

FABRICATION of SEMICONDUCTOR METAL OXIDE BASED GAS SENSORS for BREATH BIOPSY

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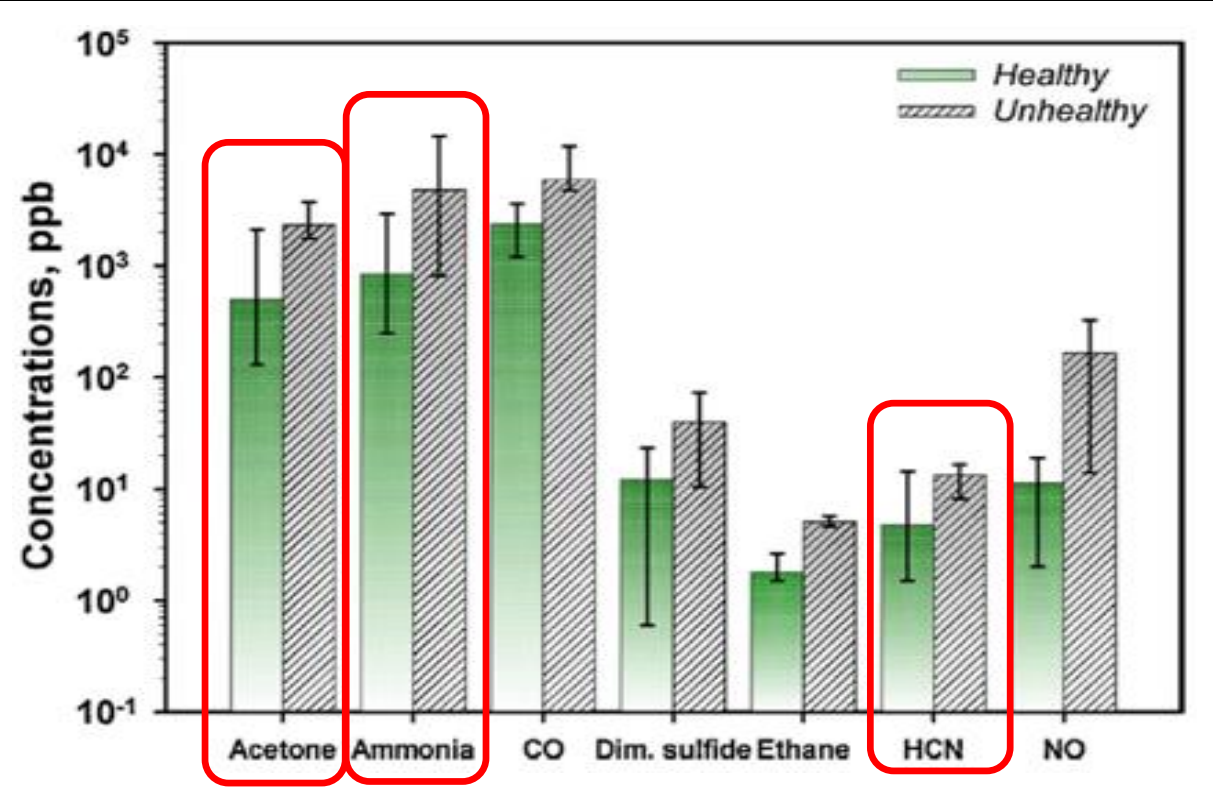
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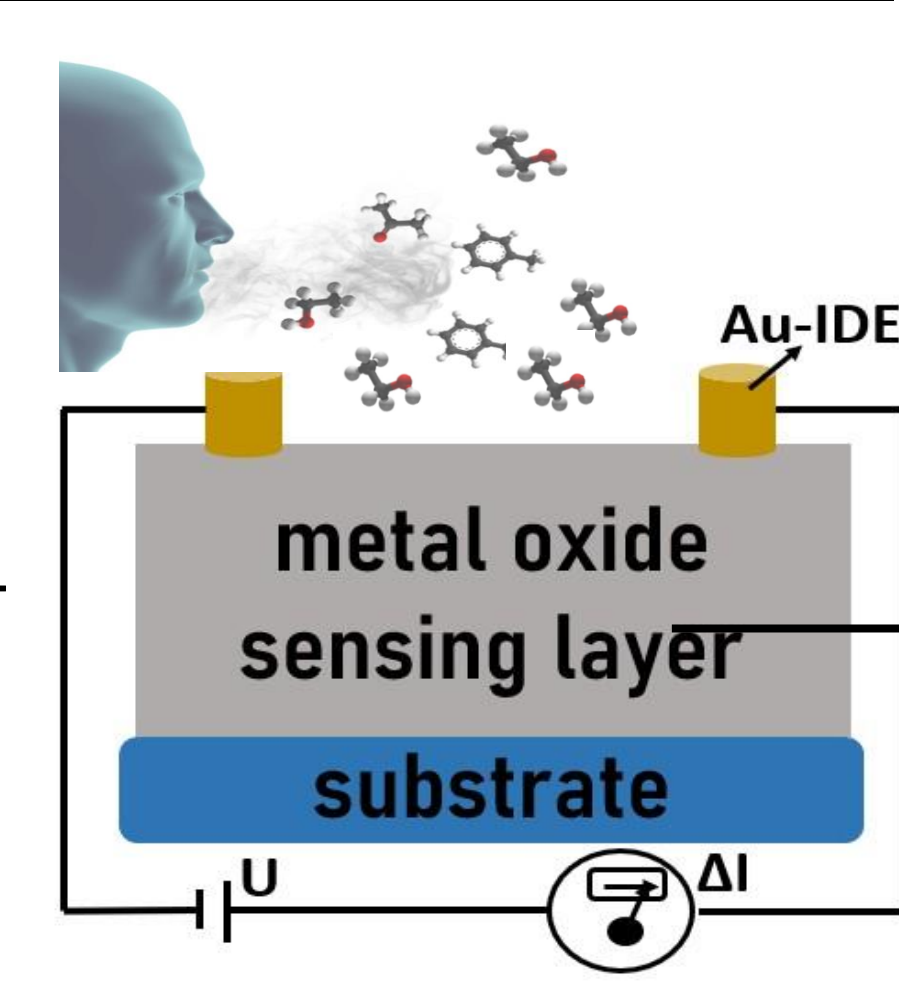
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A Non-invasive Diagnostic Way: Breath Biopsy & Semiconductor Metal Oxide (MOX) Materials

