# **Supporting information**

## Ultranarrow SPR Linewidth in UV Region for Plasmonic Sensing

Jie Zheng, <sup>a</sup> Weimin Yang, <sup>a</sup> Jingyu Wang, <sup>a</sup> Jinfeng Zhu, <sup>b</sup> Lihua Qian, <sup>c</sup> Zhilin Yang\*, <sup>a</sup>

<sup>a</sup> Department of Physics, Collaborative Innovation Center for Optoelectronic Semiconductors and Efficient Devices, Jiujiang Research Institute, Xiamen University, Xiamen, Fujian 361005, P. R. China.
<sup>b</sup> Department of Electronic Science, Xiamen University, Xiamen, Fujian 361005, P. R. China.
<sup>c</sup> School of Physics, Huazhong University of Science and Technology, Wuhan 430074, P.R. China.
E-mail: <u>zlyang@xmu.edu.cn</u>

This document provides supplementary information to "Ultranarrow SPR linewidth in UV region for Plasmonic Sensing". It includes more information about the equipment setup and numerical results. Section 1 provides the brief introduction about the laser interference lithography. Section 2 provides reliable numerical evidence for analyzing the SPR modes of Al plasmonic arrays.

#### 1. Experimental equipment

Briefly, the laser interference lithography (LIL) technology based on two beams interference theory exhibits the advantage of facile, economics and reproduction.<sup>1</sup> This technology generally includes two kinds of work modes: a) utilizing multiple coherent laser beams to produce periodic nanostructures with a holographic optical element (HOE),<sup>2</sup> and b) utilizing two or more reflectors to reflect the light onto the sample.<sup>3,4</sup> The former needs to prefabricate diffraction gratings as a HOE splitting the light into two or more laser beams. The period of nanostructures closely depends on the position of the HOE, and the process appears to be complex. The latter requires a rigorous alignment of optical path due to introducing more reflectors to reflect on the sample. Nevertheless, an improvement method has been proposed that is to place the reflector in the vicinity of the sample for simplifying the spatially designed and the alignment of optical path<sup>5,6</sup> (shown in Fig. 1a). This method enables the fabrication of periodic nanostructures over large scales and the resolution below sub-10 nm.<sup>7</sup> This technology has been widely used to fabricate reproductive and large-scale plasmonic nanostructures. The nanostructures with controllable morphology can be produced by precisely controlling exposure dose, and 1D or 2D periodic nanostructure arrays can be obtained by controlling the numbers of exposure. Mainly, a series of periodic nanostructures can be obtained by altering the incidence angle between two beams (shown in Fig. 1b).



Fig. S1. (a) Schematic of the LIL technology and (b) the correlation between periods and incidence angles for large-scale plasmonic arrays.

#### 2. Numerical results

The geometry of Al plasmonic arrays calculated in this work is labelled in Fig. 2, in which p, d,  $t_1$  and  $t_2$  denote the period (400 nm), diameter (180nm), height (80nm) of Al plasmonic arrays and the thickness (70 nm) of Al film, respectively. This calculation is performed utilizing Lumerical FDTD solution software. The incident plane wave propagates along the negative z-axis direction with polarization along x direction. Periodic boundary conditions are adopted in the x and y directions for the calculation. For ensuring the calculation convergence, 1000 fs of simulation time is set.



Fig. S2. Schematics of Al plasmonic arrays with period p, diameter d, height  $t_1$  and thickness  $t_2$ .

Fig. 3a shows that the reflectance spectrum of 400-nm-period Al plasmonic arrays has two resonant modes within the ultraviolet (UV) region in accord with the experimental result. For clearly identifying the distinct resonant modes, we calculate their electric field intensity distribution. The results demonstrate that the two resonant modes at 408 nm is attributed to dipole mode (Fig. 3c) and the other mode at 283 nm is identified as high-order mode (Fig. 3b). That evidently indicates that the long-range plasmonic arrays can simultaneously excite located surface plasmon (LSP) and SPP.



Fig. S3. The calculated optical properties of Al plasmonic arrays. (a) The reflectance spectrum of 400 nm period. The electromagnetic enhancement distribution in (b) 283 nm and (c) 408 nm.

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