

Supporting Information for

Humidity sensing characteristics of graphene and MoS₂ as well as their heterostructures with different stacking configurations

Hongliang Ma^{1, 2, 3#}, Qiang Gao^{1, 2, 3#}, Zhe Zhang^{1, 2, 3}, Kaige Yang³, Jiayin Li¹, Yabin Chen¹, Jie Ding^{3*}, Wendong Zhang^{4*}, and Xuge Fan^{1, 2, 3*}

¹ State Key Laboratory of CNS/ATM, School of Interdisciplinary Science, Beijing Institute of Technology, Beijing 100081, China.

² State Key Laboratory of Chips and Systems for Advanced Light Field Display, Center for Interdisciplinary Science of Optical Quantum and NEMS Integration, School of Physics, Beijing Institute of Technology, 100081 Beijing, China.

³ School of Integrated Circuits and Electronics, Beijing Institute of Technology, Beijing 100081, China.

⁴ State key Laboratory of Extreme Environment Optoelectronic Dynamic Measurement Technology and Instrument, North University of China, Taiyuan 030051, China.

*E-mail: xgfan@bit.edu.cn, dingjie2015@foxmail.com, wdzhang@nuc.edu.cn

#These authors contributed equally: Hongliang Ma, Qiang Gao

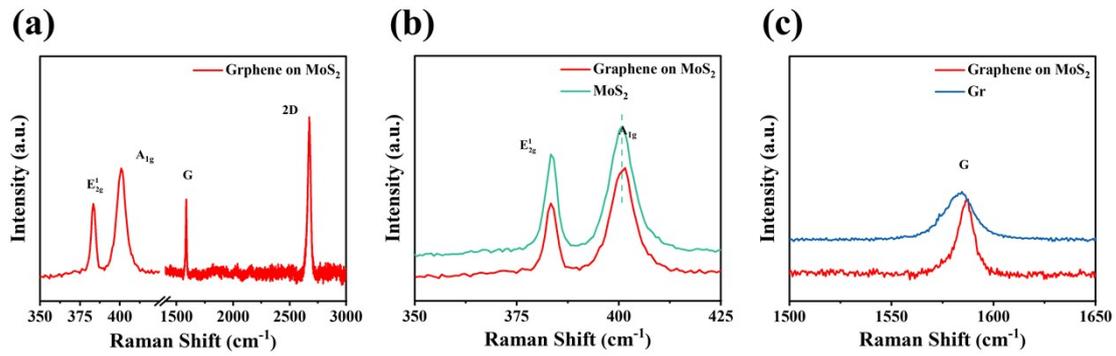


Fig. S1. Raman characteristic of graphene/MoS₂ heterostructure. (a) Raman spectra of graphene/MoS₂ heterostructure (MoS₂ on the top of graphene) on SiO₂/Si substrate. (b) Comparison between A_{1g} peaks of graphene/MoS₂ heterostructure and that of monolayer MoS₂ membrane in Fig. 2h. (c) Comparison between G peaks of graphene/MoS₂ heterostructure and that of monolayer graphene membrane in Fig. 2g. Gr is short for graphene.