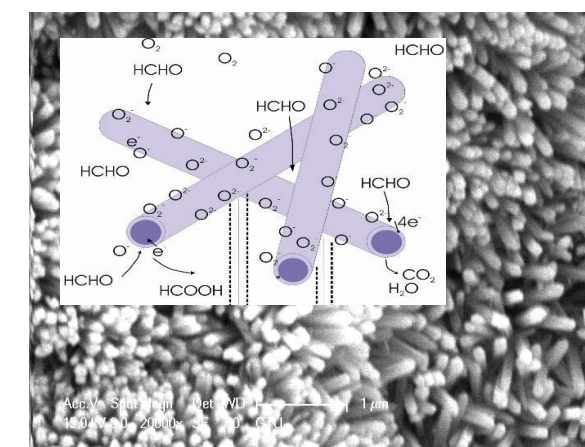


disease	biomarker	concentration
cystic fibrosiz	HCN	10 ppb
diabetes	acetone	1.8 ppm
kidney diseases	NH ₃	0.8 ppm

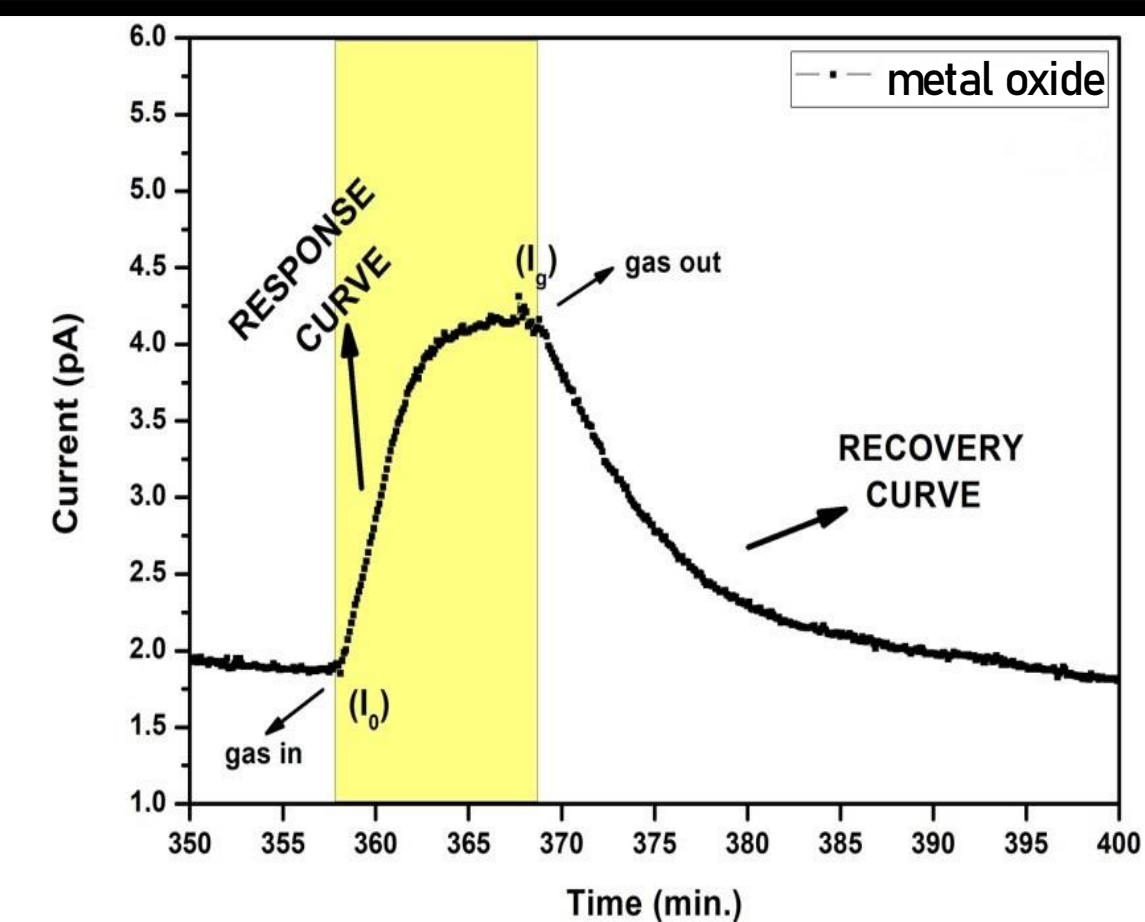


a typical metal oxide gas sensor

MOXs are one of the best candidate components for breath biopsy due to interaction with wide range of biomarkers



