Supplementary Material

Ag NPs Decorated Mg-Doped ZnO Nanostructure Heterostructure with Dramatic SERS Activity for Trace Detection Food Contaminants

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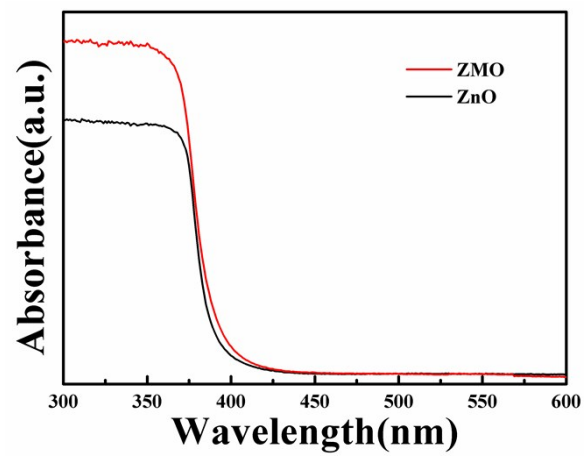
Figure S1

Figure S1. UV–vis reflectance absorption spectra of ZnO and 10%Mg doped ZnO.
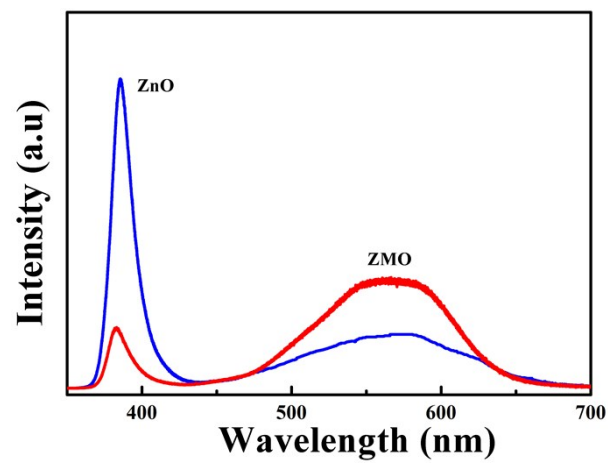
Figure S2

Figure S2. PL spectra of ZnO and 10%Mg doped ZnO.
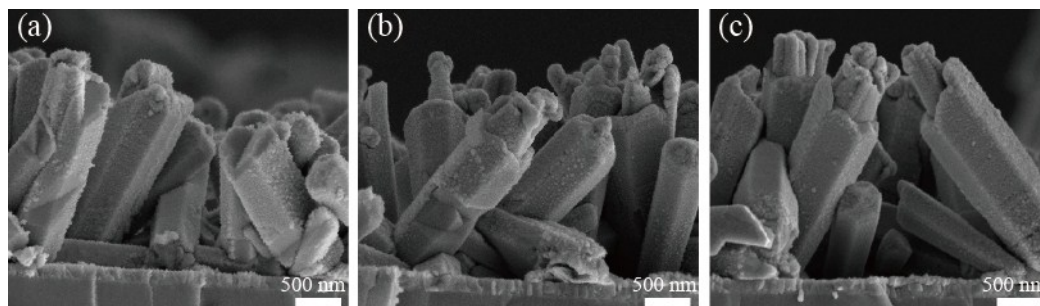
Figure S3

Figure S3. SEM images of ZMOA synthesized at different growth times (a) 6 h; (b) 9 h; and (c) 12 h.
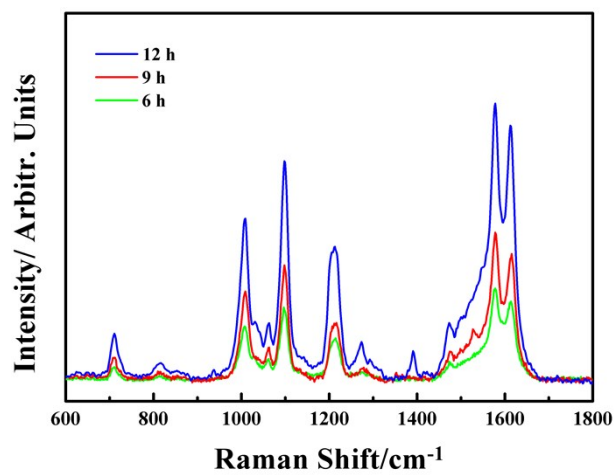
Figure S4

Figure S4. SERS spectrum of 4-MPY adsorbed on ZMOA at different growth times 6, 9, and 12 h.

Estimation of the enhancement factor

The SERS enhancement factor is determined as follows:

$$EF = \frac{I_{SERS}}{I_{Bulk}} \frac{N_{Bulk}}{N_{SERS}} = \frac{I_{SERS}}{I_{Bulk}} \times \frac{S_{laser} \times h \times C \times N_A}{S_{laser} / S_{MPy}}$$

where I_{SERS} and I_{Bulk} represent the intensities of 4-MPY in the surface enhanced Raman spectra and Raman spectra respectively, and N_{SERS} and N_{Bulk} represent the corresponding number of molecules in the surface enhanced Raman spectra and Raman spectra, respectively. S_{laser} is laser spot size of 1 μm. C is the corresponding concentration of 4-MPY used in the Raman spectra of 10.8 M (using the density 1.2 g/cm^3 and molar mass 111.16 g/mol), h is the effective layer depth of 19 μm. N_A is the Avogadro constant. S_{MPY} is the area of each 4-MPY molecule ($\sim 7 \times 10^{-7}$ μm^2). By dividing the laser surface area by the cross-sectional area per molecule. Thus, we can then obtain N_{SERS} is 9.70×10^{10} and N_{Bulk} is 1.12×10^6. The in-plane at 1576 cm^{-1} was chosen for calculation of the enhancement factor because it is intense in both spectra and is isolated from interference with nearby lines. From the observed spectra (text Figure. 5a) we obtain for the ratio of intensities I_{SERS} / I_{Bulk} = 30624/193 =158.6. The resulting EF is estimated to be 1.36×10^7.