

Supporting Information

MoS₂-based NH₃ Sensor for *in-situ* *Helicobacter Pylori* Detection

Minmin Zhao^{a1}, Zhu Zhang^{b1}, Chao Tan^a, Wei Wang^b, Lei Yang^a, Zegao Wang^{a*}

^a College of Materials Science and Engineering, Sichuan University, Chengdu 610065, China

^b Gastroenterology Department, Beijing Hospital, National Center of Gerontology, Institute of Geriatric Medicine, Chinese Academy of Medical Science, Beijing 100005, China

¹ M. Zhao and Z. Zhang contributed equally to this paper.

Corresponding author: Z. Wang, zegao@scu.edu.cn

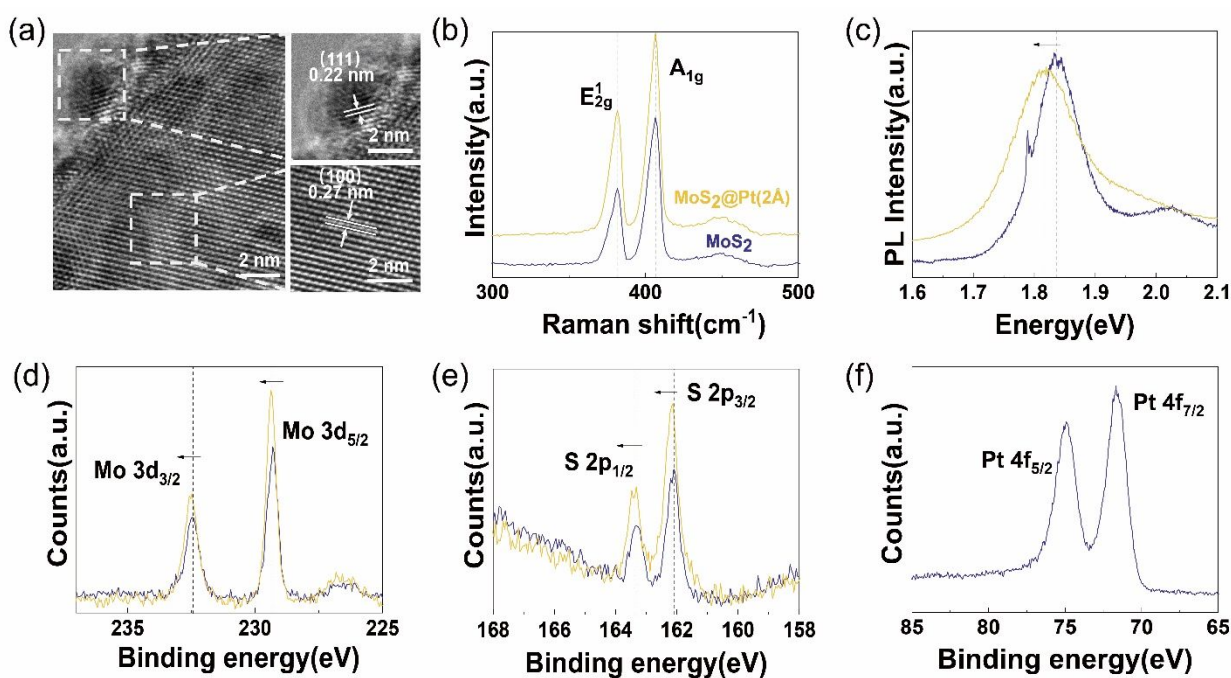


Figure S1 Morphology and electronic characteristics of Pt-decorated MoS₂ films. (a) The HRTEM on the surface of MoS₂ after 2 Å Pt-decorating, scale bar: 2 nm. The upper right is Pt-decorated nanoparticles, and the bottom right is MoS₂, scale bar: 2 nm. The (b) Raman spectra and (c) PL spectra of pure MoS₂ and 2 Å Pt-decorating MoS₂ film. High-resolution XPS spectra of (d) Mo 3d, (e) S 2p, (f) Pt 4f. The purple line is pure MoS₂, the yellow line is 2 Å Pt-decorated MoS₂

