

A Terahertz chemical microscopy ~ Application for Terahertz pathology ~

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Pathology generally refers to the study of diseases through biological investigations and medical practices. In modern medical diagnosis, pathology has become a key tool for precise identification of diseases. In particular, cancer diagnosis often relies on hospital pathologists, who prepare test specimens and examine them visually under an optical microscope. Consequently, diagnostic accuracy sometimes depends on the skills and experience of individual pathologists. Recently, “liquid biopsy” has attracted growing attention among clinicians. Unlike conventional approaches, liquid biopsy enables tumor analysis directly from solution samples, eliminating the need for extensive specimen preparation.

In our group, we have developed a terahertz chemical microscope (TCM) capable of measuring various chemical reactions in microliter-scale liquid volumes. This is achieved by employing an electric potential–terahertz transducer fabricated from a semiconductor film on a sapphire substrate. The TCM can selectively detect different types of molecules by incorporating specific chemical reaction systems on the transducer surface. We have demonstrated the detection of sodium and potassium ions, as well as histamine, using this technique [1–3]. Moreover, we have shown that even small populations of cancer cells in solution can be identified by terahertz chemical microscopy when combined with specific aptamers or antibodies [4, 5].

In this presentation, we will demonstrate the detection of cancer cells using terahertz chemical microscopy and introduce the concept of “terahertz pathology.”



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