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Supporting Information

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Sensitive Detection of a Gaseous Analyte with Low-Power Metal–Organic Framework Functionalized Carbon Nanotube Transistors

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Supporting Information

- Optical microscopy images of devices (Figure S1)
- Scanning electron microscope (SEM) images from devices (Figure S2)
- X-ray diffraction (XRD) analysis of the MOF layer (Figure S3)
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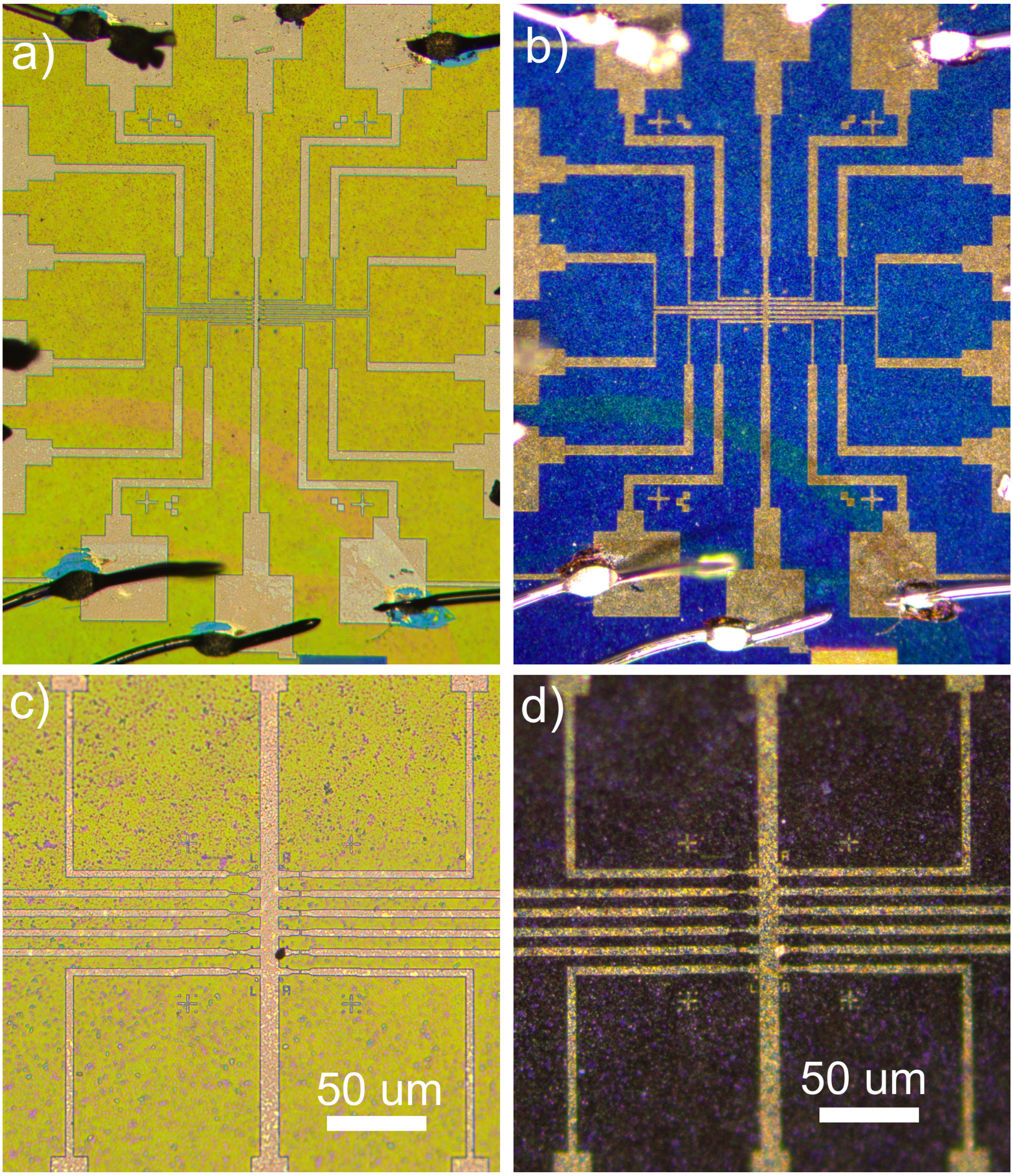


Figure S1: **Optical microscope images of devices**. a) 5x mag. bright field, b) 5x mag. dark field, c) 20x mag. bright field, d) 20x mag. dark field.