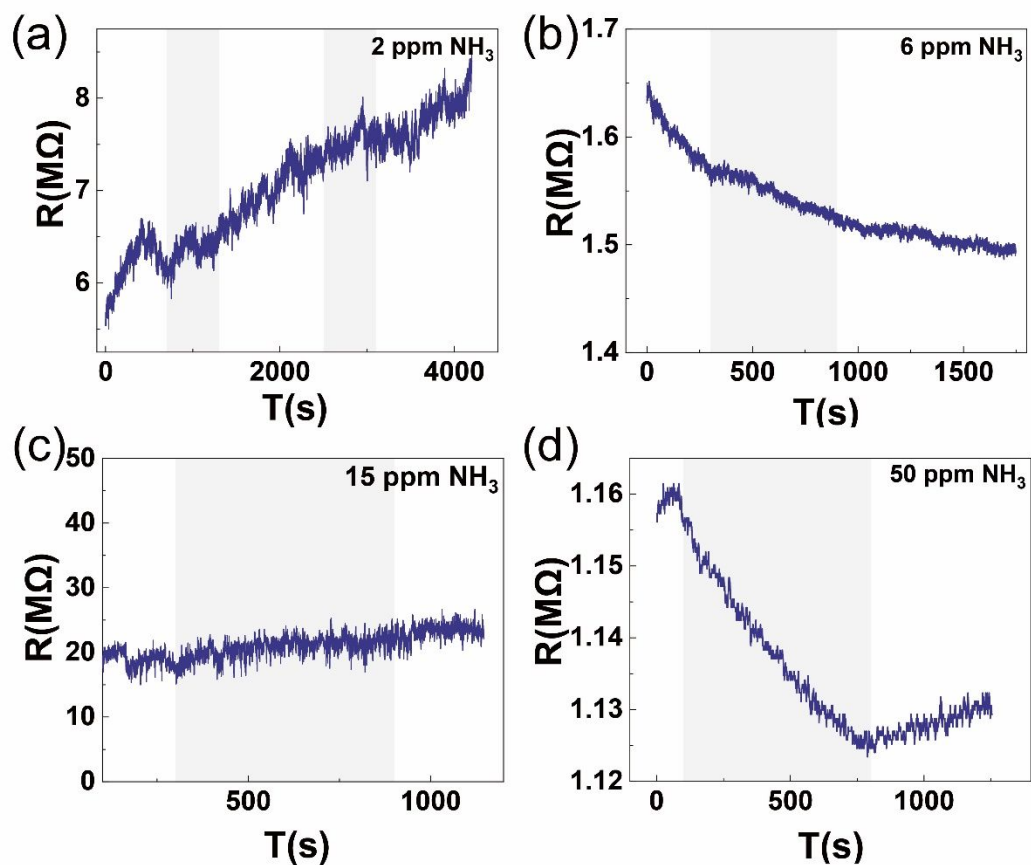


Figure S2 Response curves of pure MoS₂ devices to different concentrations of NH₃

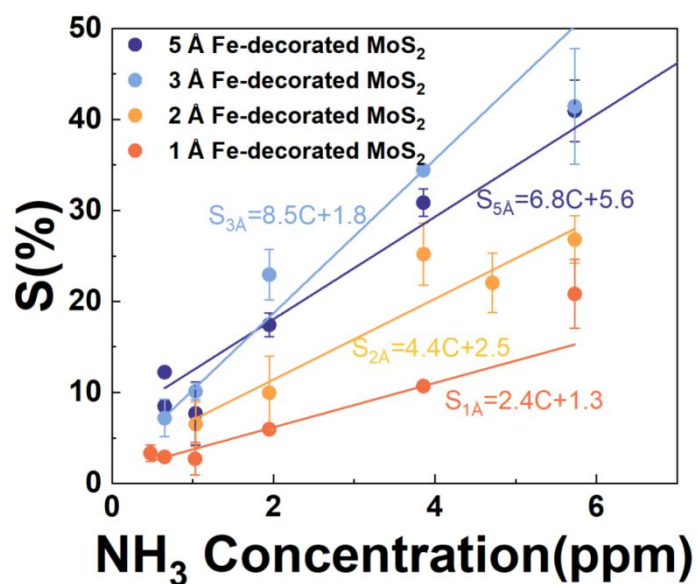


Figure S3 Concentration-dependent sensor response and the linear fitting results of the different sensors

