Microporous Oxide-Based Surface-Enhanced Raman Scattering Film for Quadrillionth Detection of Mercury Ion (II)

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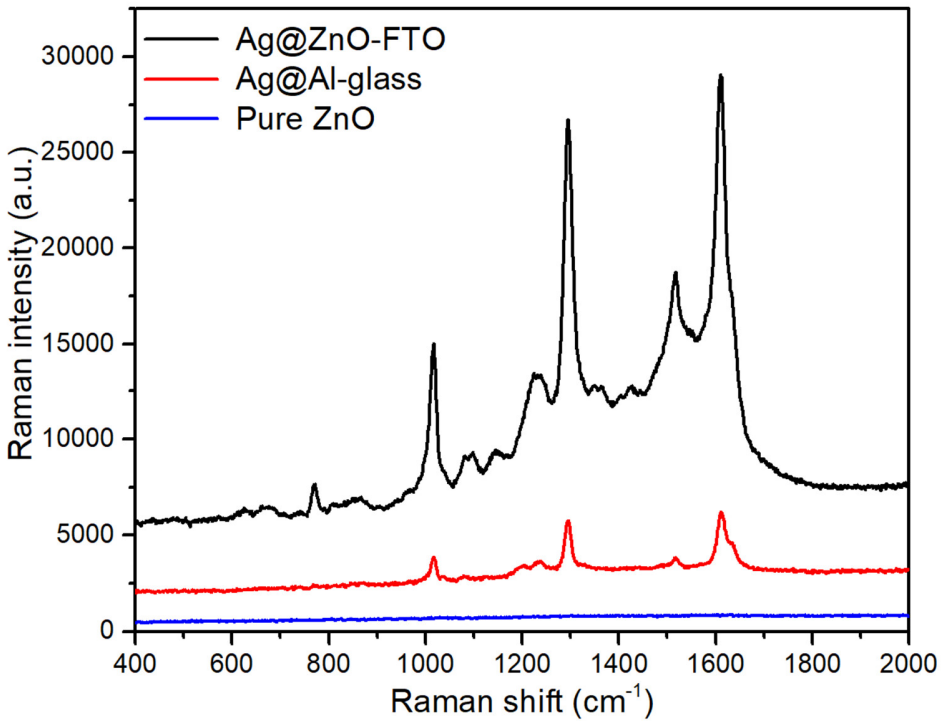

Figure S1. The SERS spectra of 6.4×10^{-4} M of DPy on the chips composed by Ag@ZnO-FTO, Ag@Al-glass and ZnO, respectively.

