

Supplementary Materials

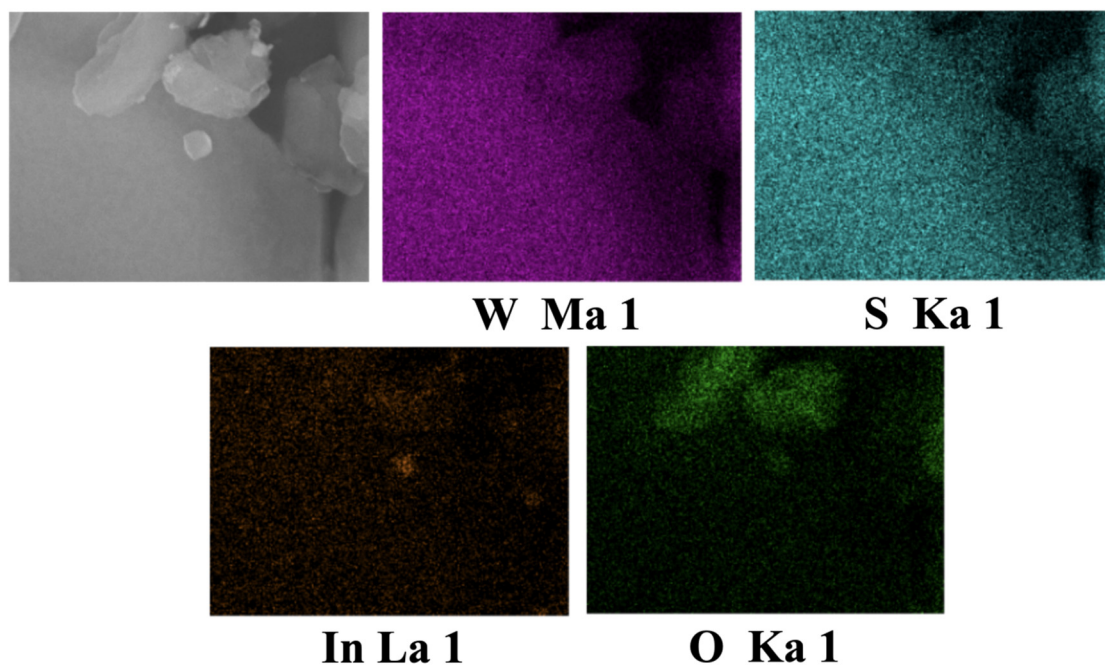


Figure S1. Elemental distribution of IO/WS₂-1 heterostructure nanocomposites based sensor.