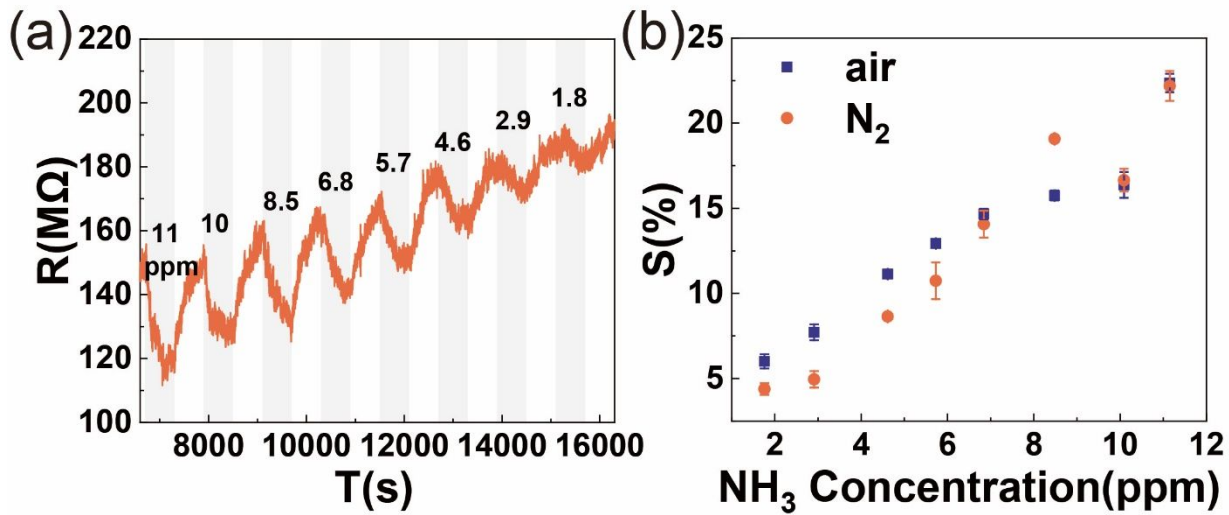


Figure S4 Comparison of the response of 5 Å Fe-decorated MoS_2 under different background gases. (a) The resistance changes of device to NH_3 balanced with N_2 . (b) Concentration-dependent sensor response to NH_3 balanced with N_2 and air, respectively, where the resistance change of air is shown in Figure 3a