nanostructural morphology provides high surface-to-volume ratio and high sensitivity

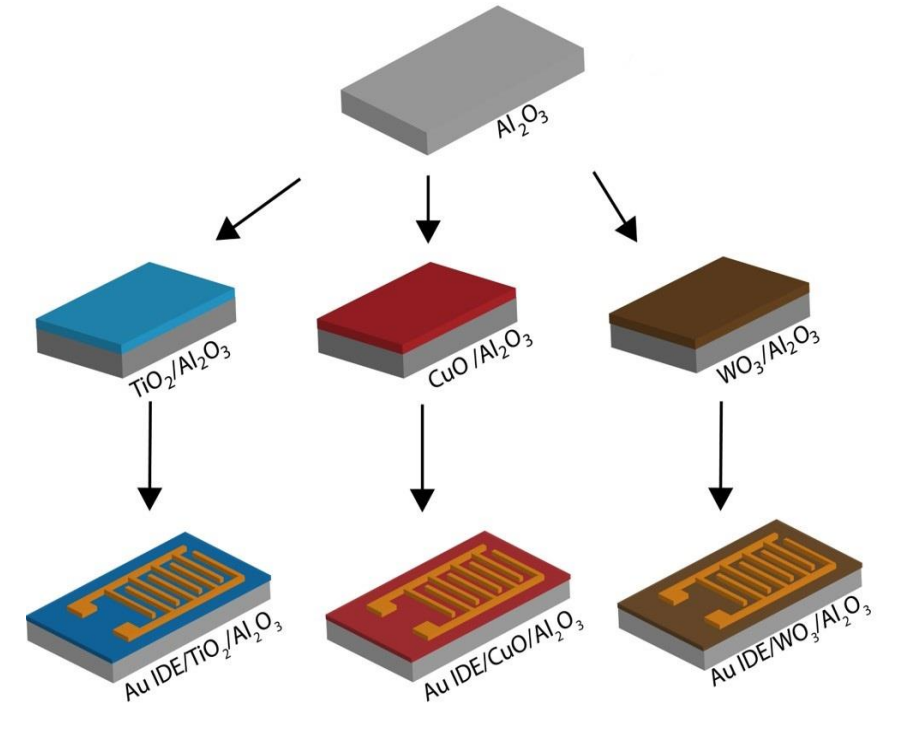


typical current-time graph of MOXs

- sensor response
- sensitivity
- selectivity
- response time
- recovery time
- reproducibility

