Electronic supplementary information

Structural and Electronic Engineering of 3DOM WO$_3$ by Alkali Metal Doping for Improved NO$_2$ Sensing Performance

Zhihua Wang, Xiaoxiao Fan, Dongmei Han, Fubo Gu*

State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, Beijing 100029, China

![Raman spectrum of the 3DOM samples](image)

**Fig. S1** Raman spectrum of the 3DOM samples, from a to f are WO$_3$ and Li$^+$-, Na$^+$-, K$^+$-, Rb$^+$-, Cs$^+$-doped WO$_3$, respectively.
**Fig. S2** SEM and TEM images of the 3DOM samples: (a), (b) 3DOM WO$_3$/Na; (c), (d) 3DOM WO$_3$/K; (e), (f) 3DOM WO$_3$/Rb; (g), (h) 3DOM WO$_3$/Cs.

**Fig. S3** STEM images and elemental mappings of the 3DOM samples: (a) Na$^+$-, (b) K$^+$-, (c) Rb$^+$- and (d) Cs$^+$- doped 3DOM WO$_3$. 
**Fig. S4** XPS spectra of the 3DOM samples: (a) full-range survey spectrum; (b) high magnification of the W4f spectrum; (c) W4f spectrum; (d) O1s spectrum, from a to f are WO$_3$ and Li$^+$-, Na$^+$-, K$^+$-, Rb$^+$-, Cs$^+$- doped WO$_3$, respectively.

**Fig. S5** PL spectrum of the 3DOM samples.
Fig. S6 Transient plot of nonporous WO$_3$ to 500 ppb NO$_2$ at the optimum working temperature (150 °C).

Fig. S7 Sensing stability of 3DOM WO$_3$/Li for nearly one month.
Fig. S8 Response of 3DOM WO$_3$/Li to NO$_2$ concentration at room temperature (25 °C), inset: the corresponding log $S_0$-1 versus log $C_g$ curves.