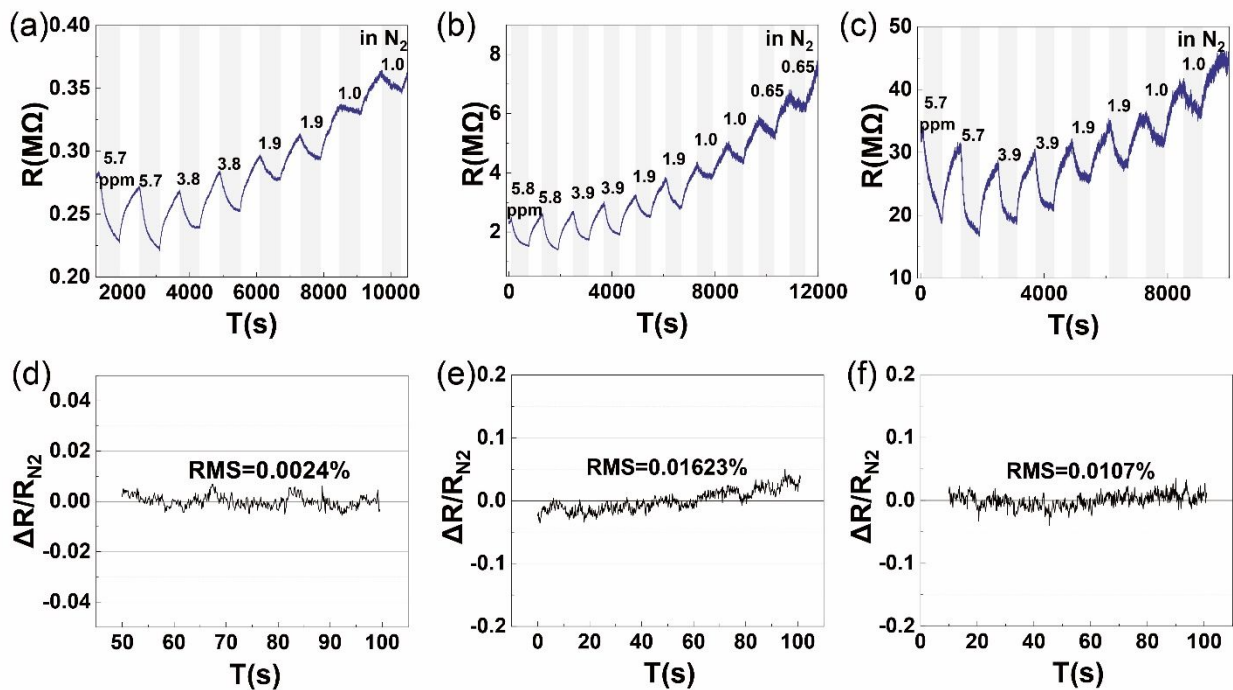


Figure S5 The NH_3 response curve of (a) 1 Å Fe-decorated MoS_2 device, (b) 3 Å Fe decorated MoS_2 device and (c) 5 Å Fe decorated MoS_2 device in N_2 . The root-mean-square noise of the dynamic response curve of (d) 1 Å Fe decorated MoS_2 device, (e) 3 Å Fe decorated MoS_2 device and (f) 5 Å Fe decorated MoS_2 device in N_2

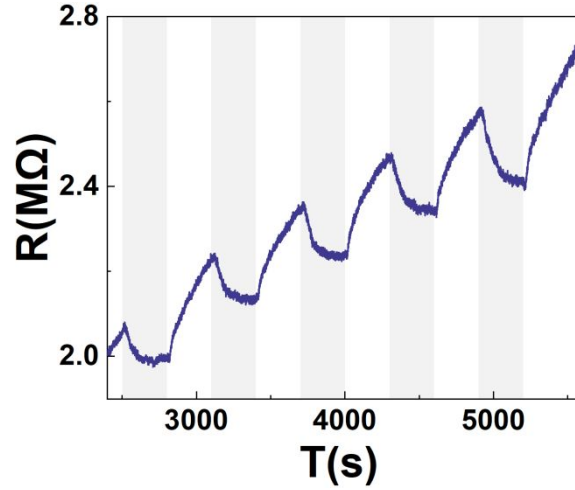


Figure S6 The stable response of 5 Å Fe decorated MoS₂ sensor exposed to 11 ppm NH₃ under 90% RH atmosphere (*H. pylori* culture humidity)

