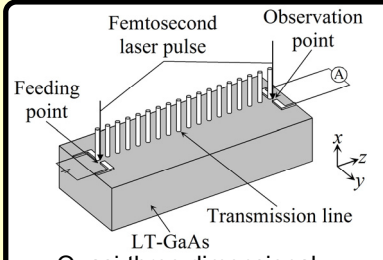
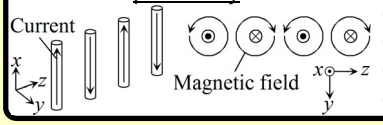
テラヘルツ表面プラズモンポラリトンのための準3次元ポストアレー

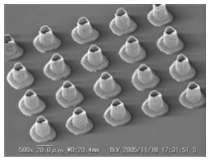
茨城大学 大学院理工学研究科 電気電子工学専攻
14NM612L　古謝 望

1. Introduction and purpose



Quasi-three dimensional post array

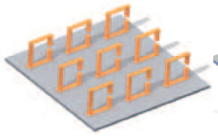




SIJ printing technology can fabricate three dimensional posts.
SIJTechnology, Inc.
(http://www.sijtechnology.com/index.html)

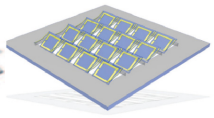
- Analysis and design of a quasi-three dimensional post array for THz spoof surface plasmon-polaritons
- Expansion of transmission line structures by Super-fine Ink Jet (SIJ) printing technology

① Femtosecond laser pulse is focused on a dipole gap.
② Laser pulse generates photocarriers at the dipole gap.
③ Current flows on the first post.
④ The opposite current flows on the adjacent post.



Stand-up SRRs by multilayer electroplating

K. Fan et al., Opt. Express **19**, 12619 (2011)

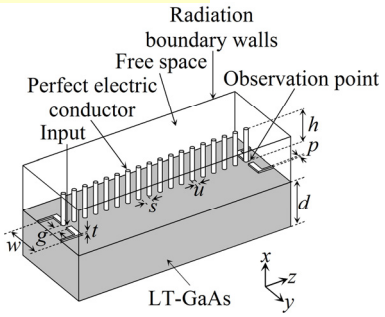


Bent SRRs by surface micromachining technology

H. Tao et al., Phys. Rev. Lett. **103**, 147401 (2009)

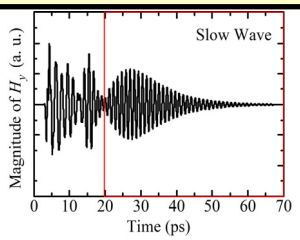
2. Analysis of post array

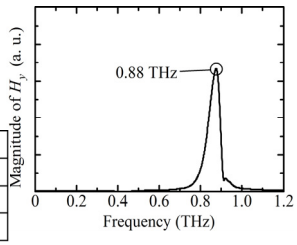
Transient analysis



u	6.0 μm (0.045λ_{eff})	h	100 μm (0.75λ_{eff})
s	20 μm (0.15λ_{eff})	w	120 μm (0.91λ_{eff})
g	10 μm (0.076λ_{eff})	d	400 μm (3.0λ_{eff})
t	0.50 μm (0.0038λ_{eff})	p	3.0 μm (0.023λ_{eff})
ε_r	12.25		

25 posts

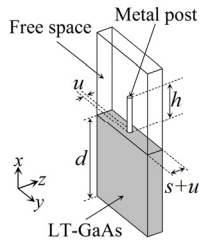


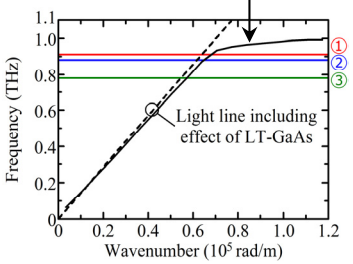


The only slow wave is Fourier transformed.