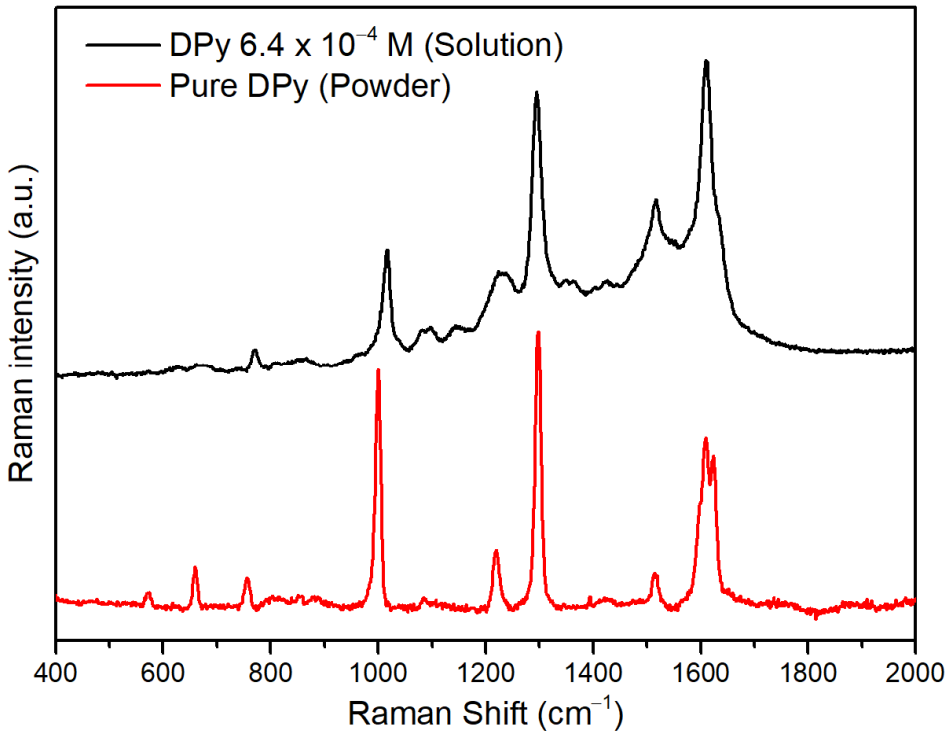

Figure S2. Present the differential of Raman results of Raman peaks between pure DPy powders (normal Raman, without SERS effect) and SERS with DPy concentration at 6.4×10^{-4} M.

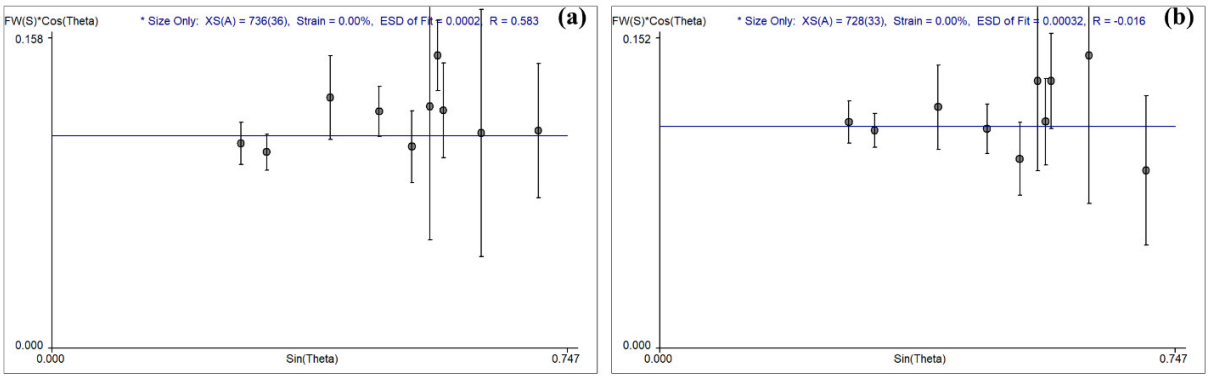

Figure S3. Williamson-Hall plot for ZnO diffraction patterns before (a) and after (b) Ag decorated by electrodecoration.

Table S1. Present the parameter of AC power supply for electrodecoration process.

Period	Time(sec)	Voltage (V)	Frequency (Hz)
Initial	2.00	0	50
Normal 1	0.25	9	50
Trans 1	--	--	--
Abnormal	1.00	0	50
Trans 2	0.75	--	--
Normal 2	3.00	0	50

Table S2. Present structure parameters for SnO_2, ZnO tetrapod nanoparticles and Ag nanoparticles are calculated by Rietveld refinement of the XRD experiment results.

Element		**ZnO**	
Space group		$P6_3mc$ (186)	
Lattice parameters		a (Å)	3.25
		b (Å)	3.25
		c (Å)	5.21
Element parameters	Zn	x	0.33
		y	0.67
		z	20.69
	O	x	0.33
		y	0.67
		z	21.08
Lattice symbol			*hP*
Element			**Ag**
Space group			Fm-3m
Lattice parameters		a (Å)	4.11
		b (Å)	4.11
		c (Å)	4.11
		x	0
		y	0
		z	0
Lattice symbol			*cF*

Table S3. Present the vibration modes of Raman and SERS spectra of DPy.

Wavelength (cm^{-1})		Symbol
Powder	Solution	
570		out-of-plane deformation
660		Ring breathing
757	771	Ring breathing
883		γ(C–H)
999	1020	Ring breathing
1001	1064	ν(C–C), ν(C–N), δ(C–H)
1219	1232	*ν*(C–C), *ν*(C–N), *δ*(C–H)
1298	1299	*ν*(C–C), *ν*(C–N), *δ*(C–H)
1513	1510	*ν*(C–C), *ν*(C–N) coupled to the pyridyl ring C–N stretching, the C–C the opposited stretching vibration and the C–H in-plane bending vibration.
1609	1611	*ν*(C–C)
1623		C–C stretching vibration and the pyridyl ring C–N in-plane bending vibration

ν, stretch; *δ*, in-plane bend; *γ*, out-of-plane bend.