



Multi Sensor Platform for Smart Building Management project: research at the University of Brescia

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Tema: aria





Who are we?



At international level the mission of **SENSOR: Nanotechnologies for Sensing and Advanced Applications** is to design and develop materials and processes to realize devices and systems for functional applications.

Nanomaterials

Chemical
Sensors

Energy

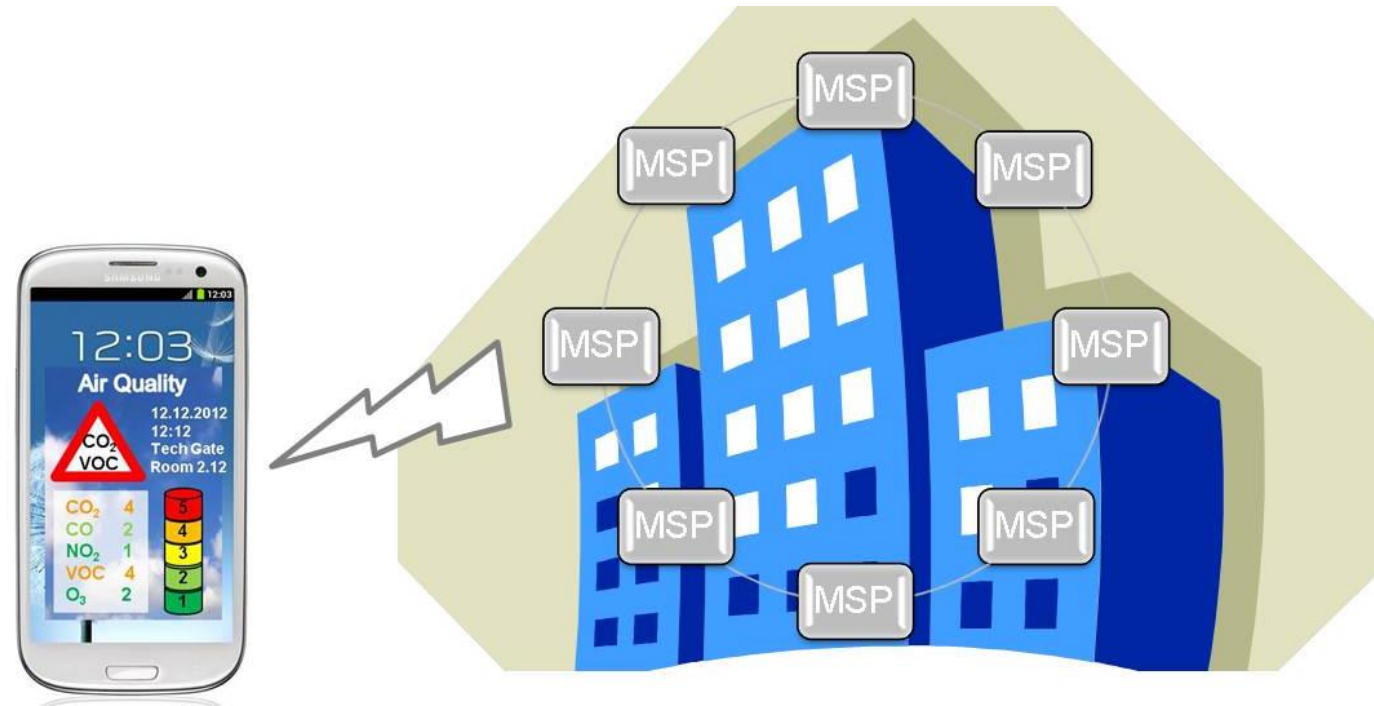