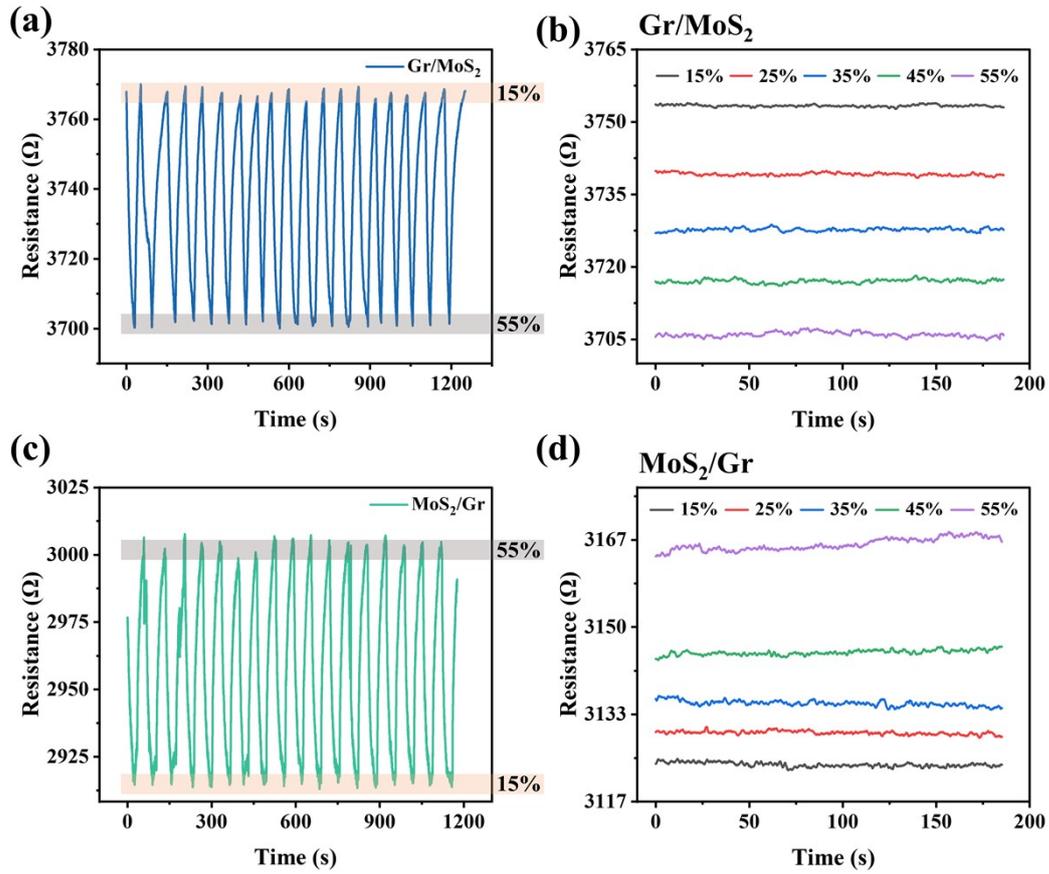


Fig. S2. Repeatability and stability of humidity sensors based on heterostructures of graphene and MoS₂ with different stack orders for long time. (a) Humidity cyclic measurement of Gr/MoS₂ heterostructure devices for 1200 s. (b) Humidity step measurement of Gr/MoS₂ heterostructure devices for 180 s. (c) Humidity cyclic measurement of MoS₂/Gr heterostructure devices for 1200 s. (d) Humidity step measurement of MoS₂/Gr heterostructure devices for 180 s.