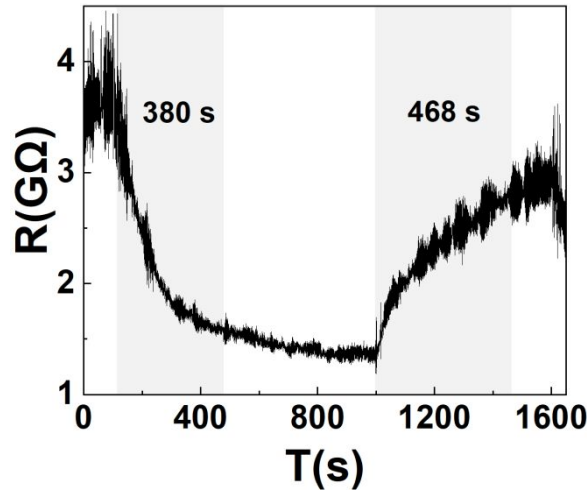


Figure S7 The response time and recovery time of 5 Å Fe decorated MoS₂ sensor exposed to 11 ppm NH₃ for 10 min at 25 °C

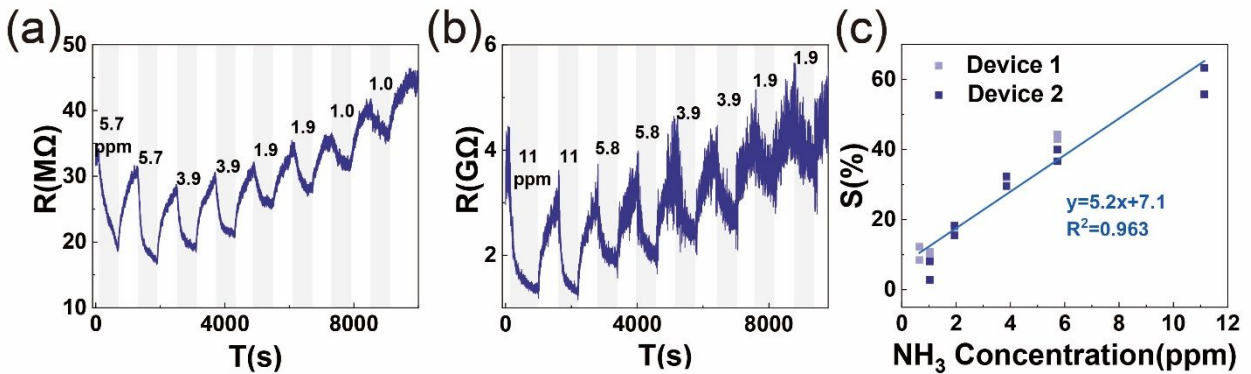


Figure S8 The response of 5 Å Fe decorated MoS₂ sensor with a resistance of (a) MΩ and (b) GΩ to NH₃. (c) Concentration-dependent sensor response and the linear fitting results of 5 Å Fe-decorated MoS₂ sensors with different resistance levels to NH₃ and the concentration