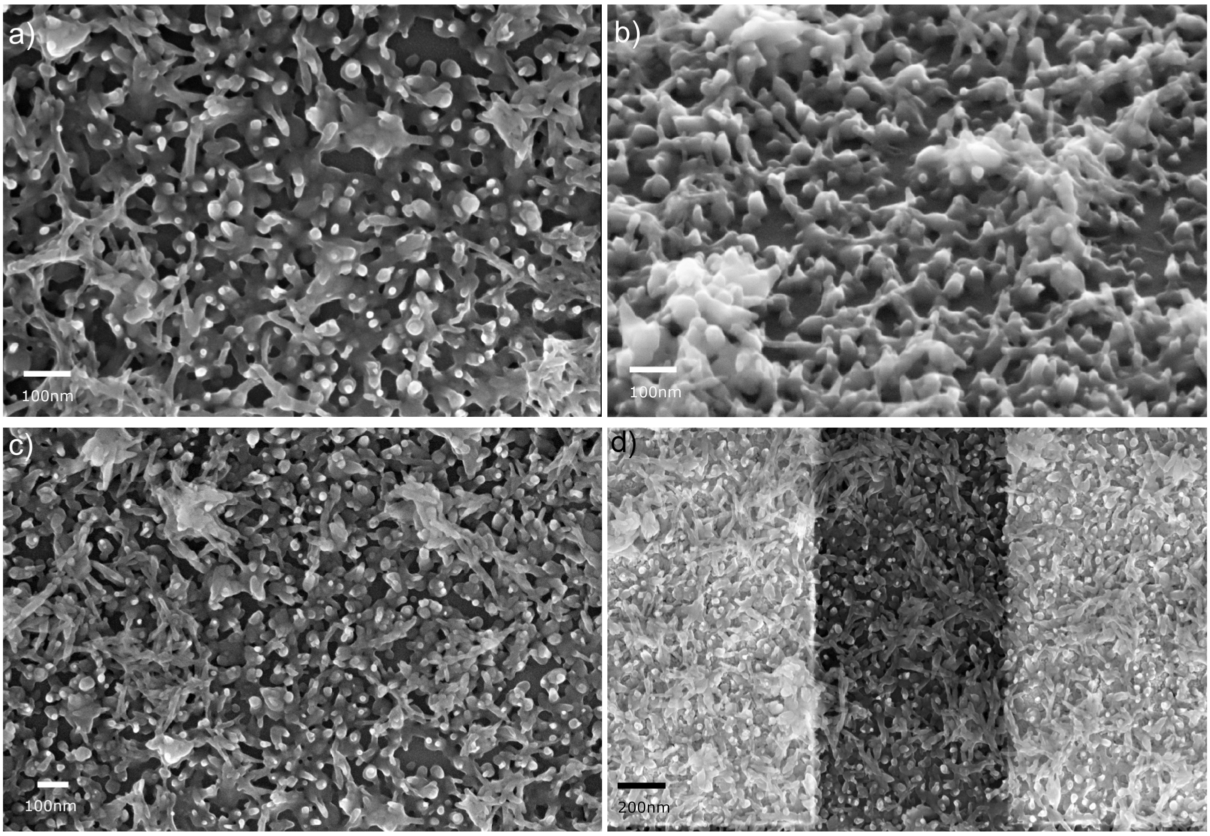


Figure S2: **Scanning electron microscopy (SEM) images**. Data recorded on the MOF/Al_2O_3/CNTFET/SiO_2/Si stack. a) 75x mag., b) 75x mag., 45° tilt, c) 50x mag., d) 35x mag. The area in d) covers the gap region and the bright areas correlate with the source and drain electrodes.

