Optical phase modulation characteristics of subwavelength tilted nano-slit arrays

Yohan Lee[1], Jongwoo Hong[1], Hwi Kim[2] and Byoungho Lee[1]
[1]National Creative Research Center for Active Plasmonics Application Systems
Inter-University Semiconductor Research Center and School of Electrical Engineering
Seoul National University, Gwanak-Gu Gwanakro 1, Seoul 151-744, South Korea
[2]Department of Electronics and Information Engineering, Korea University, 2511 Sejong-ro, Sejong 339-700, South Korea
Tel.:82-2-880-7245, E-mail: byoungho@snu.ac.kr

Very recently, a considerable number of studies have been conducted on ultrathin plasmonic structures, so called metasurfaces[1]. It is reported that metasurface can be used to control the phase of light and there are various examples using this characteristic such as directional couplers for surface plasmon polaritions[2] and ultrathin lenses[3]. Among the different types of metasurfaces, computer-generated holograms (CGHs) have attracted a lot of interest. The reflection type metasurface using nanorod array is reported, which has even 80% efficiency[4]. However, only few attempts have so far been made at researches on transmission type metasurface.

In this paper, we analyze a transmission type metasurface which consists of tilted nanoslit array. Full phase modulation is possible by rotating the angle of slit. However, the amplitude of wave is not constant due to the interaction among adjacent slits. We modify each slit length and width along the slit angle to restrain the change of amplitude values. The schematic of unit cell structure is shown in Fig. 1(a). As shown in Fig 1(b), all the amplitude values are close to 0.3 by controlling the slit parameters. In this case, the range of phase modulation is almost 360 degrees in Fig. 1(c).

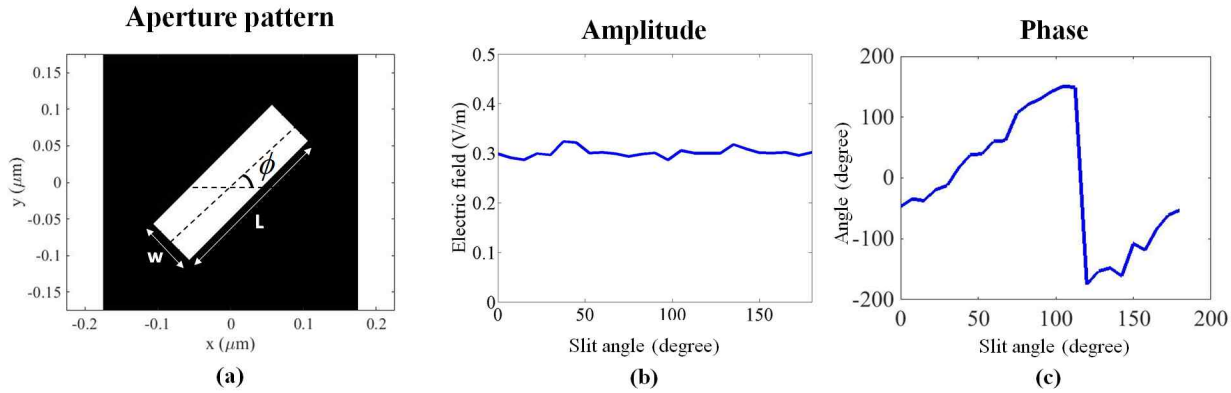

Fig. 1. (a) The schematic of the unit cell. Slit length, width, angle are L, w, ϕ, respectively. (b) Amplitude and (c) phase of the transmitted light along the slit angle.

Acknowledgment

This work was supported by the Center for Advanced Meta-Materials(CAMM) funded by Ministry of Science, ICT and Future Planning as Global Frontier Profect (CAMM-2014M3A6B3063710).

References

1. N. Yu, P. Genevet, M. A. Kats, F. Aieta, J.- P. Tetienne, F. Capasso, and Z. Gaburro, *Science* **334**, 333-337 (2011).
2. J. Lin, J. P. B. Mueller, Q. Wang, G. Yuan, N. Antoniou, X.- C. Yuan, and F. Capasso, *Science* **340**, 331-334 (2013).
3. F. Aieta, P. Genevet, M. A. Kats, N. Yu, R. Blanchard, Z. Gaburro, and F. Capasso, *Nano Lett.* **12**, 4932-4936 (2012).
4. G. Zheng, H. Mühlendbernd, M. Kenney, G. Li, T. Zentgraf, and S. Zhang, *Nature Nanotech.* (2015).