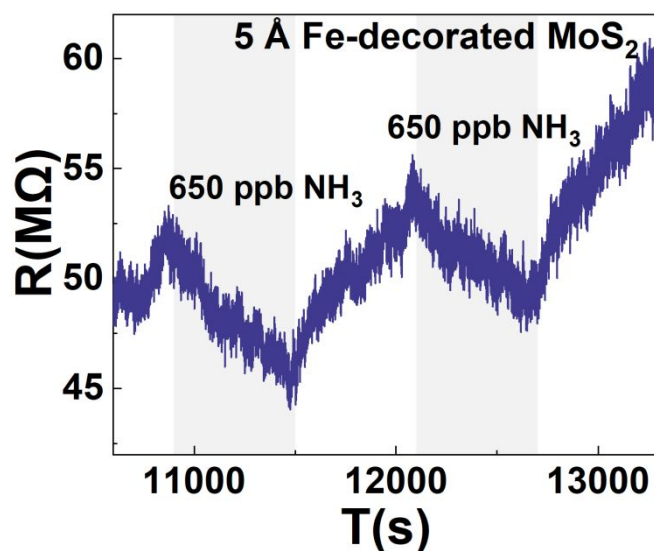


Figure S9 The response at 650 ppb NH_3 of 5 Å Fe decorated MoS_2 sensor

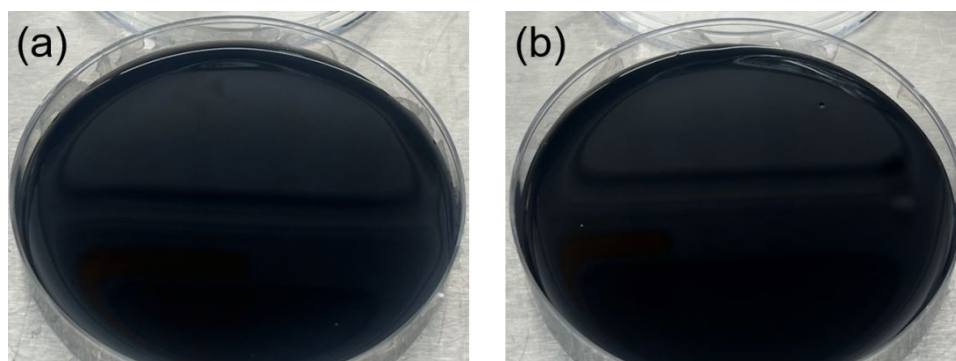


Figure S10 The Fe decorated MoS_2 devices were immersed in isopropyl alcohol for (a) 10 min and (b) 25 min for aseptic treatment, and then placed in blank dish for 12 h culture

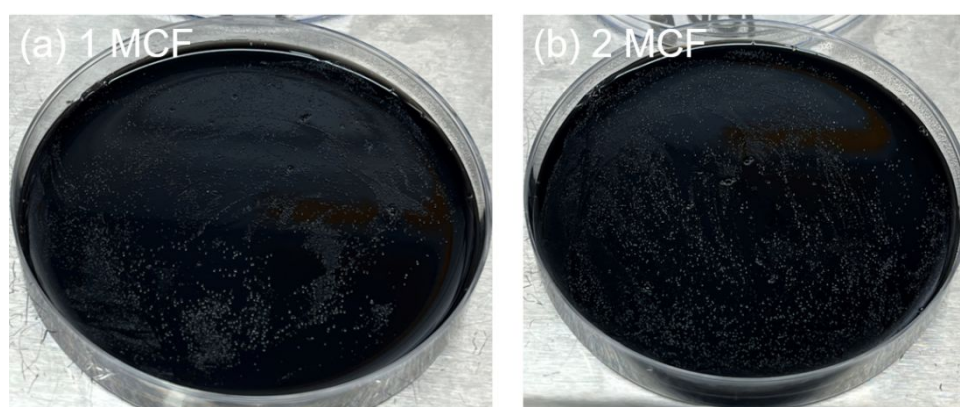


Figure S11 Images of Columbia dishes inoculated with 100 μL of (a) 1 MCF and (b) 2 MCF *H. pylori* suspensions after 96 h culture

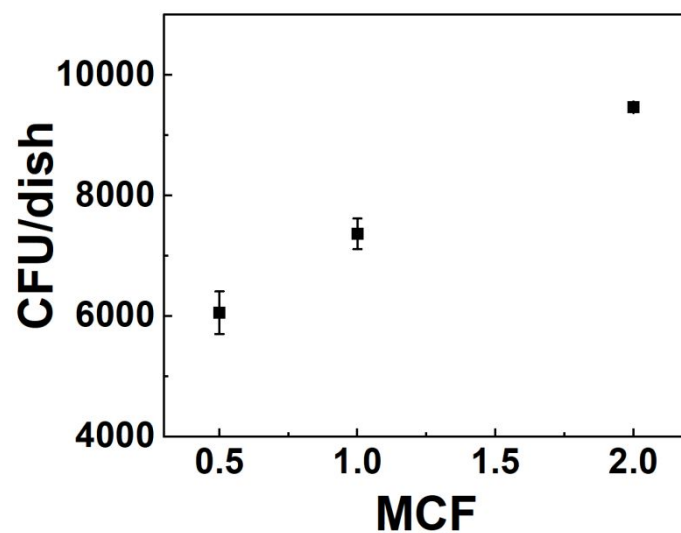


Figure S12 The relationship between the statistical number of colonies after 96h culture and the initial concentration of *H. pylori* suspension