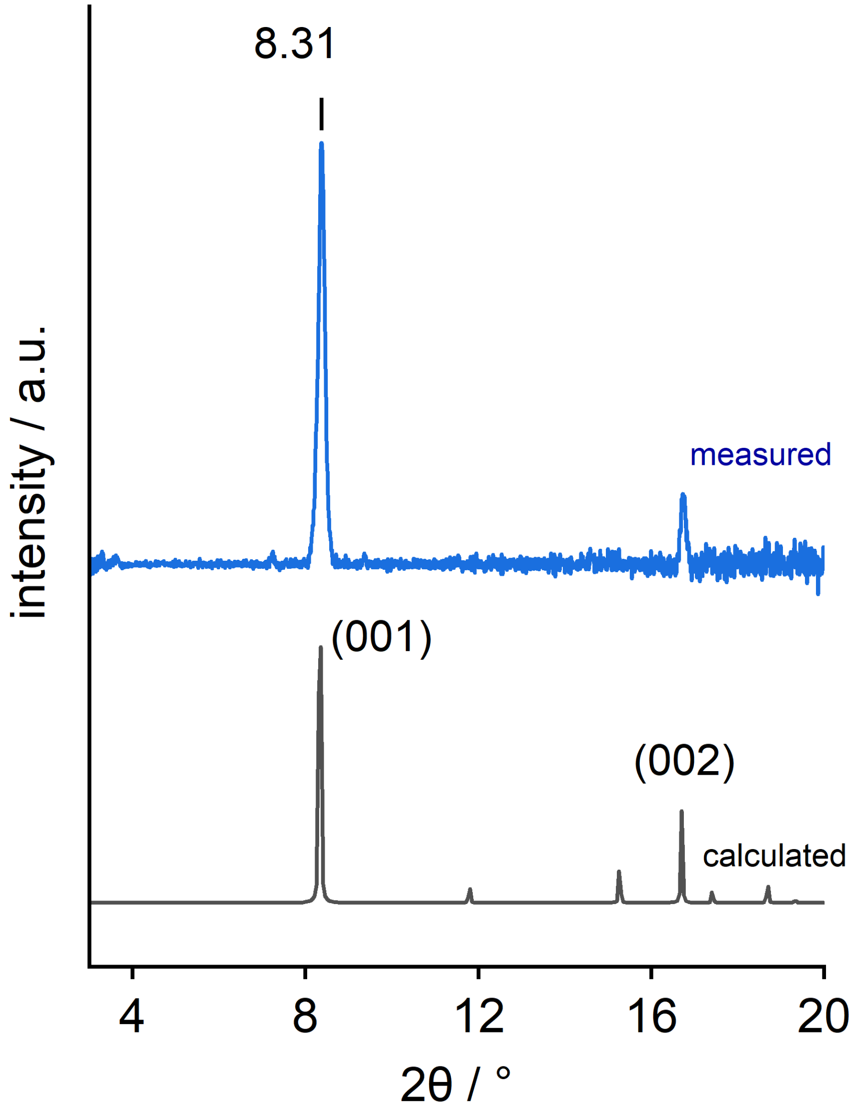


Figure S3: **X-ray diffraction (XRD) analysis**. Out-of-plane XRD data of the $Cu_2(BDC)_2$-MOF layer grown on $Al_2O_3/SiO_2/Si$.The crystal structure of $Cu_2(BDC)_2$-MOF is triclinic with lattice constants a = b = 10.803 Å and c = 5.60 Å. (from Redel et al., Appl. Phys. Lett. 2013, 103 (9), 091903.) These lattice constants were used for the calculation of the X-ray diffractogram using material studio software.

