# Plasmonic wavefront detection by the use of transport of intensity equation

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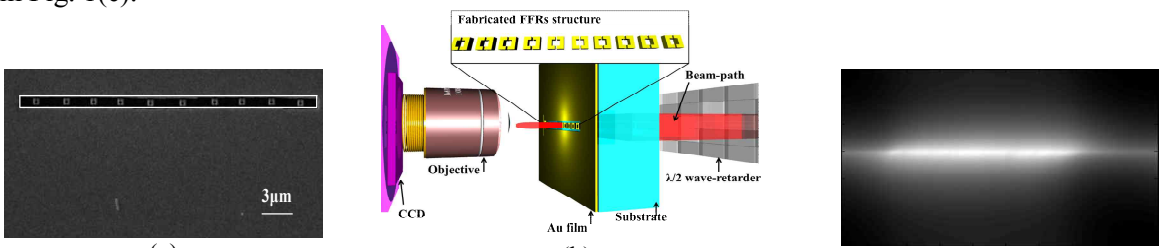
It was previously shown that the intense far-field distribution caused by the plasmonic beaming of light phenomenon can be effectively probed by the digital holographic microscopy (DHM) based on a conventional phase-shifting interferometer [1, 2]. However, when using the DHM with a phase shifting technique, the extracted phase profile can be easily affected by unwanted problems such as phase-shifting errors and mechanical vibration. As a result, it is necessary to adopt another quantitative phase imaging technique which is robust to those unwanted errors. Here, we will adopt transport of intensity equation (TIE) as a quantitative phase imaging technique to detect the wavefront emanating from plasmonic structures in nano-scale regime. An enhanced light field fundamentally caused by surface plasmons can be formed when a light passes through a narrow metal slit structure [3]. Moreover, it has been shown that the distinctive feature of surface plasmons in a nano-slit structure can effectively generate and manipulate plasmonic beaming of light in an optical far-field region [4]. As an example, a faced folded nano-rod (FFR) structure, which is made up of two folded metallic nano-rods placed facing each other in a rectangular metal aperture, can generate enhanced field intensity patterns in an optical far-field region [5]. To make use of this enhanced far-field intensity pattern, it is necessary to adopt an effective technique to probe it. After fabricating the arrayed FFRs strstructure shown in Fig. 1(a), the intensity distribution generated by the plasmonic nano-rod structure is to be detected by the experimental setup shown in Fig. 1(b). Then, we extract phase profile by the use of transport of intensity equation, and the extracted phase profile is shown in Fig. 1(c).




(a) (b) (c)

**Fig. 1. (a) SEM image of the fabricated arrayed-FFRs, (b) experimental setup and (c) Extracted phase profile by the use of TIE.**

**Acknowledgment**

This work was supported by the National Research Foundation of Korea funded by Korean government (MSIP) through the Creative Research Initiatives Program (Active Plasmonics Application Systems)

**References**

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