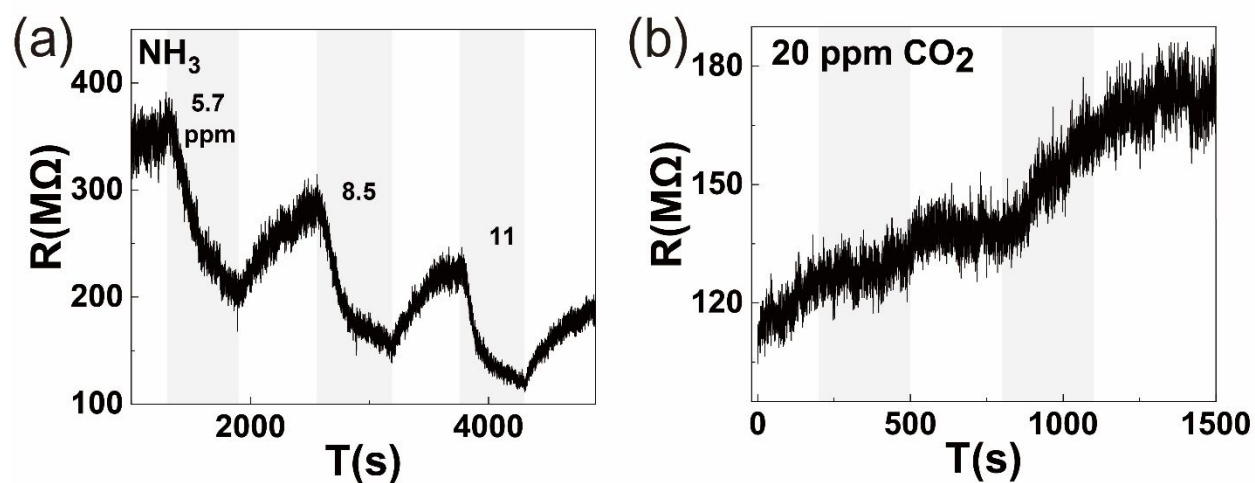


Figure S13 The response curve of the same 5 Å Fe-decorated MoS_2 device to (a) NH_3 and (b) CO_2