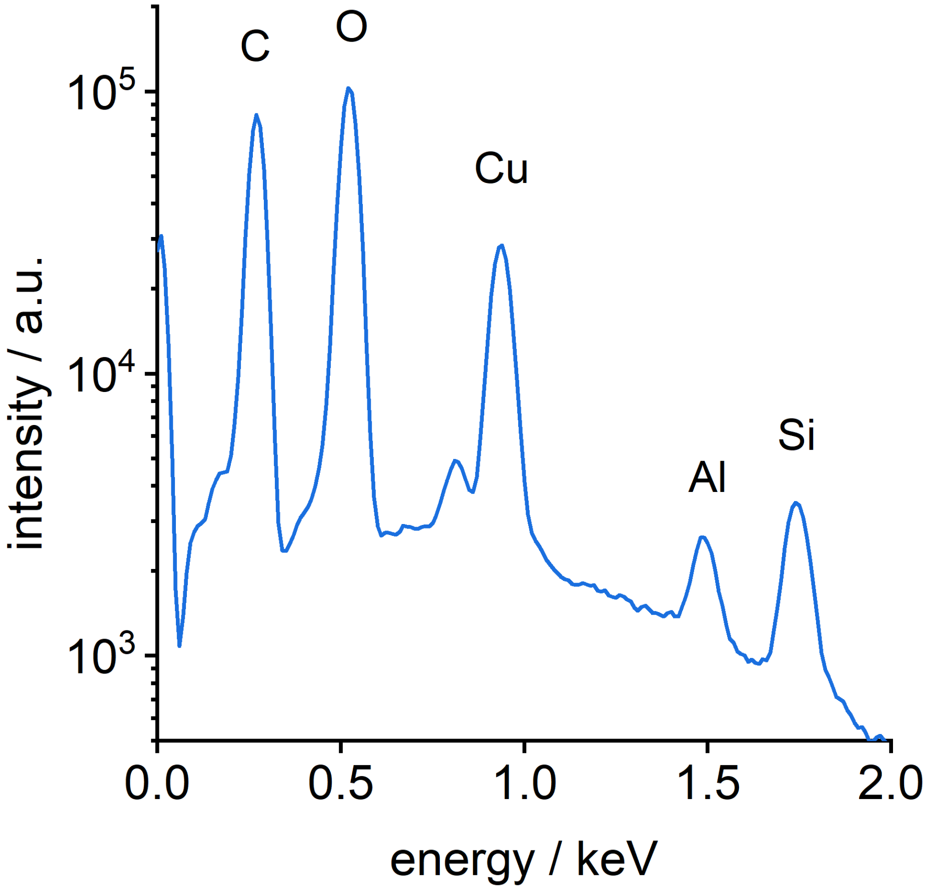


Figure S4: **Energy-dispersive X-ray (EDX) analysis.** The layer structure is 100nm-$Cu_2(BDC)_2$-MOF/5nm-Al_2O_3/300nm-SiO_2/Si.

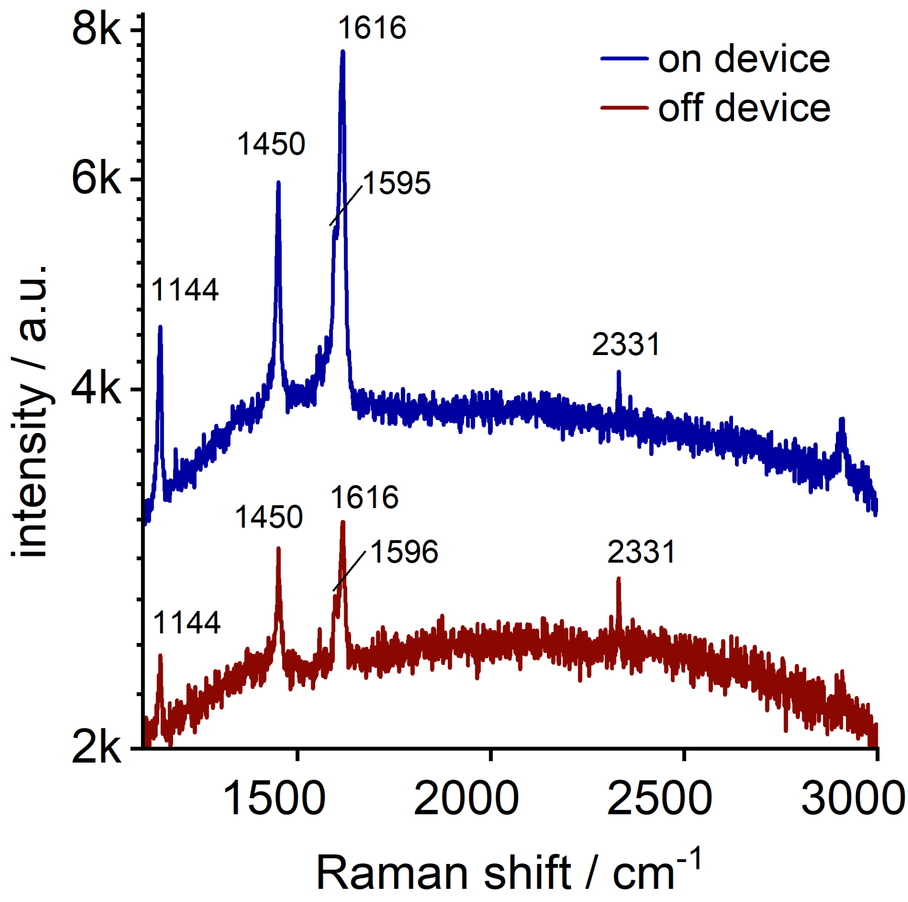


Figure S5: **Raman spectroscopy data**. The layer structure is 100nm-$Cu_2(BDC)_2$-MOF/5nm-Al_2O_3/300nm-SiO_2/Si. The Raman peaks at 1144, 1450, and 1616 cm^{-1} are assigned to the ring stretch of benzene-dicarboxylate, asymmetric CO stretch, and C=C stretch in the MOF layer, respectively (see Elder et al., Langmuir 2017, 33, 10153 and Kumar et al., Adv. Mater. 2021, 33, 2103316). The peak at 2331 cm^{-1} is from N_2(g).

