Electronic Supplementary Material (ESI) for Nanoscale.

Supplemental Material

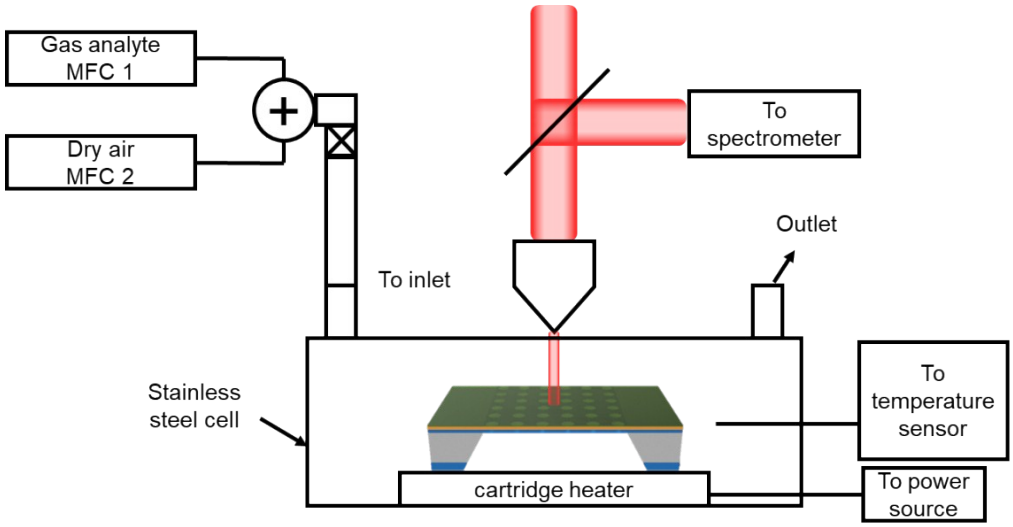

Figure S1: Schematic view of the system setup. A broadband visible light source (400 nm - 700 nm) is focused on the sensor by a microscope and the reflected signal is captured by a spectrometer. A cartridge heater is inserted in the gas cell to vary the operating temperature. Target gases (e.g. acetone and ethanol) from cylinders are mixed with dry air to generate different concentrations. The flow rate is controlled at 2 slm as set on mass-flow controllers.

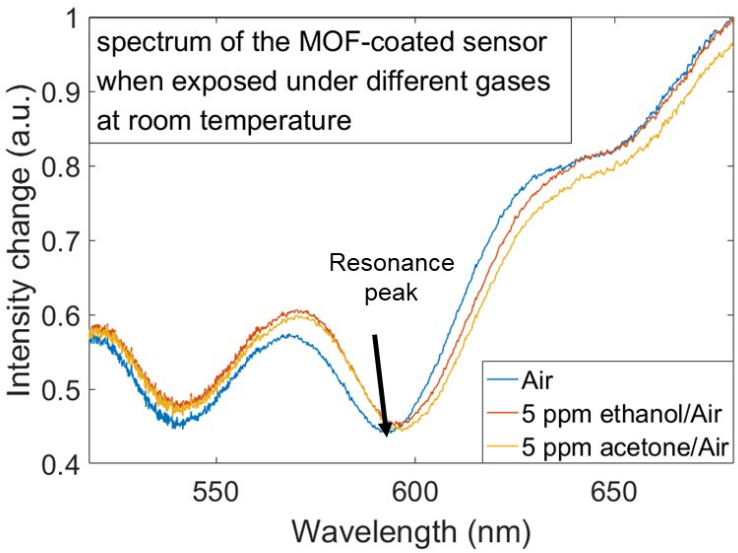

Figure S2: Measured spectrum of the MOF-coated sensor when exposed under dry air, 5 µmol/mol (ppm) acetone and 5 µmol/mol (ppm) ethanol. The intensity changes at the resonance peak are measured during the gas sensing process. Note: The spectrum is measured in a reflection-based configuration and therefore the resonance peak is inverted (occur as a valley).

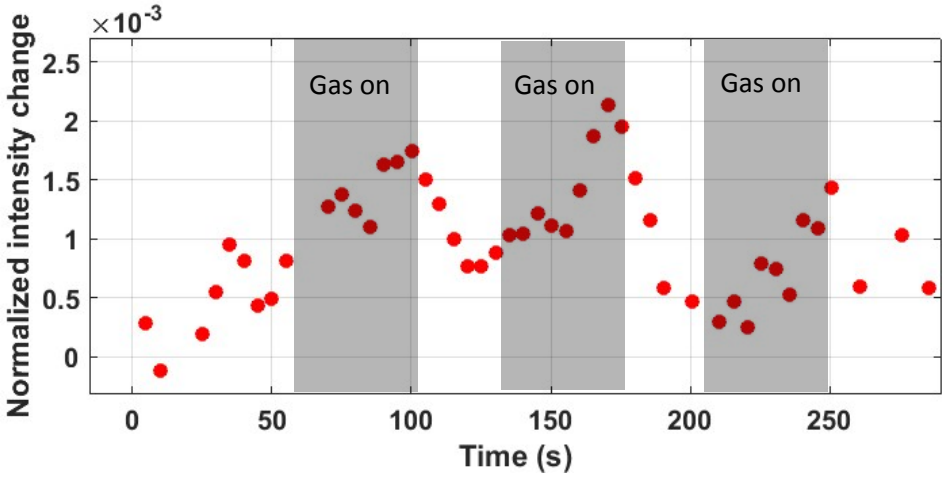

Figure S3: Three cycles testing a bare sensor response to 500 µmol/mol acetone vapor. The normalized intensity change is comparable to that from a MOF-coated NHA sensor to 10 µmol/mol acetone vapor. Because the noise level for the MOF-coated sensor is much lower, the overall response strength (signal-to-noise) of the sensor was improved by more than 50 times with the presence of MOF. We speculate that the noise level of the bare Au sensor (≈ 10 times greater than the MOF-coated sensor) may be attributed to the generally poor selectivity of the Au interacting with the background.

