

## Enhancing NO<sub>2</sub> gas sensing with ZnO/W<sub>18</sub>O<sub>49</sub> heterostructures: Experimental insights and DFT analysis

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Table S1 shows the element concentration that have been obtained by EDX spectra of the samples

| Sample<br>Element | Pure ZnO                 | ZnO/W <sub>18</sub> O <sub>49</sub> |
|-------------------|--------------------------|-------------------------------------|
| O                 | 30.22 (%W)<br>48.78 (%A) | 19.31 (%W)<br>56.37 (%A)            |
| Zn                | 69.78 (%W)<br>51.22 (%A) | 50.26 (%W)<br>35.90 (%A)            |
| W                 | 0<br>0                   | 30.43 (%W)<br>7.73 (%A)             |

Fig S1 shows HRTEM images of ZnO/W<sub>18</sub>O<sub>49</sub> heterostructure. Hexagonal disk shape of ZnO and rode shape of W<sub>18</sub>O<sub>49</sub> are clearly indicated in these HRTEM images. Therefore, a heterostructure has been formed by ZnO and W<sub>18</sub>O<sub>49</sub>.

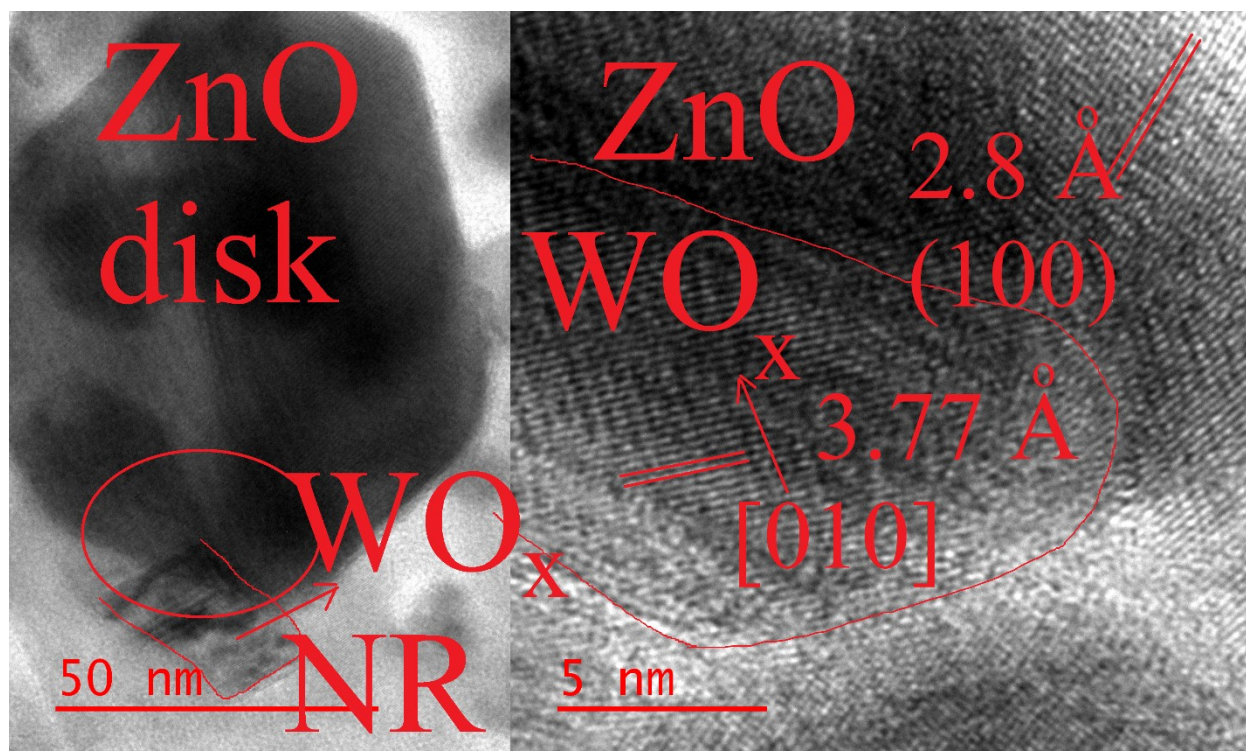


Fig. S1. TEM and HRTEM of ZnO/W<sub>18</sub>O<sub>49</sub> heterostructure

Fig S2 shows survey XPS spectrum of ZnO/W<sub>18</sub>O<sub>49</sub> heterostructure. This spectrum shows clearly that, the heterostructure is included only oxygen, zinc, and tungsten elements.

