*Electronic Supplementary Information*

# Synthesis of fluorescent tungsten disulfide by nitrogen atom doping and its application for mercury (II) detection

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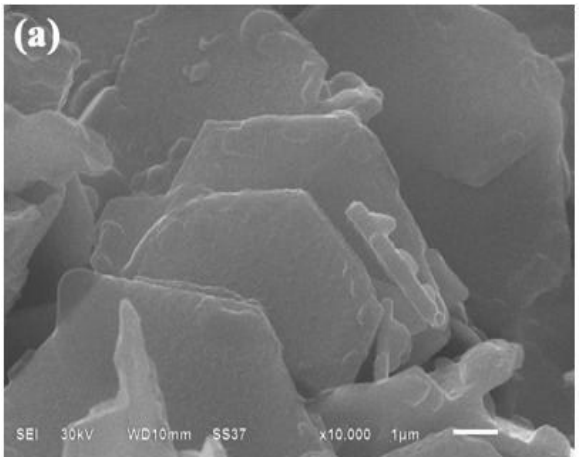


**Fig. S1** SEM image of bulk $WS_2$

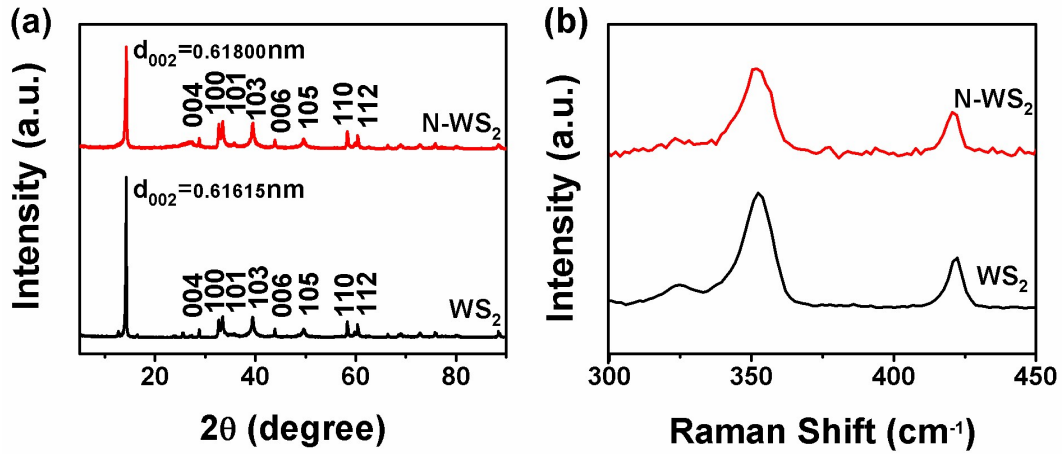


**Fig. S2** (a) XRD spectra of as-made N-$WS_2$ and $WS_2$. (b) Raman spectrum of N-$WS_2$ and $WS_2$

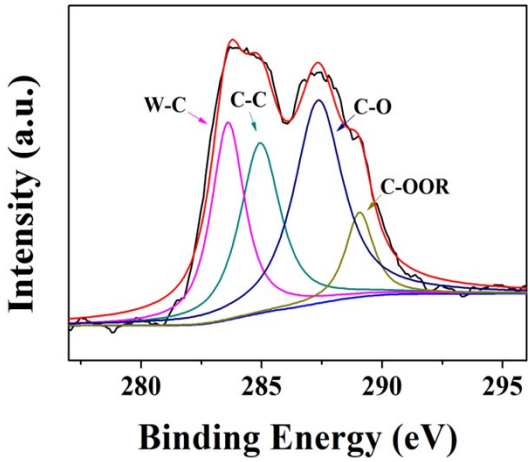


**Fig. S3** High resolution of C 1s orbits of N-$WS_2$. A peak of C is due to the adsorption of carbon compounds on the surface of the product in the atmosphere during the sampling process.

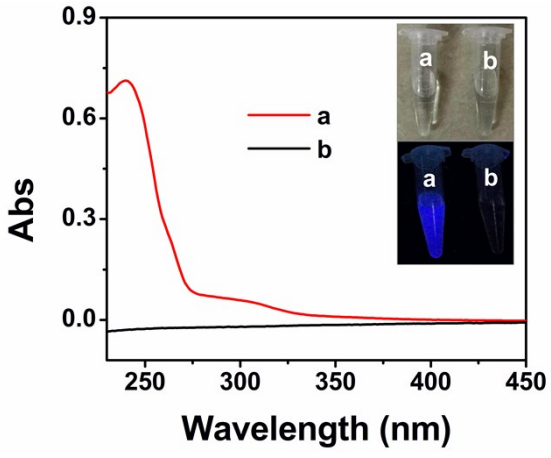


**Fig. S4** UV-vis absorption spectra of the N-$WS_2$ (0.1 mg/mL) in the absence (a) and presence (b) of mercury (II), inset: photographs of corresponding solutions under room light (up) and ultraviolet light (down), the concentration of mercury ions was 25 μM