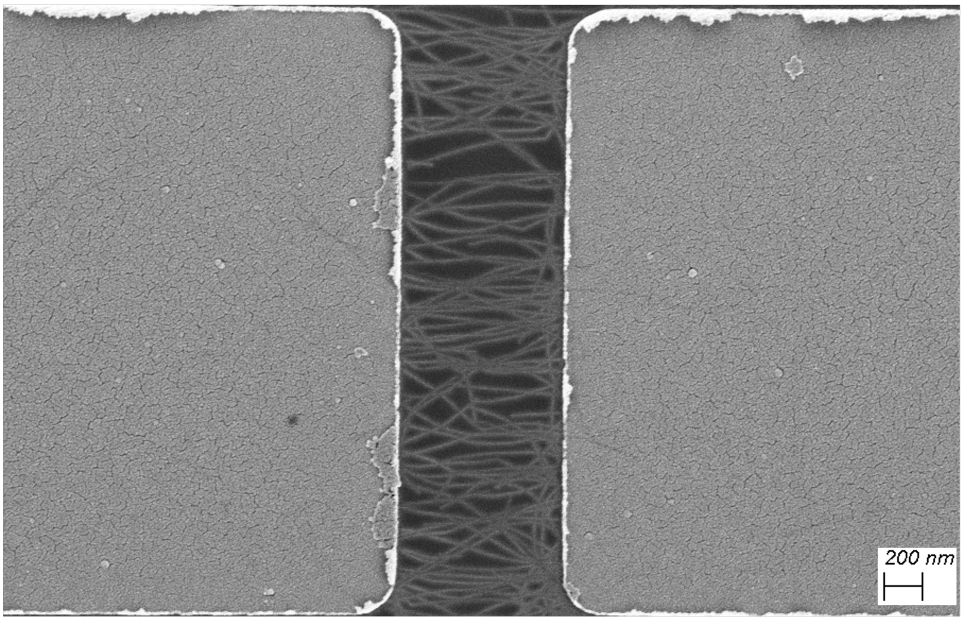


Figure S6: **Scanning electron microscopy (SEM) image**. Data taken on the pristine CNTFET. The CNTs are bridging the source and drain metal electrodes.