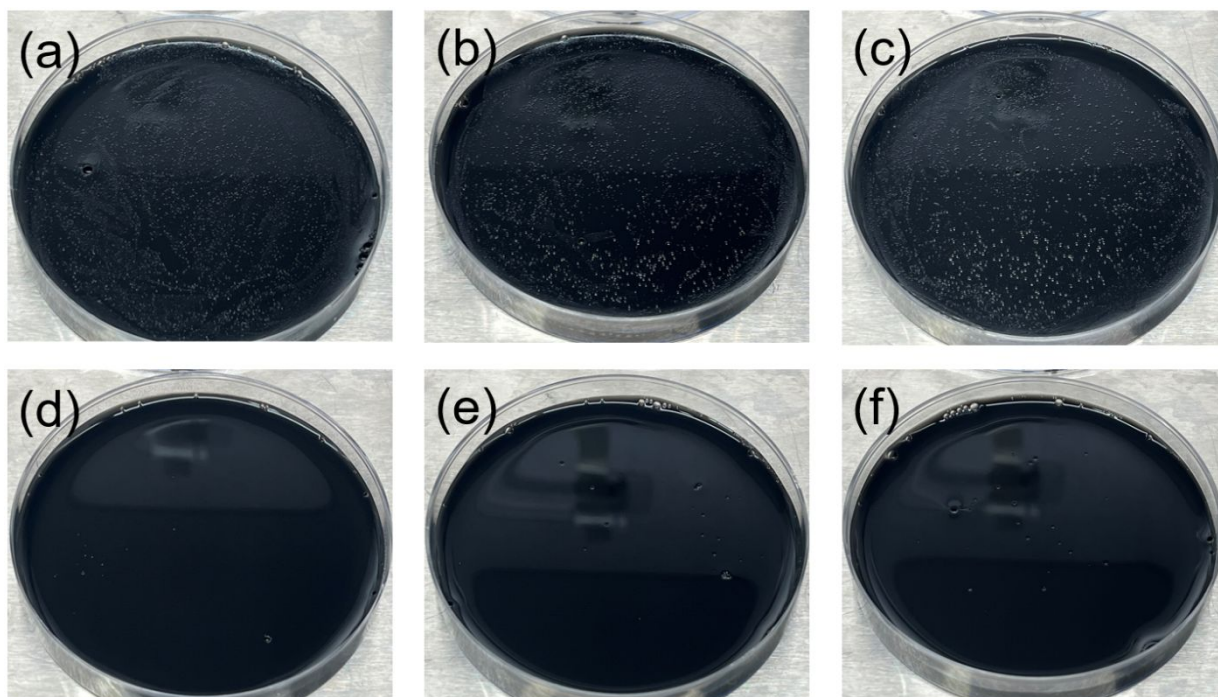


Figure S14 Photos of (a) *H. pylori* dish 1, (b) *H. pylori* dish 3, (c) *H. pylori* dish 4, (d) blank dish 1, (e) blank dish 2, (f) blank dish 3 after 96h of culture

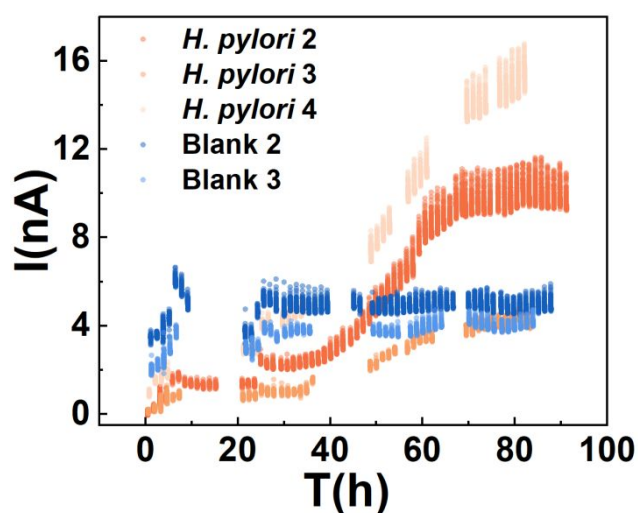


Figure S15 Fe-decorated MoS₂ sensor continuously monitored the current of three *H. pylori* dishes and two blank dishes during 92 hours culture

Table S1 A summary of MoS₂-based room-temperature NH₃ gas sensors

Material	Responsivity (Concentration)	LOD	Time (Response/ Recover)	Ref
MoS ₂ nanoflowers	40% (100 ppm)	100 ppb	92 s/-	IEEE: Kolkata, India, 2023; pp 1 – 2

MoS ₂ nanochains	40% (200 ppm)	720 ppb	80s/ 70s	ACS Omega 2022, 7 (14), 11664 – 11670.
MoS ₂ nanosheets	6% (2 ppm)		193 s/ 965 s	J. Mater. Chem. C 2022, 10 (30), 11027 – 11039.
MoS ₂ /MoO ₃ composite	55% (50 ppm)		45 s/ 53 s	ACS Sustainable Chem. Eng. 2021, 9 (21), 7328 – 7340
PMMA-Mo S ₂ nanosheets films	54% (500 ppm)		10 s/ 14 s	Journal of Alloys and Compounds 2020, 832, 155005
V-doped MoS ₂	25% (100 ppm)	80 ppb	29.8 s/ 39.5 s	ACS Appl. Nano Mater. 2024, 7 (4), 4546 – 4554.
Pt-MoS ₂	35% (70 ppm)	130 ppb		R. Soc. open sci. 2018, 5 (12), 181462.
5 Å Fe-decorate d MoS ₂	41% (5.6 ppm)	6.2 ppb	100 s/ 30 s	This work
