Supplementary Material (ESI) for Chemical Communications
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Supporting Information for:

Tunable SERS from Aluminum Nanohole Arrays in the Ultraviolet Region

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In order to know the SPs modes and UV-SERS properties at the transmitted surface of the aluminum nanohole arrays, electric field intensity enhancement at the transmitted surface and transmission intensity over the spectral range of 200 nm to 500 nm from Al nanohole arrays with p=256 nm, d=150 nm and t=90 nm were calculated by using FDTD method. The main results are shown in Fig. S1 and Fig. S2. Although the SERS enhancement factor at the transmission surface is relative lower than that at the reflection surface (Fig. S1), the SPs modes keeps unchanged (Fig. S2).

It is known that a thin oxide layer of about 2~3nm will form on the aluminum surface upon exposure to atmospheric air. This oxide layer will result in red shifted SPR peaks and a reduction of SERS enhancement of the ordered Al nanohole arrays since the near field exhibits exponential decay normal to the metal surface. The quantitative effects of the oxide layer on the EOT and SERS for Al nanohole arrays were simulated based on FDTD method, and the main results are shown in Fig. S3~Fig. S5.

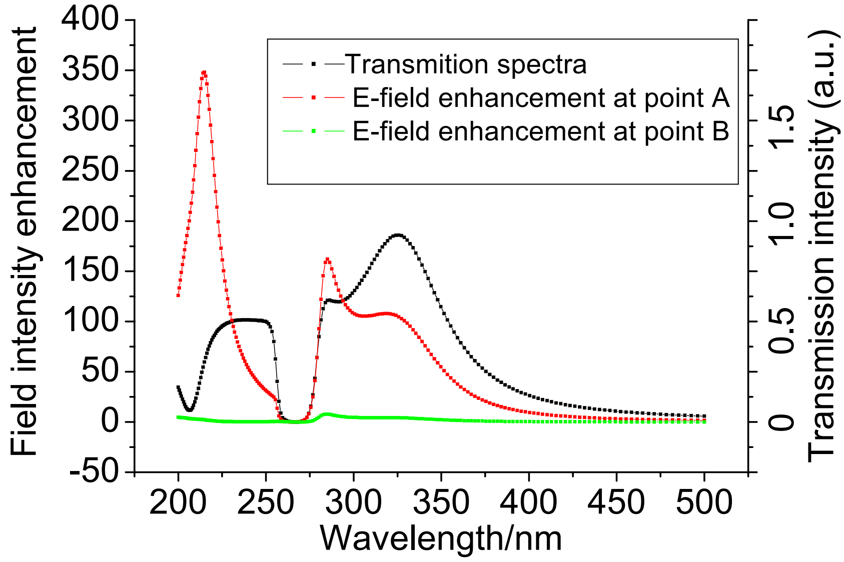


Fig. S1 Calculated electric field intensity enhancement of two points (A,B, marked in figure 1) at the transmitted surface and transmission intensity over the spectral range of 200 nm to 500 nm from nanohole arrays with p=256 nm, d=150 nm and t=90 nm.

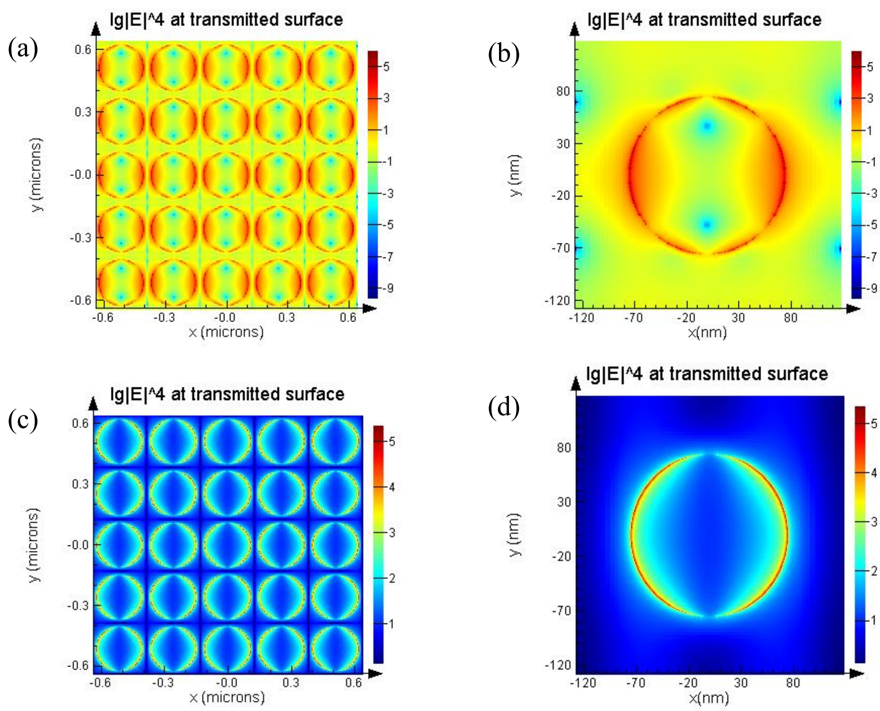


Fig. S2 Calculated SERS electromagnetic enhancement distribution at the transmitted surface of Al nanohole arrays with p=256nm, d=150nm, t=90nm at 211nm excitation (a), (b) and at 282nm excitation (c), (d).