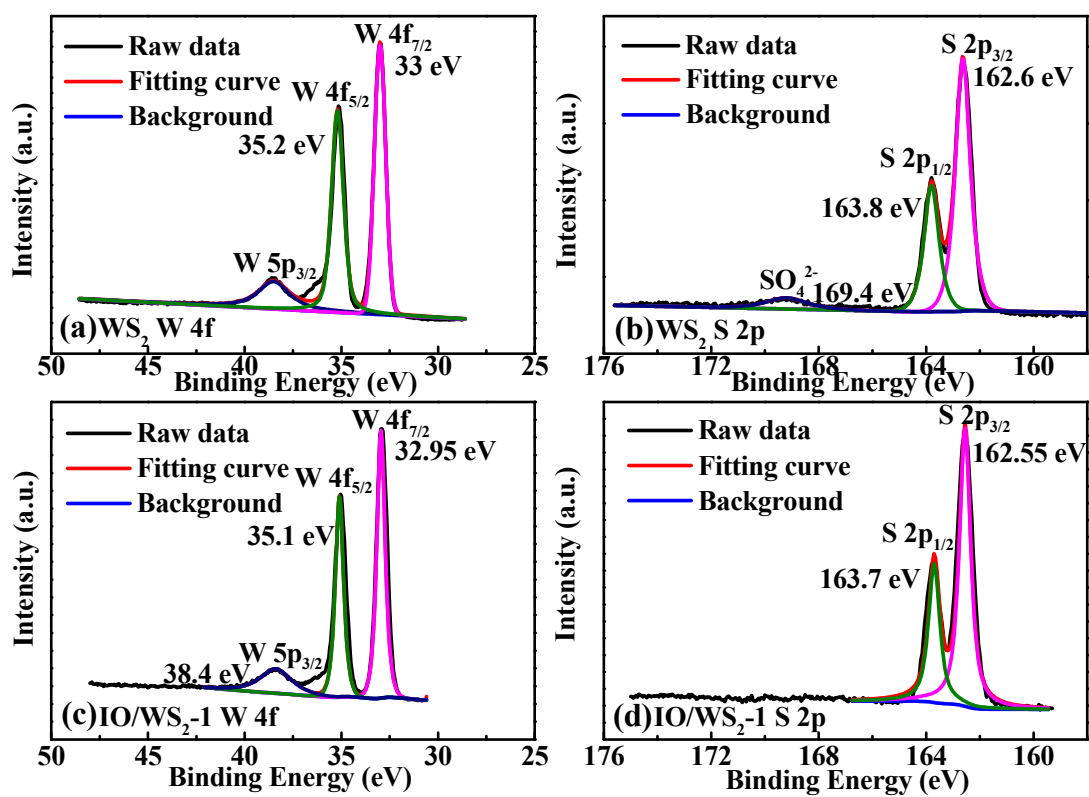


Figure S2. (a,b) W 4f and S 2p refined core spectra of WS₂, (c,d) W 4f and S 2p refined core spectra of IO/WS₂-1 heterostructures nanocomposites based sensor.

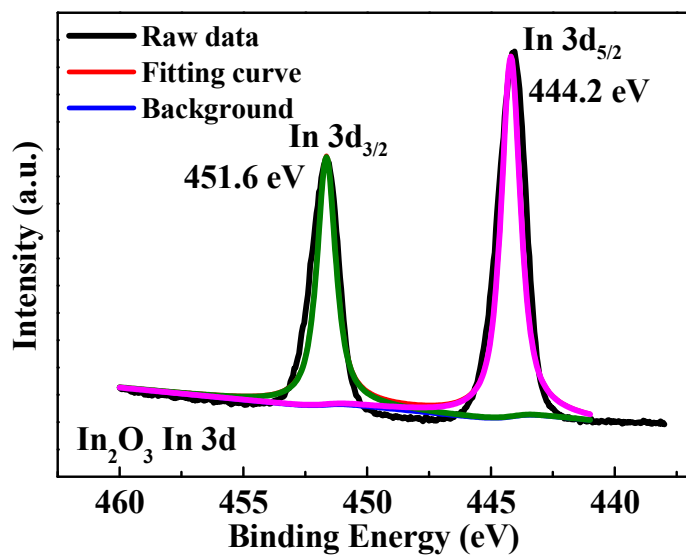
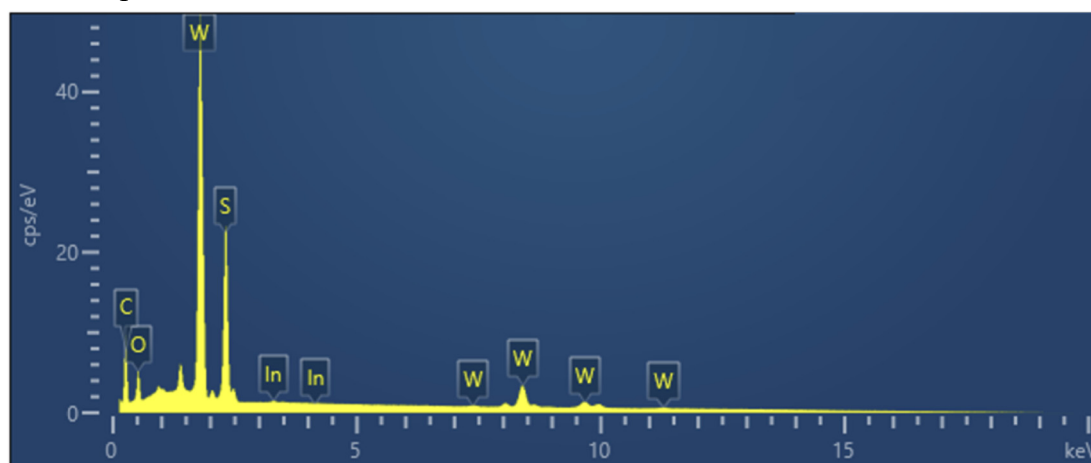


Figure S3. In 3d refined core spectra of In₂O₃.

Table S1. The relative concentrations of each element in IO/WS₂-1 heterostructure nanocomposites based sensor.