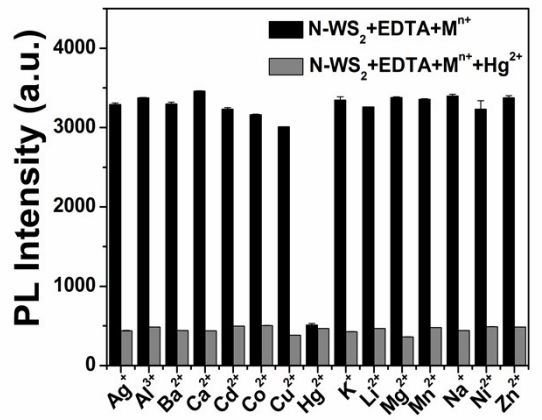


**Fig. S5** Fluorescent response of N-$WS_2$ towards different ions, the black bar represents the fluorescence intensity of N-$WS_2$ in the presence of EDTA and different metal ions; the gray bar represents the changed values of fluorescence intensity that occurred upon addition of $Hg^{2+}$ ions to the previous solution. ($\lambda$ex = 250 nm, the concentration of ions and EDTA were 25 μM, 500 μM, the concentration of N-$WS_2$ was 0.1 mg $mL^{-1}$)

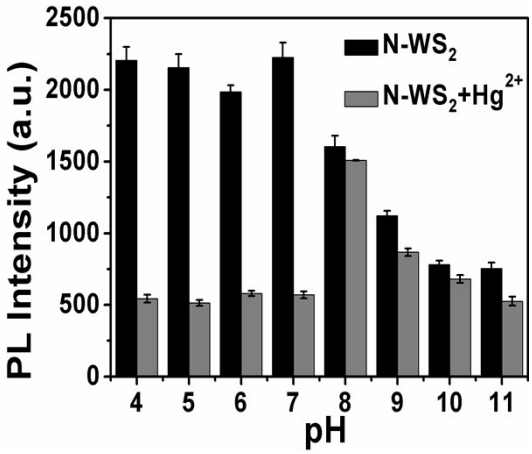


**Fig. S6** Effect of pH on N-$WS_2$ solution with addition of the mercury (II), the concentration of mercury (II) was 25 μM, the concentration of N-$WS_2$ was 0.1 mg $mL^{-1}$

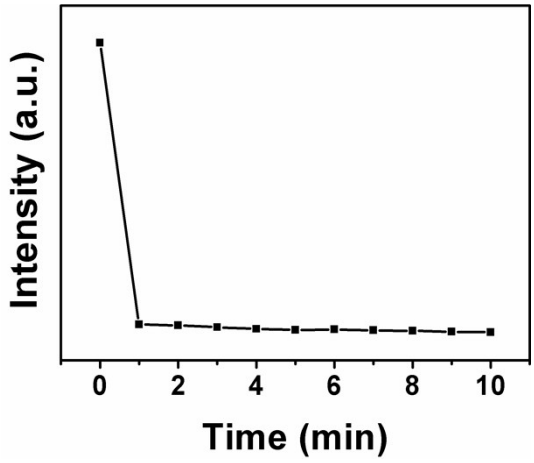


**Fig. S7** Fluorescence intensity of N-$WS_2$ with reaction times after added mercury (II), the concentration of mercury (II) was 25 μM, the concentration of N-$WS_2$ was 0.1 mg $mL^{-1}$

**Table S1.** Comparisons of LOD and linear range of different fluorescent probes for mercury (II) detection

| Probe | Liner range (μM) | LOD (μM) | References |
|---|---|---|---|
| phenylamine-oligothiophene derivative | 0–10 | 0.439 | *Spectrochim. Acta A*, 2016,153, 3-146 |
| Polymer | 0–30 | 0.728 | *J. Mater. Chem.*, 2012, 22, 478-482 |
| organic molecules NBD | 0.1–80 | 0.03 | *Anal. Methods.*, 2014, 6, 4797 |
| Polymer Sensor | 1–30 | 0.728 | *J. Mater. Chem.*, 2012, 22, 478-482 |
| BODIPY-based probe | 0–15 | 0.17 | *Inorg. Chem.*, 2016, 55, 12052–12060 |
| AuNCs | 0.1–10 | 0.05 | *Talanta,* 2016, 161, 170-176 |
| Carbon dots | 0–2.69 | 1.3 | *Biosens. Bioelectron.*, 2010, 26, 1302-1306 |
| N-CQDs | 0–25 | 0.23 | *Biosens. Bioelectron.*, 2014, 55, 83-90 |
| Polymer nanoparticle | 0–10 | 0.075 | *Sens. Actuators B: Chem.*, 2017, 242: 818-824 |
| AgNCs | 0.03–5.2 | 0.016 | *Sens. Actuators B: Chem.*, 2017, 250, 364-371 |
| N-$WS_2$ | 0.1–10 | 0.02 | Present work |

**Table S2.** Sample recovery rate of mercury (II) in the actual water

| Samples | Added | Found | Recovery (%) | RSD (n=3, %) |
|---|---|---|---|---|
| 0 | 0 | 0 | / | / |
| 1 | 3 | 2.970 | 99 | 7.47 |
| 2 | 5 | 5.118 | 102.36 | 5.82 |
| 3 | 7 | 7.103 | 100.19 | 6.41 |