

Scanning Laser Terahertz Imaging System

K. Serita, H. Murakami, J. Darmo, I. Kawayama, and M. Tonouchi
Institute of Laser Engineering, Osaka University, Osaka, JAPAN
Email : serita-k@ile.osaka-u.ac.jp

Terahertz (THz) imaging technique has attracted much attention for various applications from biology to security. For practical use of this technique, there are several problems to be overcome, such as imaging speed and spatial resolution. Recently, to overcome these problems, we have developed a scanning laser THz imaging system using a galvano meter and a nonlinear optical crystal as a two dimensional (2D) THz emitter. In this system, 1.56 μm femtosecond laser pulse beam is modulated by using an optical chopper or an acousto-optic modulator (AOM) and scanned over the 2D THz emitter by using the galvano meter. THz pulses that are locally generated at the laser beam irradiation spots transmit through a sample that is set directly on the emitter are detected by a photoconductive antenna. Therefore, we can observe a THz transmission image of the sample by monitoring the amplitude of the THz pulses. Using this system, we could observe THz transmission images of a triangle-shaped copper sheet sample and a human hair sample. The images are composed of 512 x 512 pixels, and the imaging speed is about 47 seconds/image at a modulation frequency of 100 kHz. In the image of a copper sheet sample, we could observe a clearly visible screening of the THz waves. As for a human hair sample, we could observe a clear thin shape of the hair sample, and several strong THz radiation spots were observed as well as weak THz radiation spots inside the identical hair sample. These may indicate that THz waves relate to the inner structures or internal constituent of the human hair. The spatial resolution in this measurement reaches up to 56 μm , although the main frequency is located around 0.4 THz in the broadband spectrum of the generated THz waves. This spatial resolution is achieved probably due to near-field effect. Further details about the system configuration and the experimental results will be presented.