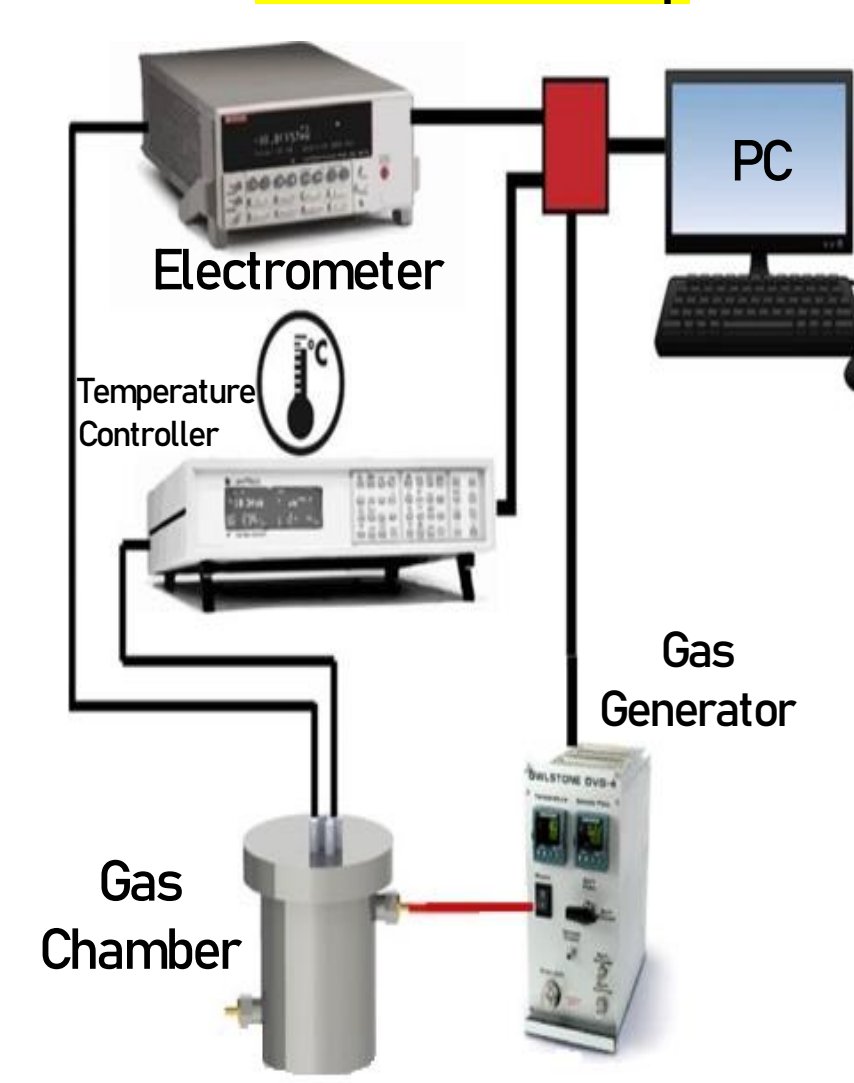
Sensor Fabrication & Structural Characterization

fabrication process of sensors

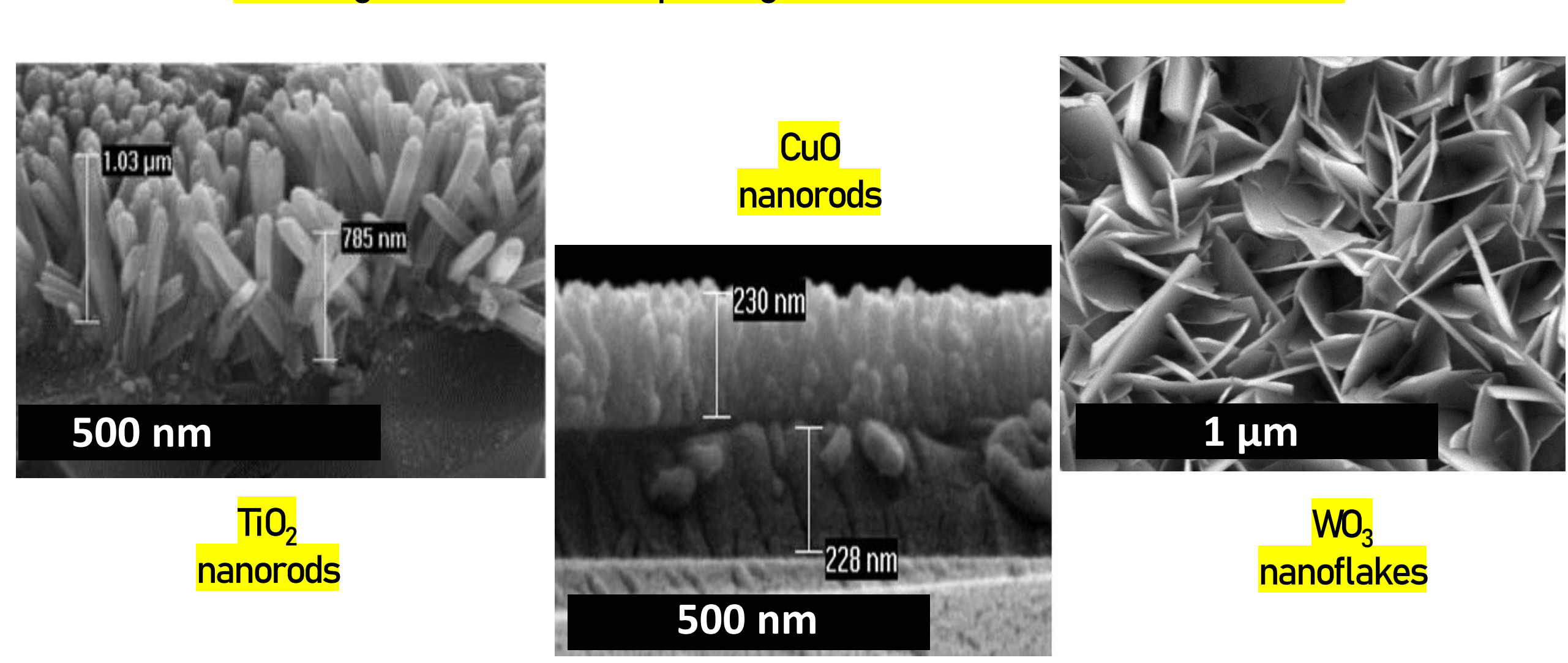


- very simple & environmentally clear hydrothermal route was performed on Al₂O₃ substrate
- Au-IDE(electrot) was coated on surface for sensor measurements