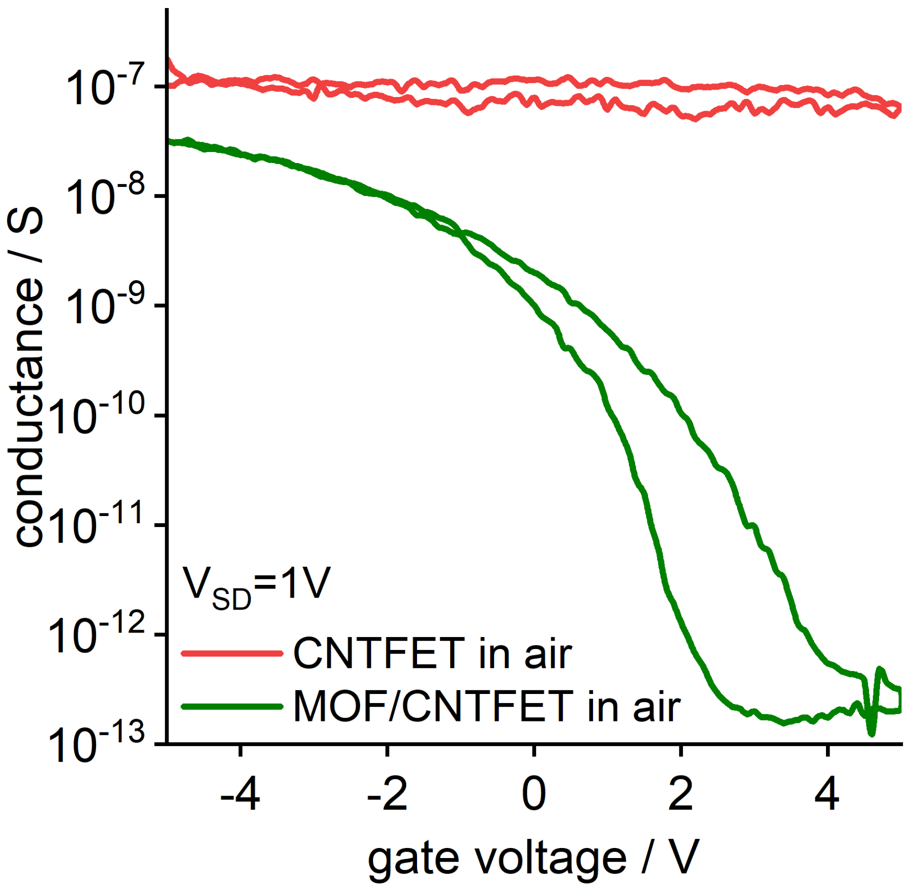
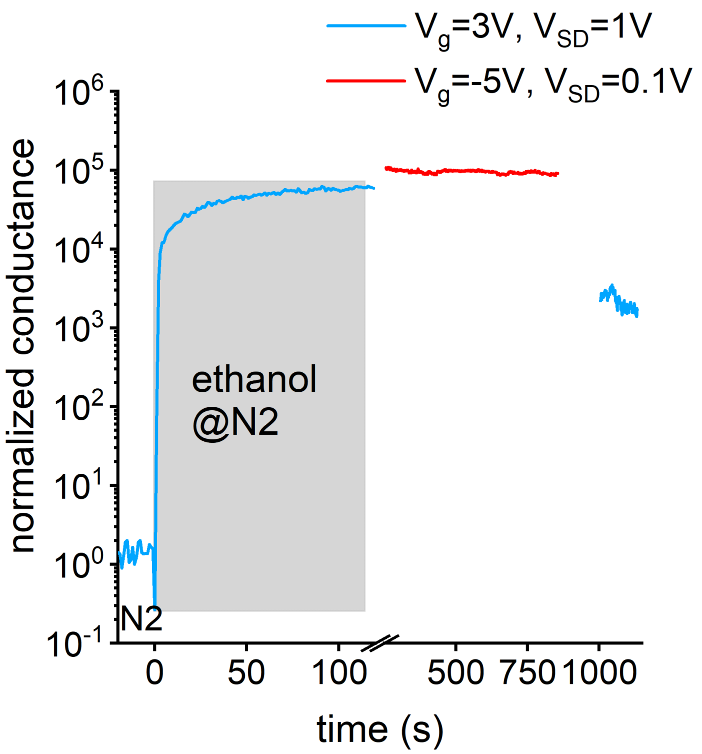


Figure S7: **Transconductance data**. Comparison between pristine CNTFET in air and MOF/CNTFET in air.



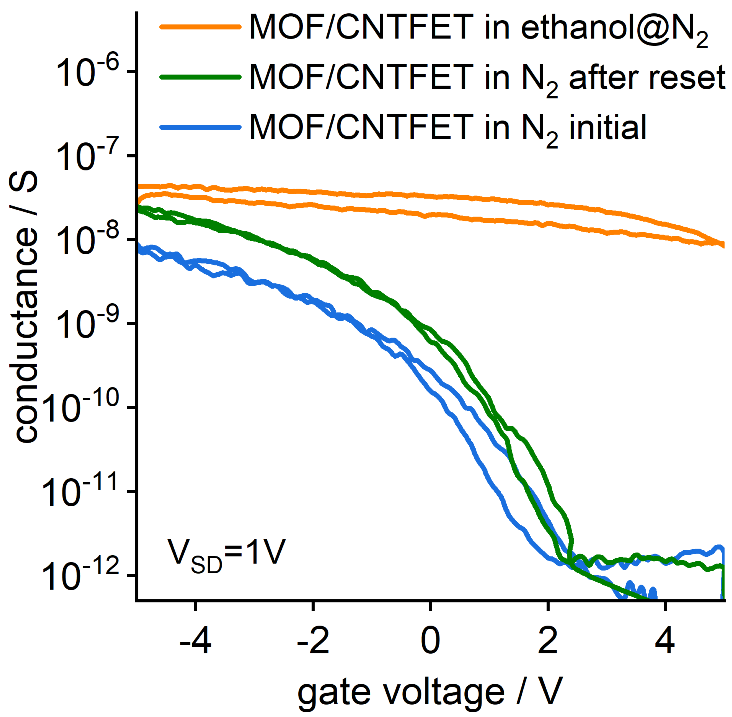


Figure S8: **Complementary reset data.** (Top) Incomplete reset. The device cannot be reset by changing the gate voltage only while keeping the source-drain bias low (0.1V). (Bottom) Effect of reset on the transconductance data. Comparison of MOF/CNTFET data taken initially in N_2, during exposure to ethanol@N_2, and again in N_2 after the reset.

