Supplementary Information for

## Uniform Porous Multilayer-Junction Thin Film for Enhanced Gas-Sensing Performance

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Fig. S1 Schematic of the gas sensing measurement system and the cross-sectional schematic of gas sensor based on bilayer  $In_2O_3/CuO$  porous thin film nanostructures.



Fig. S2 XRD patterns of pure In<sub>2</sub>O<sub>3</sub>, CuO, and In<sub>2</sub>O<sub>3</sub>/CuO bilayer porous thin films.



Fig. S3 The high resolution XPS spectra of (a) In 3d and (b) Cu 2p in the  $In_2O_3/CuO$  bilayer porous thin film.



Fig. S4 The current–voltage characteristics for the sensors based on  $In_2O_3$ , CuO and  $In_2O_3/CuO$  porous thin film.



**Fig. S5** Four response transients of different gas sensors to different ethanol concentrations (50-1000 ppm) at 250°C working temperature.