Elements	Type of line	Weight percentage	Wt% Sigma	Atomic percentage
C	K	30.35	0.23	70.93
O	K	4.33	0.07	7.59
S	K	15.88	0.08	13.90
In	L	0.32	0.05	0.08
W	M	49.12	0.18	7.50

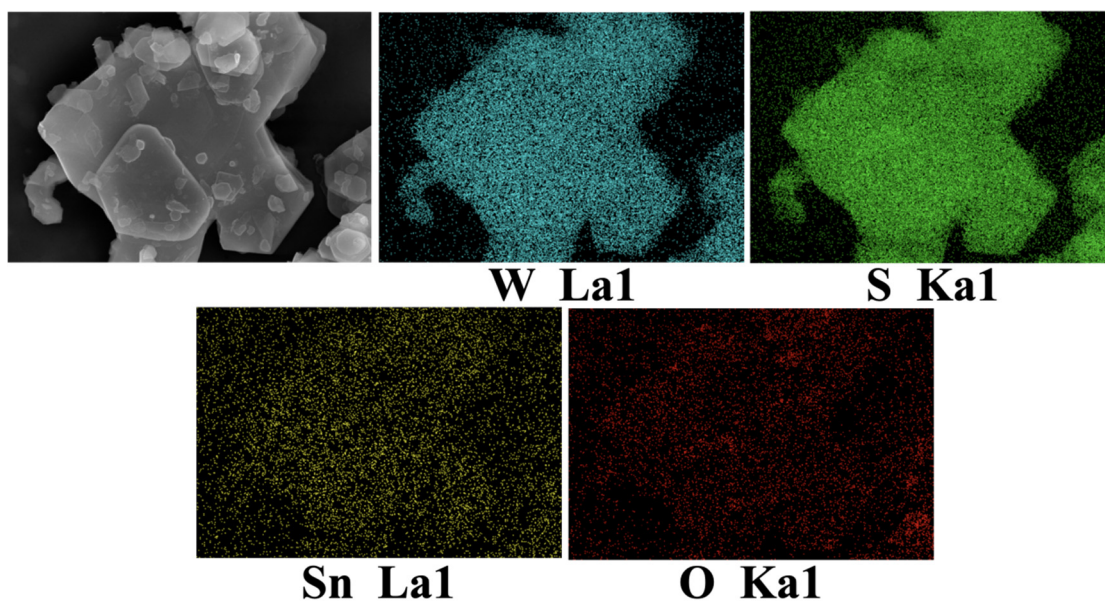


Figure S4. Elemental distribution of SnO₂/WS₂-1 heterostructure nanocomposites based sensor.

