P3.37: CW Terahertz Imaging of Paraffin-embedded Epithelia Cell of Rat

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Abstract: *CW Terahertz imaging system is being constructed to investigate the response of cell to the terahertz wave. This system consists of a 0.2THz radiation source and some off-axis-parabolic mirrors(OAPs) with 2 dimensional(2D) translation stage. Detection is achieved with a pyroelectric sensor operated at room temperature. Biological terahertz imaging of a rat's paraffin-embedded epithelial cell with tumor is presented.*

Keywords: Terahertz; imaging; CW; paraffin-embedded; BWO; tumor

Introduction

The pioneering Terahertz(THz) imaging in the frequency range between 0.1 and 2.0 THz by Hu [1] have generated tremendous interest in the fields of THz sensing and imaging. Especially in medical imaging, terahertz imaging is expected to be a powerful technique because of the effective piercing feasibility, which enables to perform safe and high resolutive imaging(e.g., effective wavelength enough to pierce slight samples and to get clear image, extremely low energy compared to X-ray,).

Most of the initiative works on THz imaging utilized time-domain measurements using a femtosecond laser[2-4]. A big advantage of vast information due to broadband operation provides with a good resolution. However, low intensity limits their THz imaging in practice taking too much time to scan the objects. Recently there also exists THz imaging using CW THz radiation sources such as BWO's and quantum cascade lasers. [5,6] CW THz sources like BWO's can provide much higher output power and frequency stability for a better signal-to-noise ratio. Potentially THz camera can be realizable using CW THz sources with a array detector. Good review on comparison between pulsed and CW THz imaging is published. [7] In this report, we present a CW THz imaging for a epithelial cell of rat.

Imaging Setup

CW THz imaging system is constructed as shown in Fig. 1. This system consists of 0.2 and 0.5THz radiation sources (gunn diode for 0.2THz source and BWO for 0.5THz source) and a pyro-electric detector. Sample is located at the middle of two mirrors for maximally focused transmission. A pyro-electric detector is used to measure transmitted chopped signals. Signal to noise ratio(SNR) for this system is about 10,000:1.

Measurement

Can we distinguish the cancer cell from normal cell? The sample is a paraffin-embedded epithelial cell of rat as shown in Fig. 2. A preliminary measurement using 0.2THz source is shown in Fig. 3. This measurement will provide us with the difference in water contents in cells. The details of experiment will be presented along with measurement using 0.5THz source.

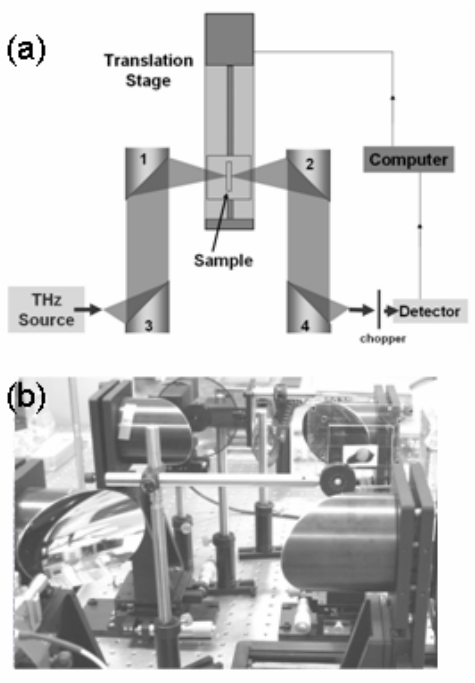

Figure 1: (a) Schematic of CW imaging system (b) picture of CW imaging system

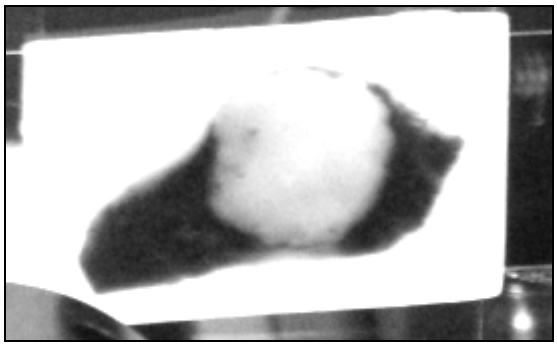

Figure 2: Optical image of paraffin-embedded epithelial cell of rat (2*3.5cm^2, 3mm thickness)

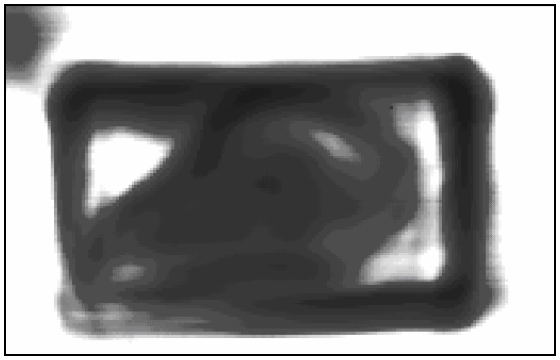

Figure 3: 0.2 THz image of paraffin-embedded epithelial cell of rat (@0.2THz, 3*4 cm^2, 150*200 pixels)

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