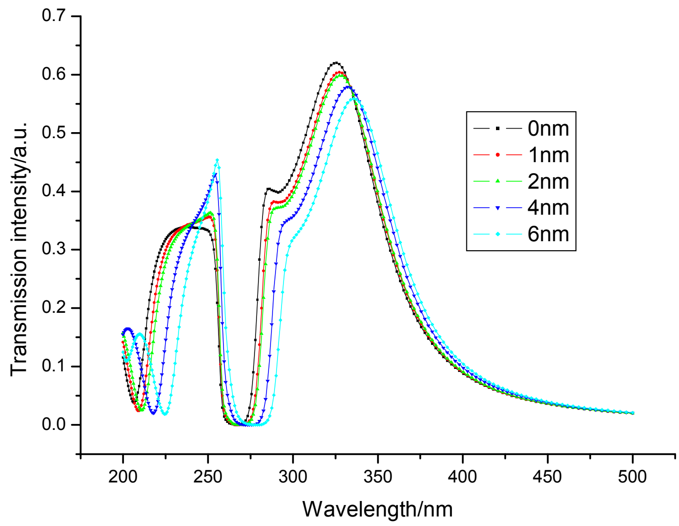


Fig. S3 Calculated transmission spectra for nanohole arrays with a Al_2O_3 layer of different thicknesses with *p*=256 nm, *d*=150 nm, *t*=90 nm. The thicknesses of the oxide layers are listed in the legend. The oxide layer makes all SPR peaks slightly red-shifted.

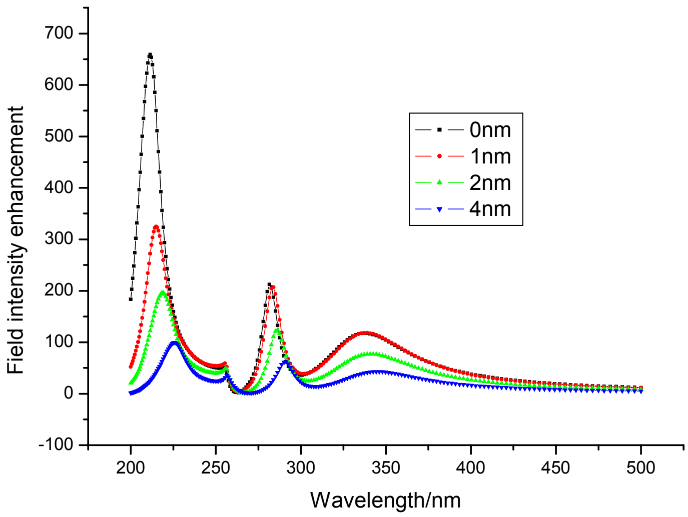
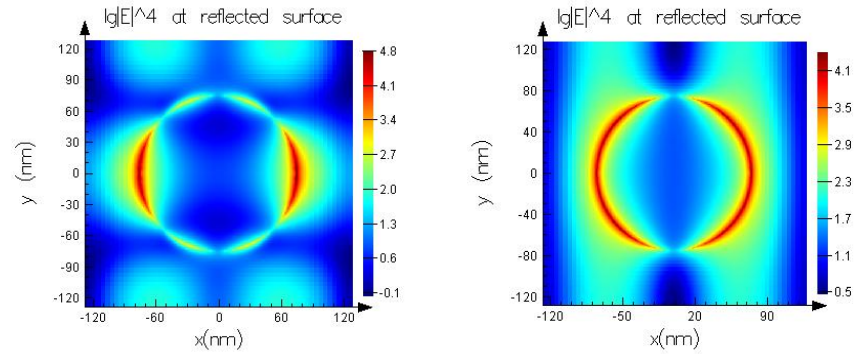


Fig. S4 Calculated electric field intensity enhancement at point A (marked on Fig. 1) at the reflective surface over the spectral range of 200 nm to 500 nm from nanohole arrays with different thicknesses of Al_2O_3 oxide layer. If the thickness of the oxide layers are set to be 0, 1, 2, 4 nm, the maximum SERS enhancement at point A is about 4×10^5,1×10^5, 4×10^4, and 1×10^4 respectively.



(a) (b)

Fig. S5 Calculated SERS enhancement distribution at the reflective surface of Al nanohole arrays covered with 2 nm of Al_2O_3 at 219 nm laser excitation (a) and at 286 nm excitation (b).