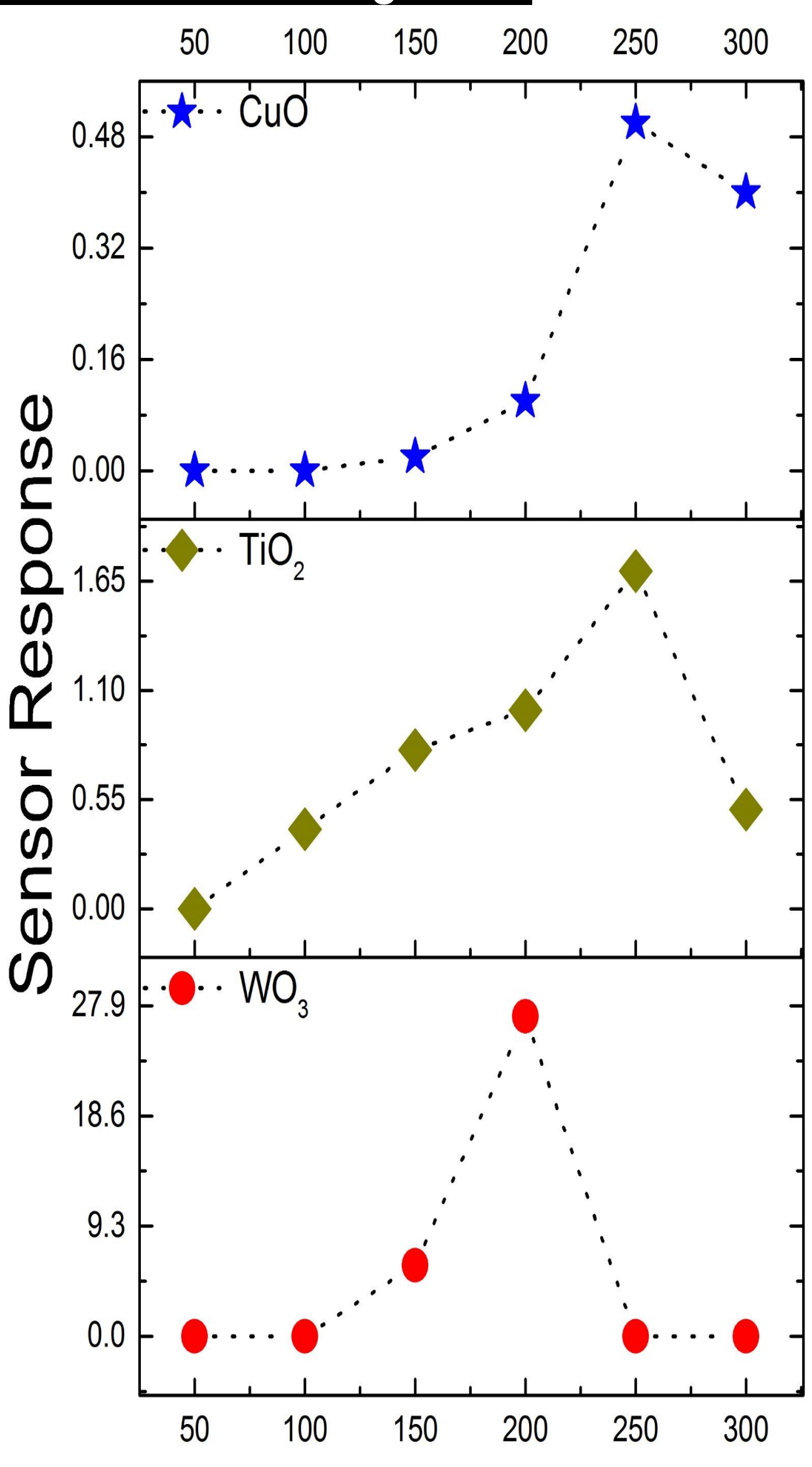
sensor test setup



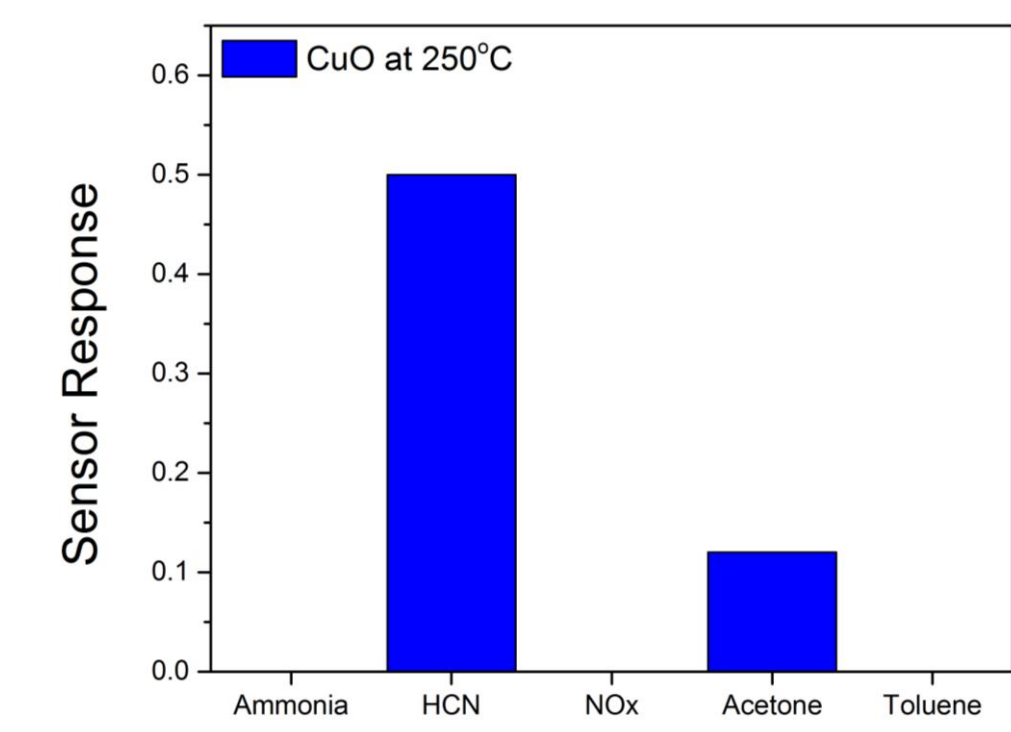
scanning electron microscope images of fabricated nanostructural MOXs