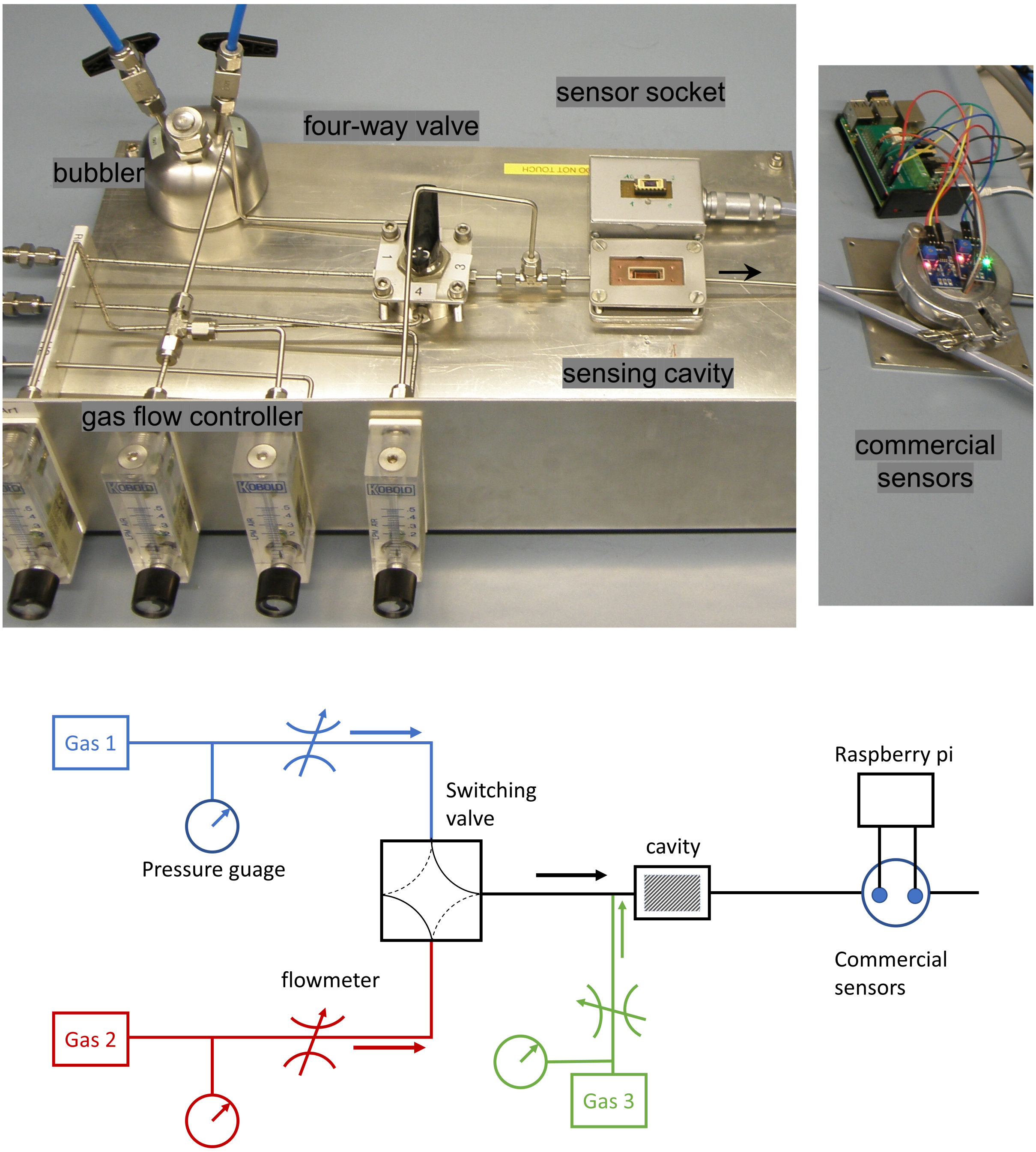


Figure S9: **Gas sensing setup**. Photography (top) and schematic drawing (bottom).