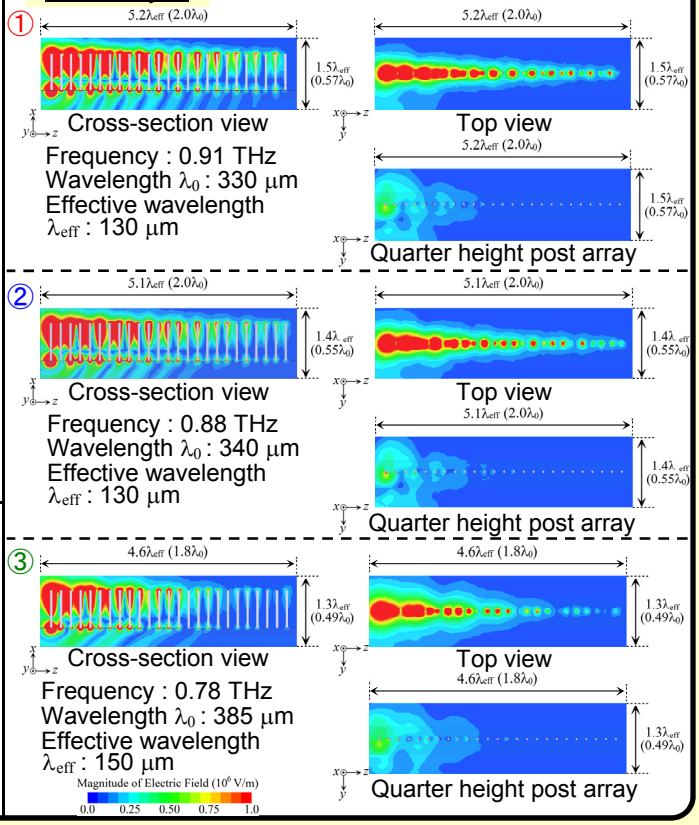
Eigenmode analysis

The electromagnetic wave is confined.

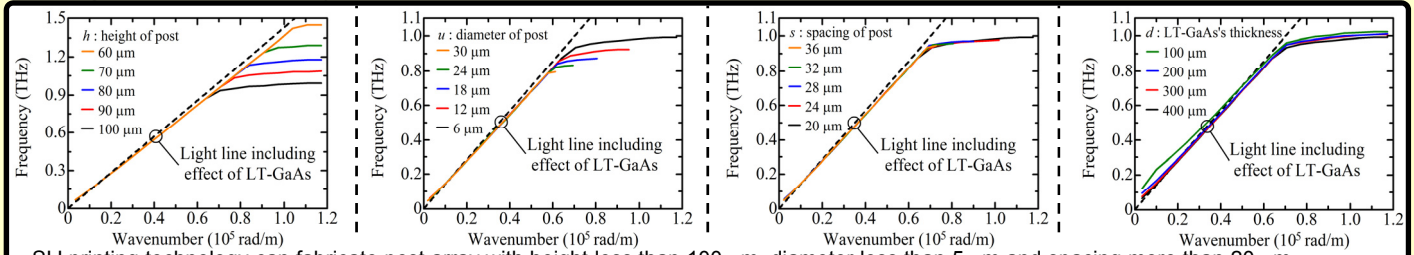




FEM analysis



3. Eigenmode analysis for various parameters



SIJ printing technology can fabricate post array with height less than 100 μm, diameter less than 5 μm and spacing more than 20 μm.

4. Conclusions

The quasi-three dimensional post array is analyzed and designed under the condition of SIJ printing technology.

5. Future works

We are planning to fabricate the post array by SIJ technology and measure the propagation of the THz spoof SPPs.

6. Research achievement

[1] Nozomu Koja, Keisuke Takano, Masanori Hangyo, John C. Young, and Takehito Suzuki,"Quasi-three Dimensional Post Array for Terahertz Magnetic Spoof Surface Plasmon Poraritons," META 2014 5th International Conference on Metamaterials, Photonic Crystals and Plasmonics, Singapore May 20-23, 2014.
[2] 大内 隆嗣, 古謝 望, 谷 正彦, 山本 晃司, 高野 恵介, 萩行 正憲, 鈴木 健仁, "薄フィルム上無給電素子の積層による光伝導アンテナの放射スペクトル制御の検討," 2014年春季 第61回 応用物理学関係連合講演会, 17p-E17-15, 青山学院大学, Mar. 2014.
[3] 古謝 望, 高野 恵介, 萩行 正憲, 八代 真樹, 鈴木 健仁, "テラヘルツ擬似磁気表面プラズモンポラリトン伝搬のための準三次元ポストアレー," 2013年秋季 第74回 応用物理学関係連合講演会, 18p-A14-11, 同志社大学, Sep. 2013.