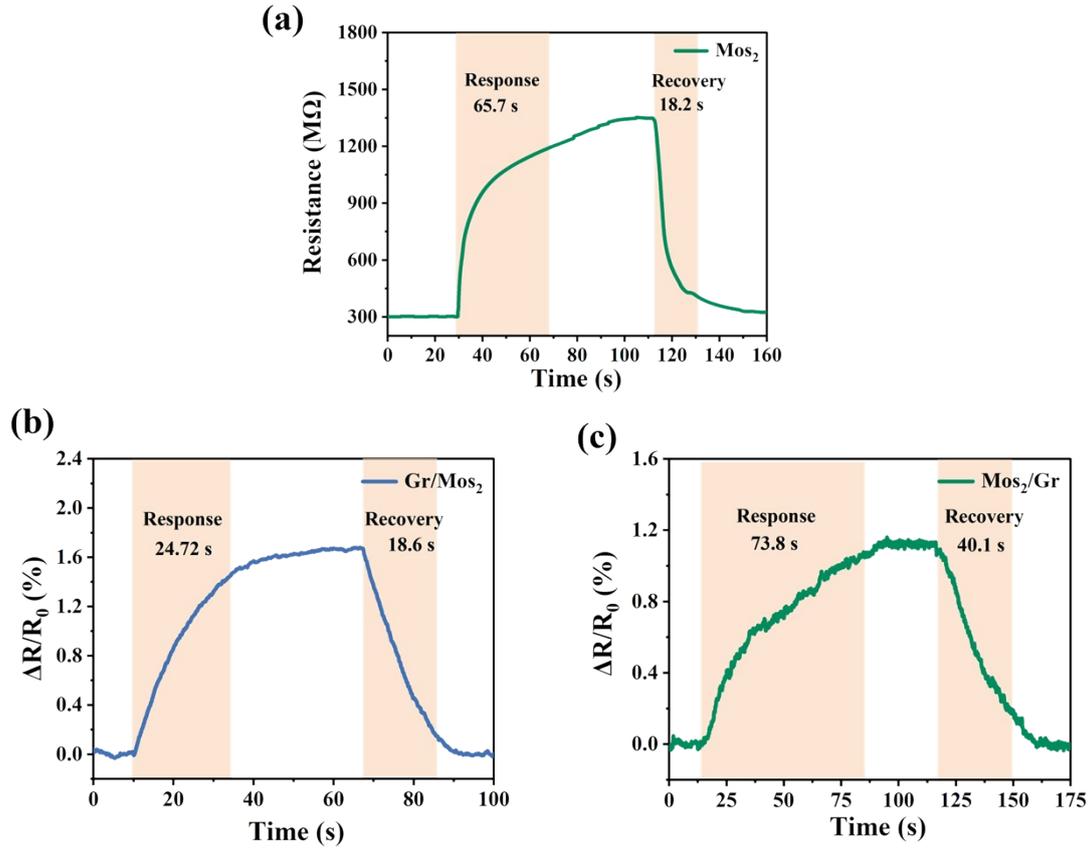


Fig. S3. Measurement of response/recovery time for humidity sensors. (a) MoS_2 . (b) Gr/MoS_2 . (c) MoS_2/Gr .

