Double Layer SRR Device for Terahertz-wave Imaging System

◦Zhengli Han[1], Seigo Ohno[2], Yu Tokizane[1], Kouji Nawata[1], Mio Koyama[1], Takashi Notake[1], Yuma Takida[1], Shin'ichiro Hayashi[1], Hiroaki Minamide[1] (1. RIKEN, 2. Tohoku Univ.)

E-mail: zhengli.han@riken.jp

Metamaterial with flexible substrate is proposed for the near field terahertz (THz)-wave imaging system. The metamaterial constitutes double layers of split ring resonators (SRRs), which are embedded in the polymer substrate. The SRRs works as an array of probe that reserves the object near field information and transfer it to the detection system based on the frequency up-conversion with nonlinear DAST crystal. This abstract reports the progress of the research work.

THz wave near field image is desired to observe the matter-THz wave interaction and the chemical analysis for the bio applications, etc. While for the traditional THz near field imaging technique [1], single probe is normally used which needs long time scanning to get one image. A system with real time feature while also holds near field image resolution will benefit the research community. In reference [2], we have reported a proposal using metamaterial device as the probe array to improve the THz wave near field image available with real-time performance. The SRRs hold two functions to the imaging system, improving image resolution and up-conversion efficiency of the DAST crystal. The metamaterial device is designed with polymer flexible substrate working at sub-THz band. In this abstract, we report the recent progress on the device manufacture.

Figure 1 shows the SRR design and the optical microscopy photo of the inter-process results of the device. A polymer spacer is designed to accommodate the double layer SRRs. Lift-off with photolithography is planned for the process. We began with a handle wafer and finally the polymer will be released to obtain the flexible device. Figure 1(b) shows the device image before release.

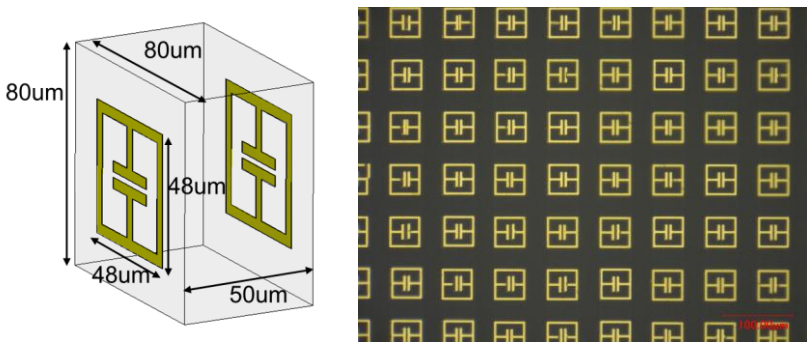

Fig. 1 Metamaterial design (a, left) and the developed device (b, right).

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Reference: [1] H.-T. Chen, et al., Appl. Phys. Lett. 83, 3009 (2003). [2] 1. Z. Han, S. Ohno, Y. Tokizane, K. Nawata, M. Koyama, T. Notake, Y. Takida, S. Hayashi, and H. Minamide, "Metamaterials to improve terahertz-wave real-time imaging system," The 76th JSAP Autumn Meeting 2015, 15p-2E-11, Nagoya Congress Center, Japan (Sep. 15, 2015). [Oral]