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3D Hierarchical Assembled Ag Nanosheetsas SERS Platforms with Hydrophobic Condensation Effect Biomimetic Surfaces for Explosives Sensing

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An efficient hydrophobic condensation strategy was presented to develop3D hierarchical Ag-nanosheet micron/nano-pillar arrays (AMA) surface-enhanced Raman scattering (SERS) spectroscopy sensors for the ultrasensitive detection of diluted water soluble organicmolecules. Highly uniform Si micro-pillar arrays which had the similar modality as cicada wings were prepared by a photolithographic technique and deep-Si etching process and then used as templates for the electrochemical deposition generation of 3D hierarchical AMA with biomimetic superhydrophobicsurface. For the first time, we reported the use of such AMA SERS platform to detect various organic pollutants (R6G, explosives picric acid, NTO, FOX-7) based on this working principle. Through a simple synthetically processing, NTO, and FOX-7 were synthesized as water-soluble salt $K^+(NTO)^-$and $K^+(FOX\text{-}7)^-$. When solution was dropped to the biomimetic superhydrophobic substrate, the greatly diluted solute was concentrated and localized into a very small region of the plane, where plasmonic electric-field hot spots were used to carry out molecule detection. So few molecules could be localized and detected even at femto-(10^{-15}mol/L of aqueous R6G) levels without solution wasting in a short time. Contrastively, R6G was detected only at 10^{-12}mol/L levels in ethanol. The integration of water-soluble synthesis of low-solubility molecules and the hydrophobic condensation strategy dealing with the problems for limited organic solutions of target molecules in difficulty to SERS sensing were achieved.