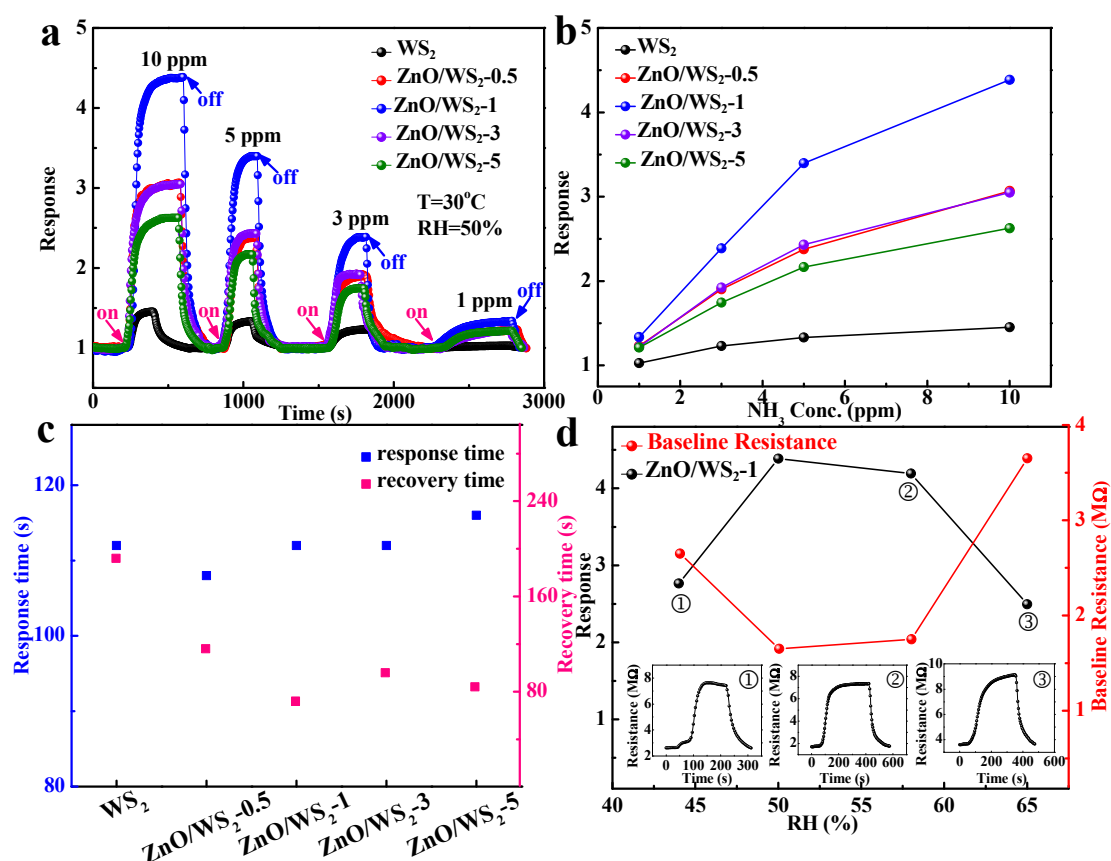


Figure S5. (a, b) Response curves and response values of WS₂ and ZnO/WS₂ heterostructure nanocomposites based sensors to different concentrations of ammonia at room temperature, (c) response/recovery time of WS₂ and ZnO/WS₂ heterostructure nanocomposites based sensors to 10 ppm ammonia at room temperature, (d) relationship between ZnO/WS₂-1 heterostructure nanocomposites based sensor's

response/baseline resistance and humidity.

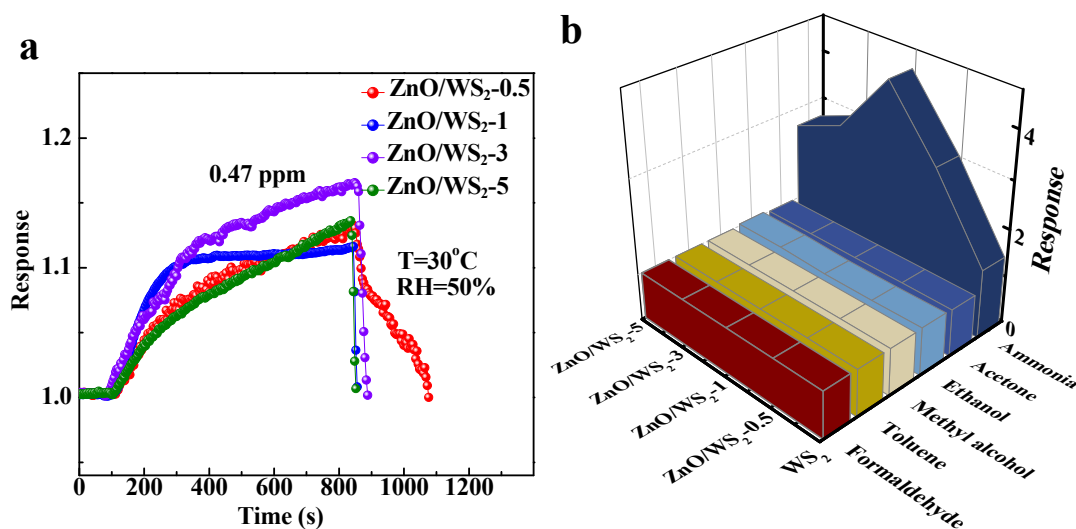


Figure S6. (a). The response curve of the prepared ZnO/WS₂ heterostructure nanocomposites based sensors to 0.47 ppm ammonia at room temperature, (b) the selectivity of the WS₂ and ZnO/WS₂ heterostructure nanocomposites based sensors to different gases at room temperature.