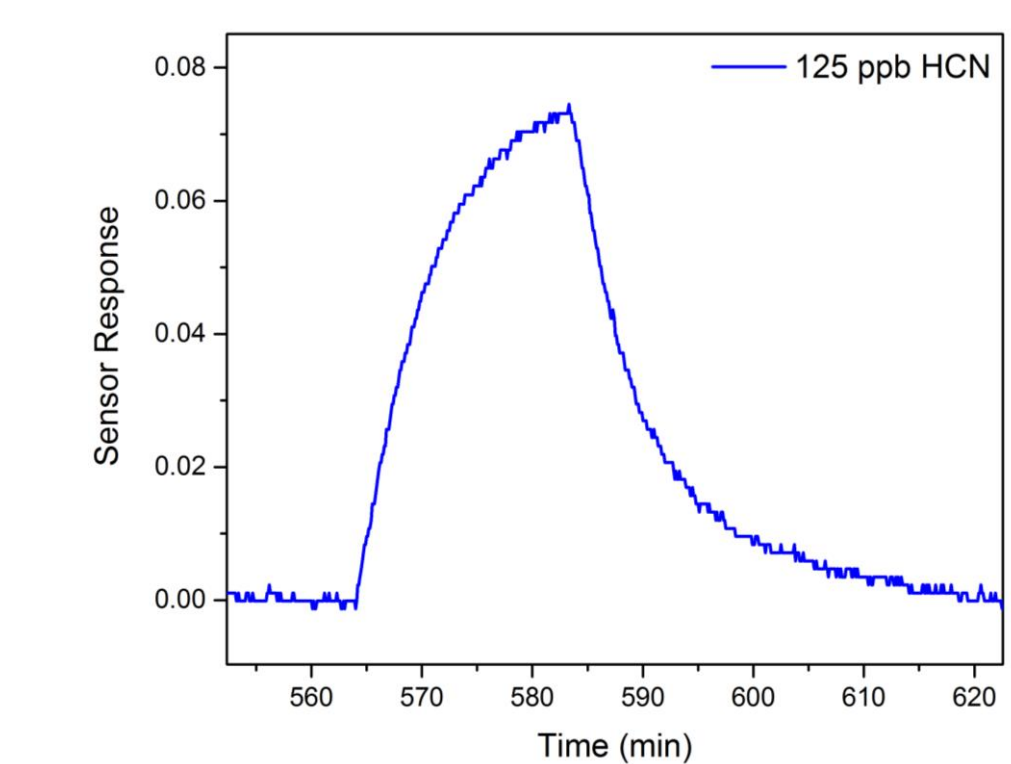
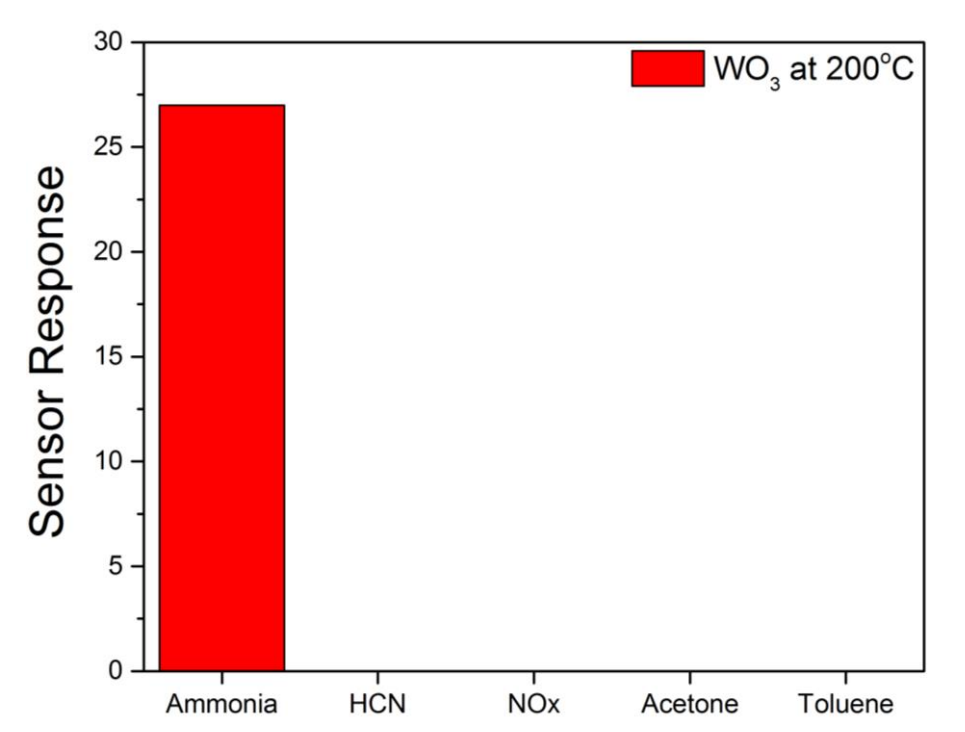
