

## Exploit Terajet Generated from Dielectric Cuboid to Enhance Spatial Resolution of THz Imaging System

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**Introduction:** Recently, a terajet, a jet in the terahertz (THz, 0.1 -10 THz) region, generated from a dielectric cuboid has been introduced [1] and attracted many research interests owing to its capability to obtain subwavelength full width at half maximum (FWHM) that is promising for many applications. The terajet was previously visualized and characterized in the THz region by our unique THz-waves visualization system based on electro-optic (EO) detection [2], e.g. the direct observation of the terajet generation and the angular characteristics of the terajet [3]. In this study, the subwavelength-resolution THz imaging based on the terajet is demonstrated by exploiting the cuboid in an THz imaging system.

**Experimental results and discussions:** The cuboid in our experiment was made from Teflon ( $n=1.46$ ) with the dimensions  $2.4 \text{ mm} \times 2.4 \text{ mm} \times 2.4 \text{ mm}$ . THz waves at frequency 125 GHz ( $\lambda = 2.4 \text{ mm}$ ) was generated based on photonics technology and focused to the cuboid by a commercially available parabolic mirror with measured NA of 0.55 (Fig. 1). The EO sensor was used to visualize THz waves distribution of a focused beam with and without the cuboid. Figs. 2(a) and 2(b) show the experimental visualization of the amplitude distribution with the cuboid, and the beam profiles, respectively. The measured area was  $18 \text{ mm} \times 18 \text{ mm}$  and the sampling interval was 0.12 mm. A terajet generated from the cuboid under focused incidence can be clearly observed in Fig. 2(a). The FWHM of beam profiles with and without the cuboid were  $0.5\lambda$  and  $1.2\lambda$ . These results indicate that the generated terajet under focused incidence can enhance the resolution of the imaging system 2 times to the subwavelength region. The nondestructive THz imaging was demonstrated by placing the sample (an IC card) at the distance of about 0.5 mm behind the cuboid where the terajet generated. Fig. 2(c)

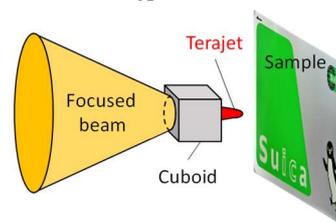


Fig. 1 Experimental configuration

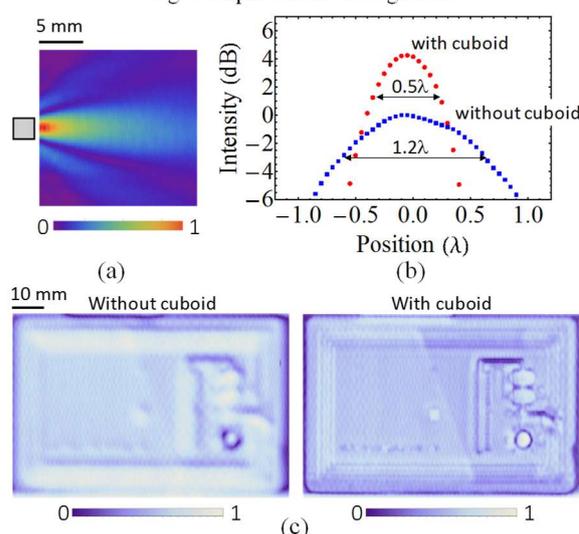


Fig. 2 (a) Visualized result of generated terajet, (b) beam profiles and (c) nondestructive imaging results with and without using cuboid.

shows the amplitude images with and without using the cuboid. Without the cuboid, the obtained image was blur due to the lack of the spatial resolution, while the electronics circuit inside the sample can be resolved clearer with the cuboid. The cuboid can be used as a resolution enhancer by simply placing it in the imaging system.

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