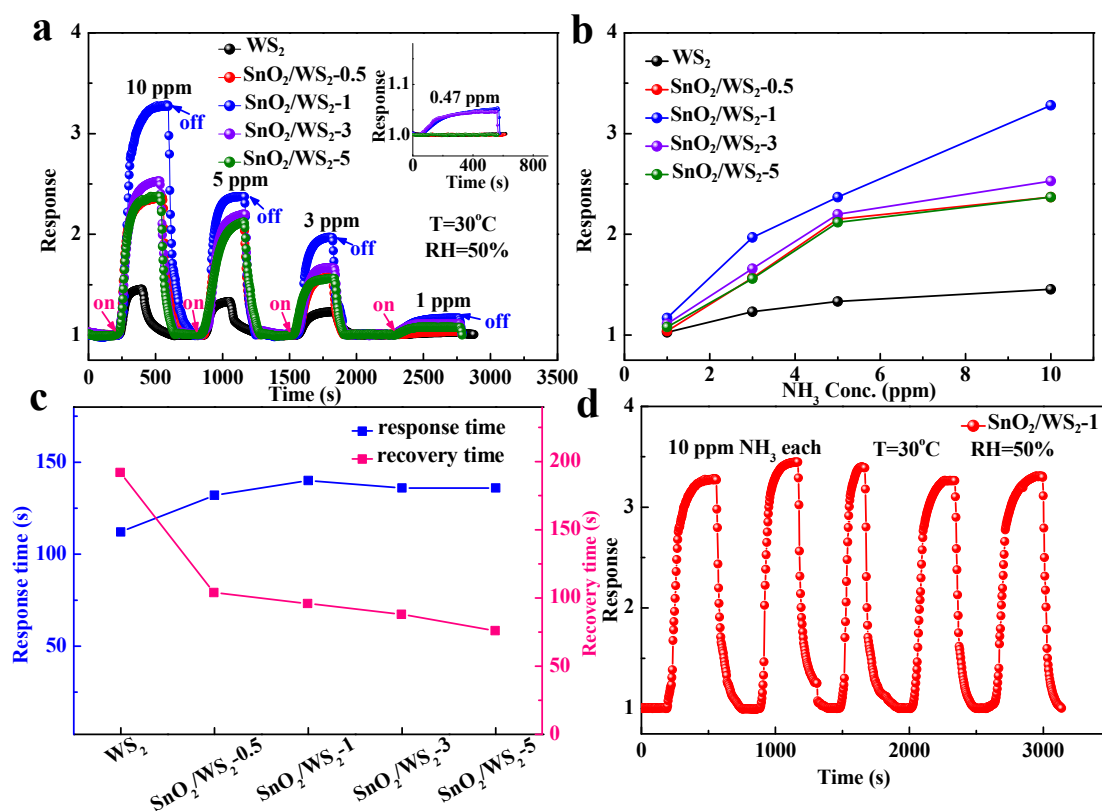


Figure S7. (a,b) Response curves and values of WS₂ microflakes based sensor and SnO₂/WS₂ heterostructure nanocomposites based sensors to different concentrations of ammonia at room temperature, (c) response/recovery time of the SnO₂/WS₂ heterostructure nanocomposites based sensors to 10 ppm ammonia at room temperature, (d) repeatability of SnO₂/WS₂-1 heterostructure nanocomposites based sensor.

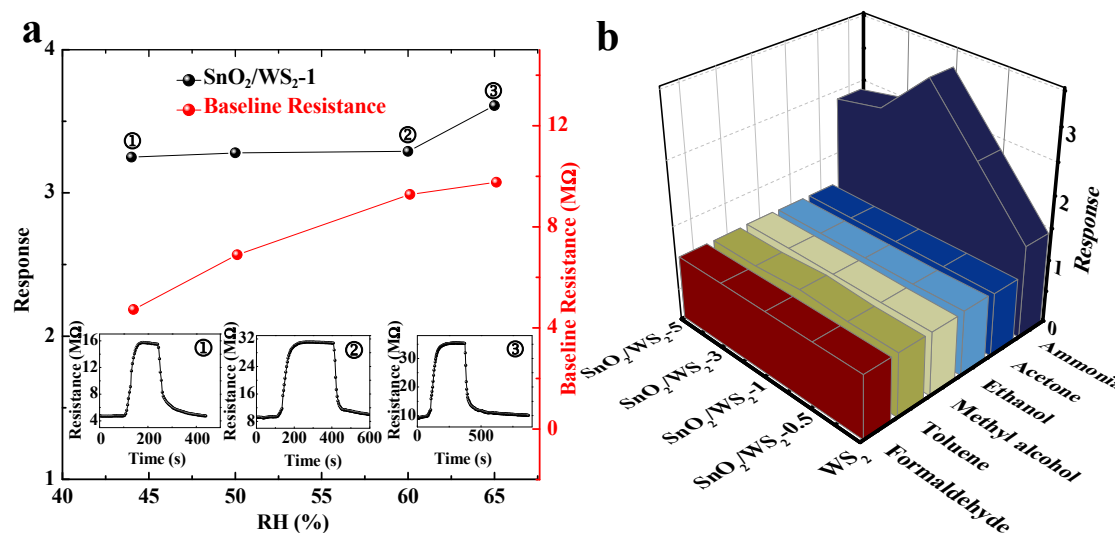


Figure S8. (a) The relationship between the response/baseline resistance and humidity of SnO₂/WS₂-1 heterostructure nanocomposites based sensor, (b) selectivity of the WS₂ microflakes based sensor and SnO₂/WS₂ heterostructure nanocomposites based sensors to different gases.