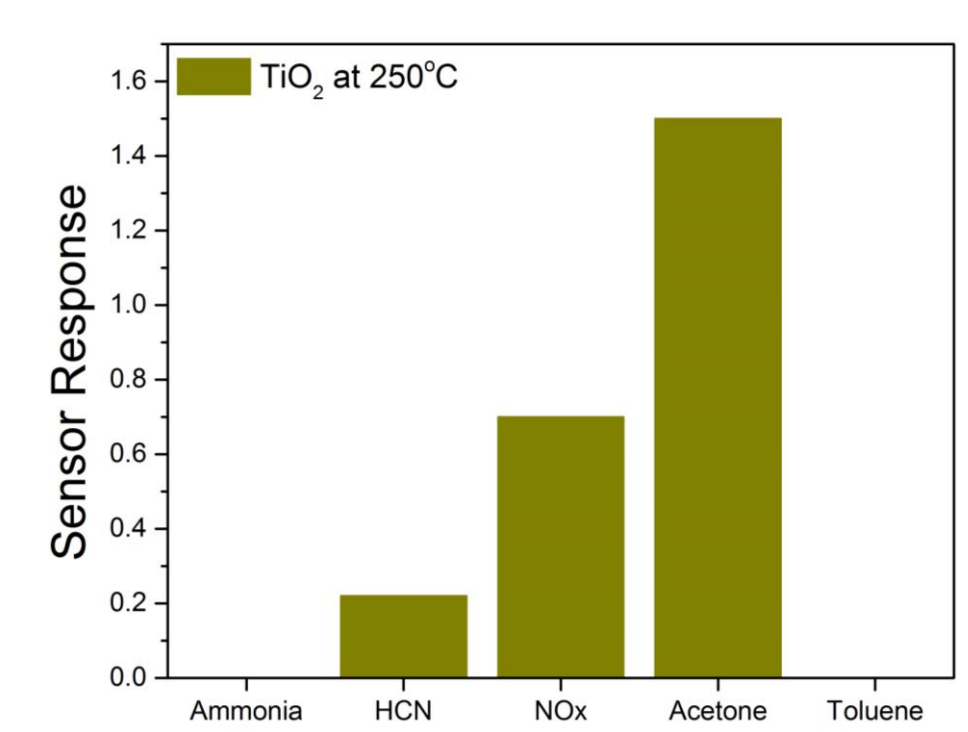
Biomarker Sensing Tests