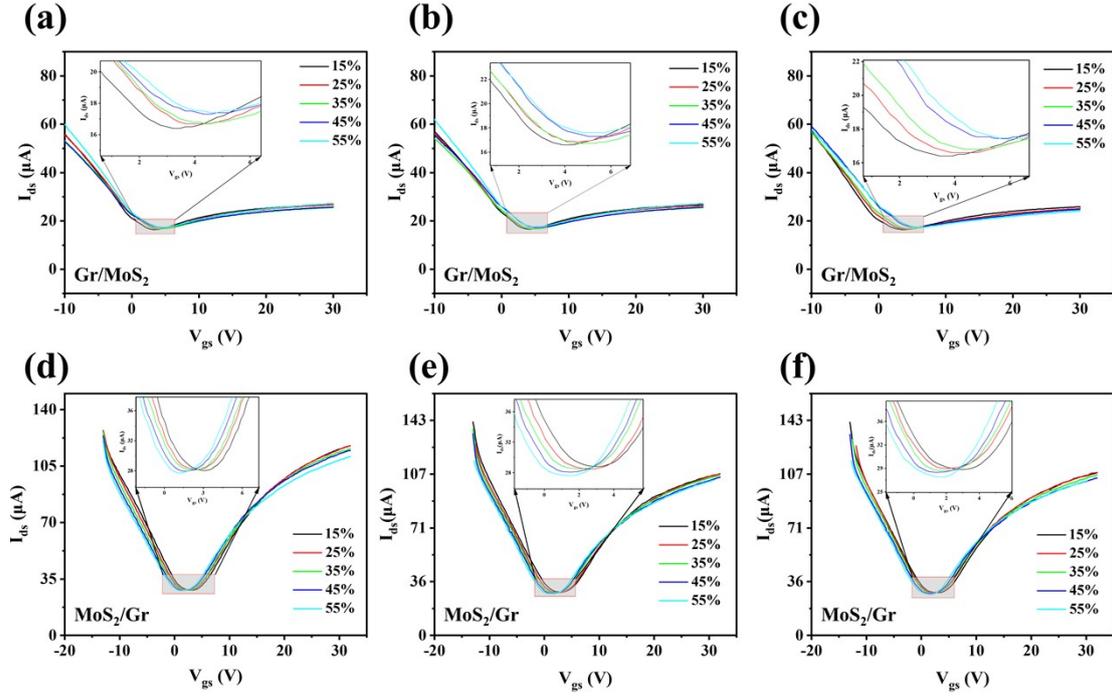


Fig. S4. Transfer characteristic curves of graphene/MoS₂ heterostructures and MoS₂/graphene heterostructures for different samples. (a)-(c) The transfer characteristic curves of three different graphene/MoS₂ heterostructure humidity sensors under different humidity levels. (d)-(f) The transfer characteristic curves of three different MoS₂/graphene heterostructure humidity sensors under different humidity levels. Gr is short for graphene.

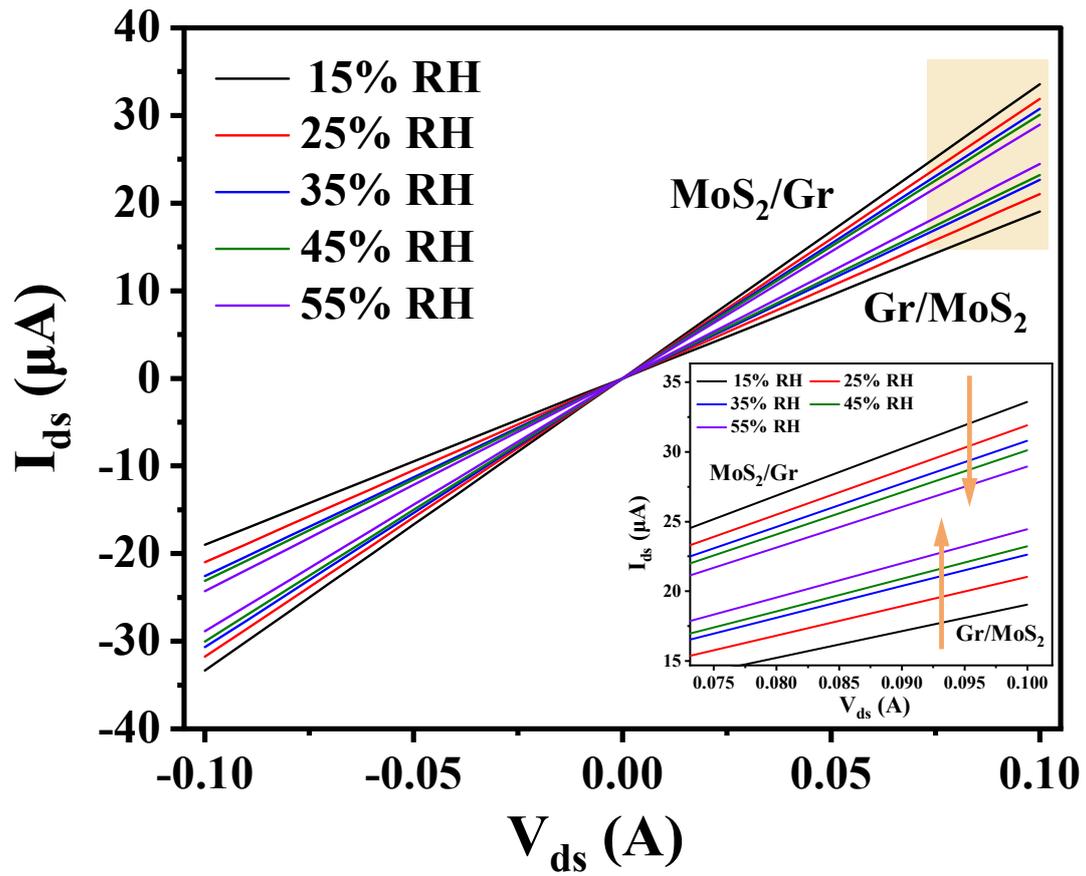


Fig. S5. The output characteristic curves of graphene/MoS₂ heterostructure and MoS₂/graphene heterostructure at V_{gs}=0V for different humidity levels.