state, we tried to use a membrane filter, such as poly-vinylidene fluoride with 0.22  $\mu\text{m}$ -pore, on which a 1mL solution containing chemical was loaded and dried at 60°C for 12 hours under vacuum and then applied directly for the assay system. The spectrometric profiles of glycine dissolved in deionized water, bovine albumin solution, and serum, respectively, are compared with those of the pellet in solid state mixed with polyethylene powder, as shown in Fig. 1, indicating of partial similarity of the peak profiles among different states of glycine molecule. The utility of the assay system is also shown in the case of L-threonine, L-alanine, L-glutamine and other aminoacids with the concentration dependent profiles.

Furthermore, the spectrometric profiles in the different molecular states of crystal and co-crystal of pharmaceutical drugs were obtained clearly to distinguish them each others. A marked significance to use Terahertz spectroscopy was shown to assay the molecular vibration profiles of chemicals.



**Fig. 1.** Comparison of the Terahertz spectrometric profiles of glycine among different assay systems.

[1] K. Suto, J. Nishizawa, *IEEE J. Quantum Electron.* **QE-17** (1983) 1251-1254.

[2] T. Tanabe, K. Suto, J. Nishizawa, T. Kimura, K. Saito, *J. Appl. Phys.* **93** (2003) 4610-615.

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