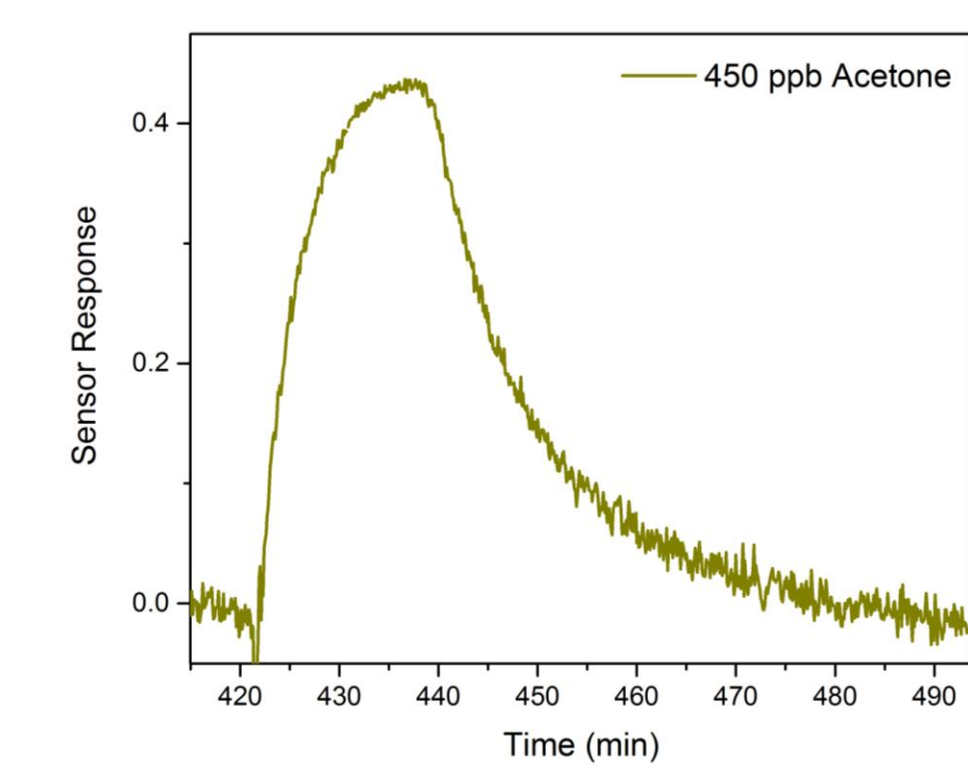
temperature depending sensor response of each sensor against 1 ppm biomarker (HCN for CuO; acetone for TiO₂; ammonia for WO₃)



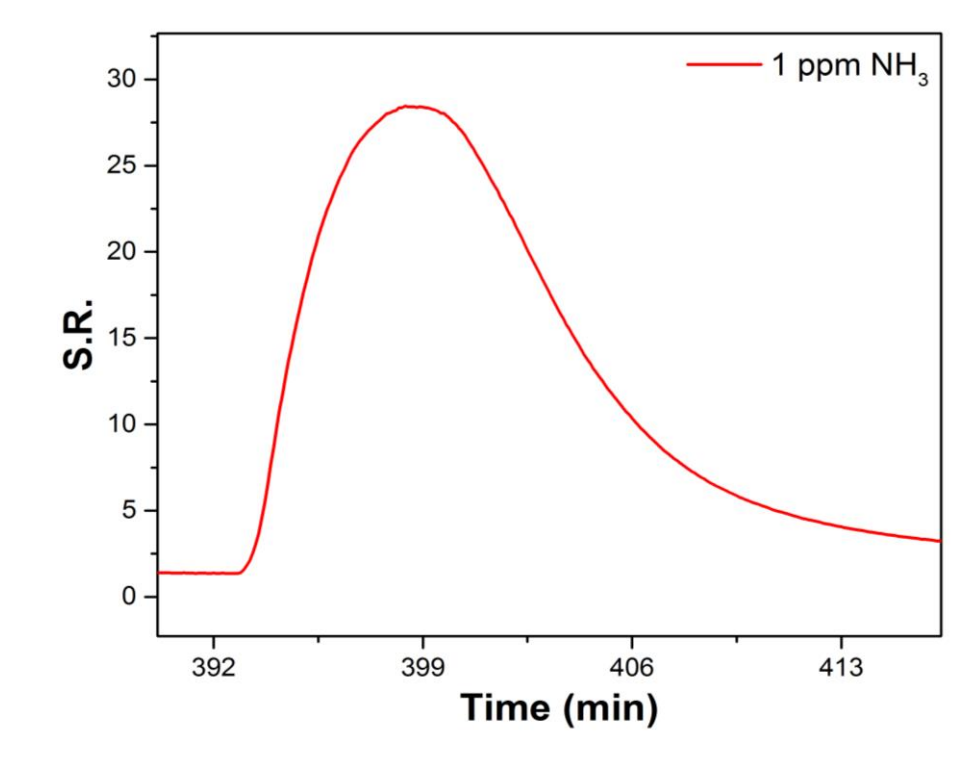
sensor response of each sensor against varying interference gases at optimal operating temperature



sensor response peak of CuO against 125 ppb HCN



sensor response peak of TiO₂ against 450 ppb acetone



sensor response peak of WO₃ against 1 ppm ammonia

- optimal operating temperature was identified for each sensor
- clear sensor response peaks
- 3 excellent sensor performances at low diagnosis limits for 3 diseases;

cystic fibrosiz → CuO
diabetes → TiO₂
kidney diseases → WO₃

Conclusion & Overview

each of the sensors are good candidates for further sensor array applications due to

- ✓ easy & clean fabrication
- ✓ cheap
- ✓ highly sensitive & selective
- ✓ portable & non-invasive

for early diagnosis of kidney diseases, cystic fibrosiz & diabetes disease