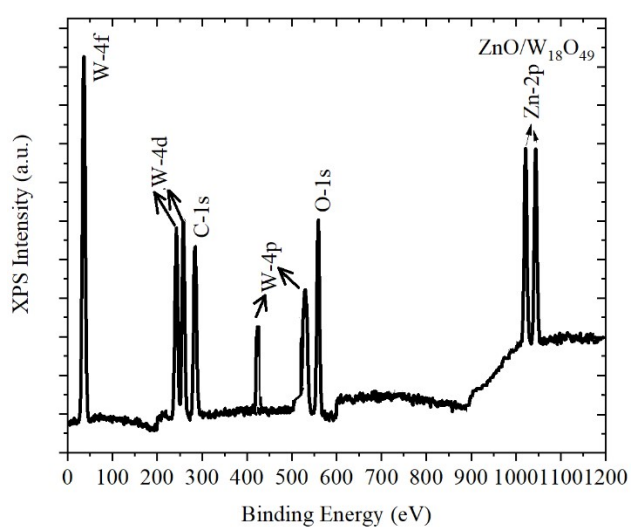


Fig. S2. XPS survey scan of ZnO/W<sub>18</sub>O<sub>49</sub> heterostructure.

Fig. S3 shows XPS spectrum of Zn-2p and W-4f. These spectra indicates that ZnO and  $W_{18}O_{49}$  phases have been formed.

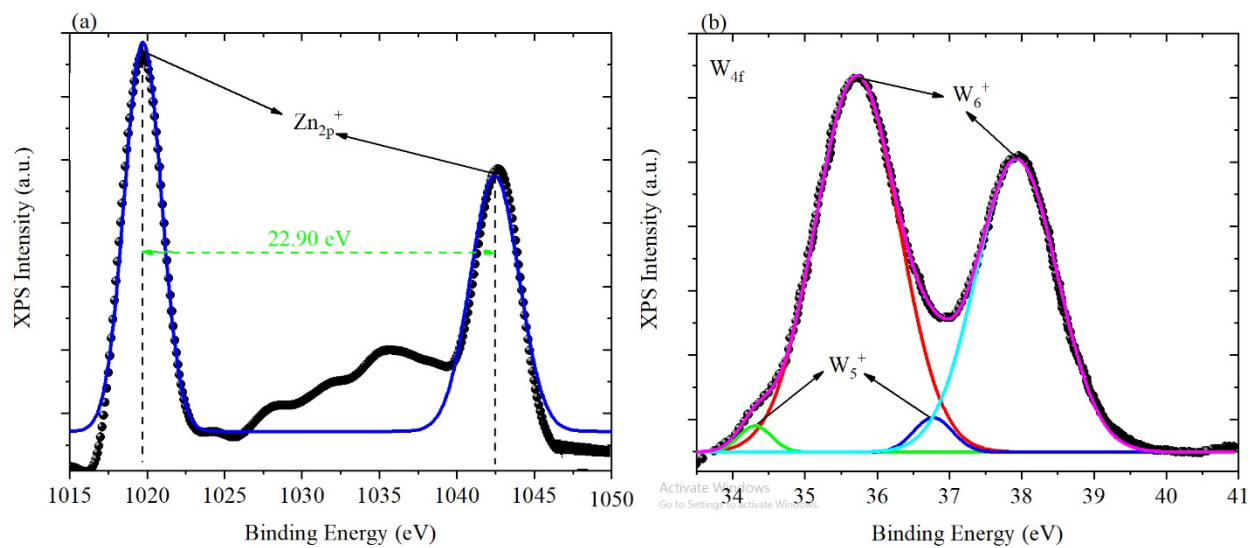


Fig. S3. High resolution XPS spectrum of (a) Zn-2p and (b) W-4f of the ZnO/ $W_{18}O_{49}$  heterostructure.