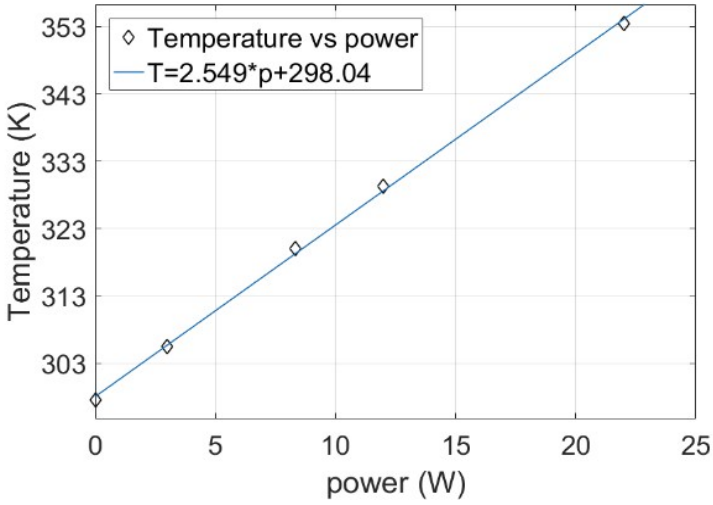

Figure S4: Temperature vs power consumption for the system. The system has a high-power consumption of 2.549W/K because the whole gas cell is heated up by the cartridge heater. The power consumption can be decreased by using an integrated micro-heater. In this case, only the sensing platform (300 µm × 300 µm) instead of the whole gas cell would be heated.

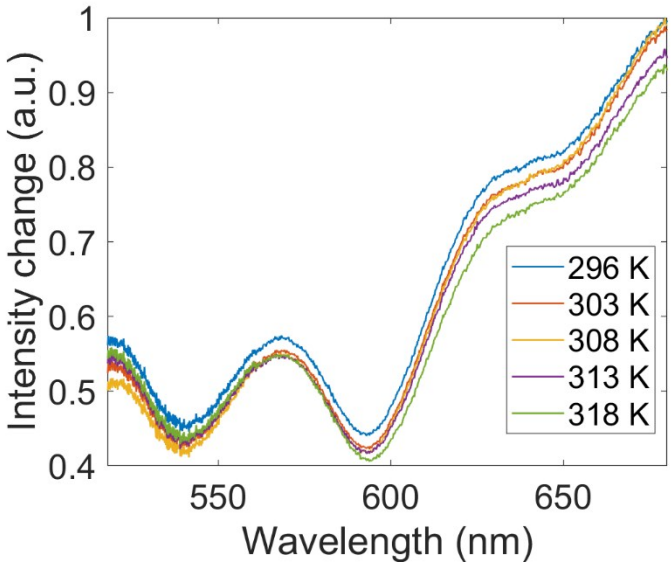

Figure S5: The spectrum of the MOF-coated sensor at different temperatures are measured. The spectra red shift as the temperature increases because the refractive index of the material (mainly from Au and Si) increases as temperature increases from 296 K to 318 K. The information is used to calibrate the baseline of the sensor during the measurement.

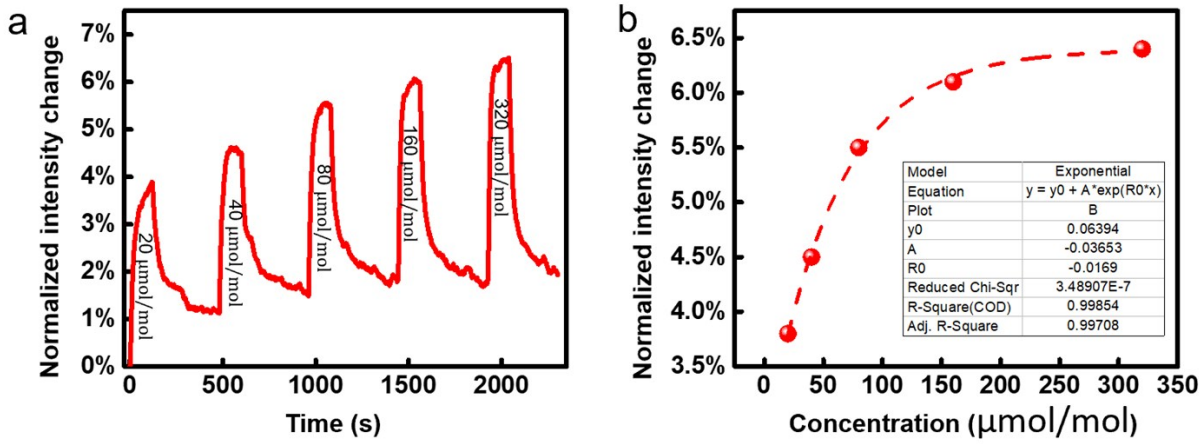

Figure S6: Results from a single set experiment to establish the dynamic range of the device for acetone monitoring. (a) Sensor response to acetone vapor with concentration from 20 µmol/mol (ppm) to 320 µmol/mol. This experiment was run to determine the upper limit of the NHA sensor. As from the exponential curve fitting of the sensor

response vs vapor concentration (b), the practical upper limit of the NHA sensor appears to be ≈ 300 µmol/mol.