

課題番号 : F-16-TU-0010
利用形態 : 装置利用
利用課題名(日本語) : Micron pattern devices for THz image system
Program Title (English) : Micron pattern devices for THz image system
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1. 概要(Summary)

THz wave holds the unique fingerprint characteristics on many molecules, leading to the active researches on the THz spectroscopy and THz image. We propose to use the micron pattern devices (or so called metamaterial) for various THz applications such as remote sensing, nondestructive inspection and so on. We have designed micron pattern devices working on THz frequency range. We use the facility of μ SIC (micro system integration center) at Tohoku University to fabricate the micron devices.

2. 実験(Experimental)

【利用した主な装置】

両面アライナ露光装置一式
ステッパ装置一式
EB 描画装置、
レーザ描画装置、
芝浦スパッタ装置、
電子ビーム蒸着装置、
ダイサ、
Tencor 段差計、
デジタル顕微鏡、
熱電子 SEM.

【実験方法】

We mainly use the photolithography technique to fabricate the micron devices. A polymer substrate is employed to accommodate the micron devices. Wet etching process is applied for the metallic micron patterns. Since the minimum size is around $5 \mu\text{m}$, it needs to take careful attention for the entire device process. We began with a handle wafer and finally the polymer substrate was released to

obtain the film metamaterial device. The process optimization is under developing.

3. 結果と考察(Results and Discussion)

By several try and error tests, we have succeeded to obtain the film metamaterial device with releasing from the handle wafer. The micron array has a process yield close to 100%.

4. その他・特記事項(Others)

Thanks to Prof. H. Ito of RIKEN/Tohoku Univ. and Prof. M. Kumano of Tohoku Univ. for fruitful discussions.

5. 論文・学会発表(Publication/Presentation)

- (1) Zhengli Han, Seigo Ohno, Yu Tokizane, Kouji Nawata, Mio Koyama, Takashi Notake, Yuma Takida, Yoichi Ogata, Shin'ichiro Hayashi, Hiroaki Minamide, "Flexible Metamaterial Device for Terahertz-Wave Imaging System," in Proc. 16th Int. Conf. on Nanotechnology (IEEE NANO 2016), Aug. 22-25, 2016, Sendai, Japan. (oral)
- (2) Zhengli Han, Seigo Ohno, Yu Tokizane, Kouji Nawata, Mio Koyama, Takashi Notake, Yuma Takida, Yoichi Ogata, Shin'ichiro Hayashi, Hiroaki Minamide, "Metamaterial Device for THz Wave Imaging System," The 14th International Conference of Near-Field Optics, Nanophotonics and Related Techniques, Hamamatsu, Japan, Sept. 4-8, 2016. (oral)
- (3) Zhengli Han, Yu Tokizane, Kouji Nawata, Mio Koyama, Takashi Notake, Yuma Takida, Yoichi Ogata, Hiroaki Minamide, "An Ultrathin Terahertz Quarter Wave Plate With High Transmission By Flexible Metamaterial," the 40th International Conference on Infrared, Millimeter, and Terahertz Waves (IR-MMW THz 2016), Copenhagen, Denmark, 25 - 30 Sept. 2016. (poster)
- (4) Zhengli Han, Yu Tokizane, Kouji Nawata, Mio Koyama, Karsaklian Dal Bosco Andreas, Yoichi Ogata, Takashi Notake, Yuma Takida, Hiroaki Minamide, "Polymer Metamaterials for Terahertz Wave Devices", 第 77 回応用物理学会秋季学術講演会、[15p-C301-4]、朱鷺メッセ (2016年9月15日)【口頭】