Bio-devices

Artificial
Olfaction



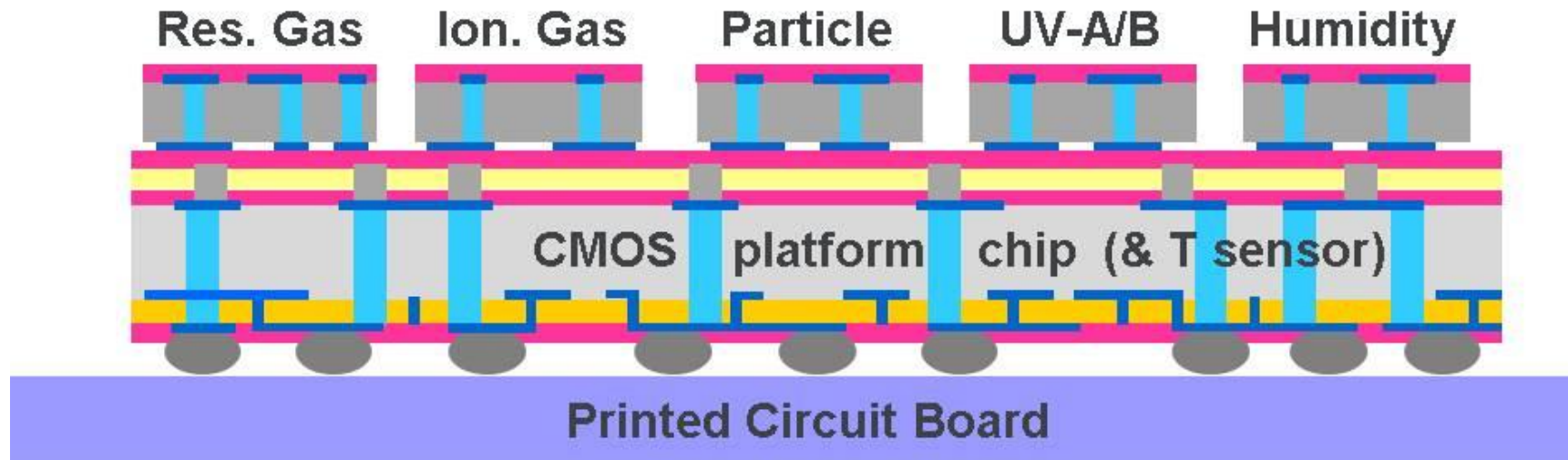
OVERVIEW MSP-PROJECT

FP7 Project: MSP - Multi Sensor Platform for Smart Building Management



GOAL OF MSP-PROJECT

- Development of smart 3D-integrated multi-sensor systems enabling indoor and outdoor environmental monitoring!



Air Quality Monitoring

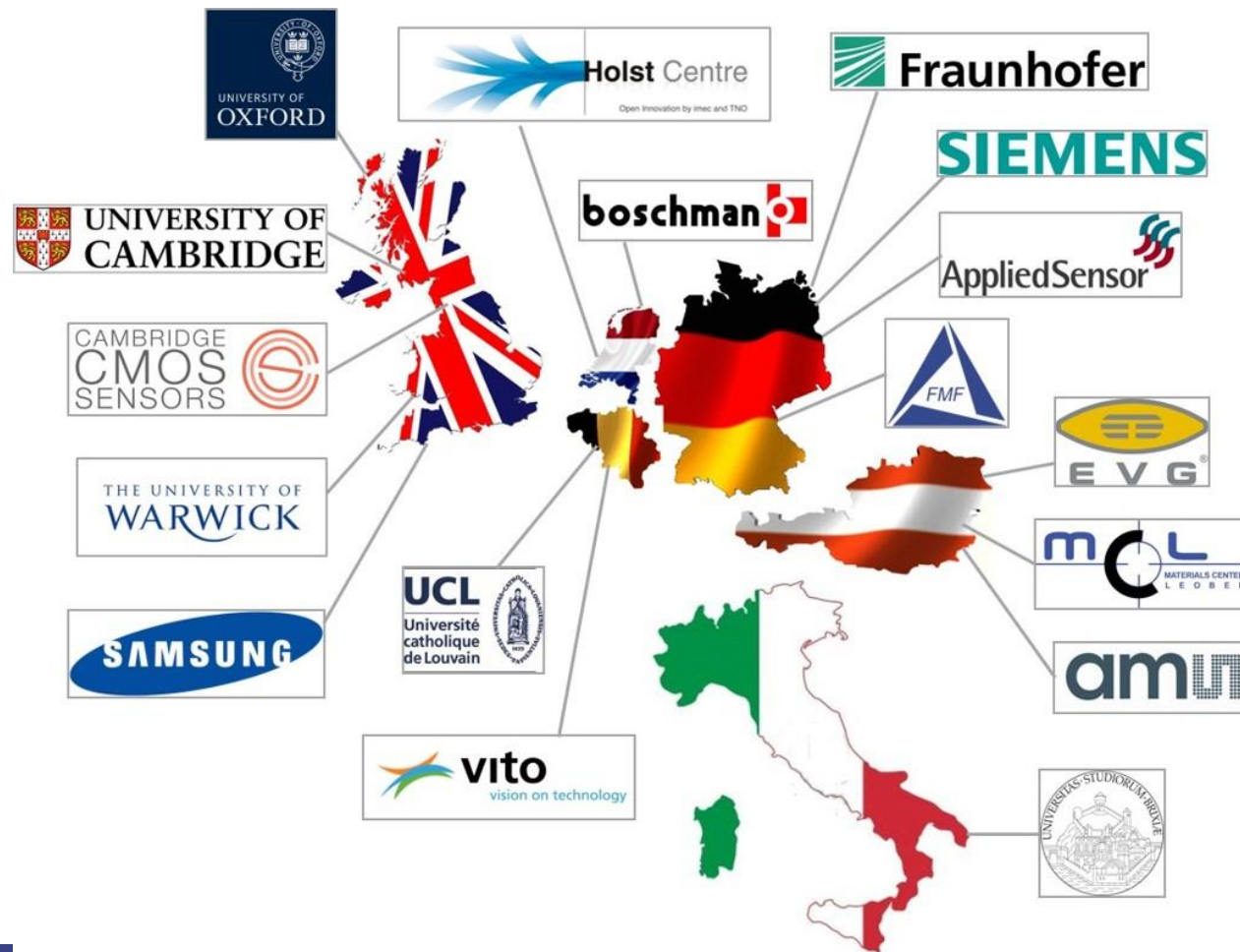


Indoors
CO, CO₂, VOCs, PM



Outdoors
NO₂, O₃, CO, PM₁₀, PM_{2.5}, UFPs

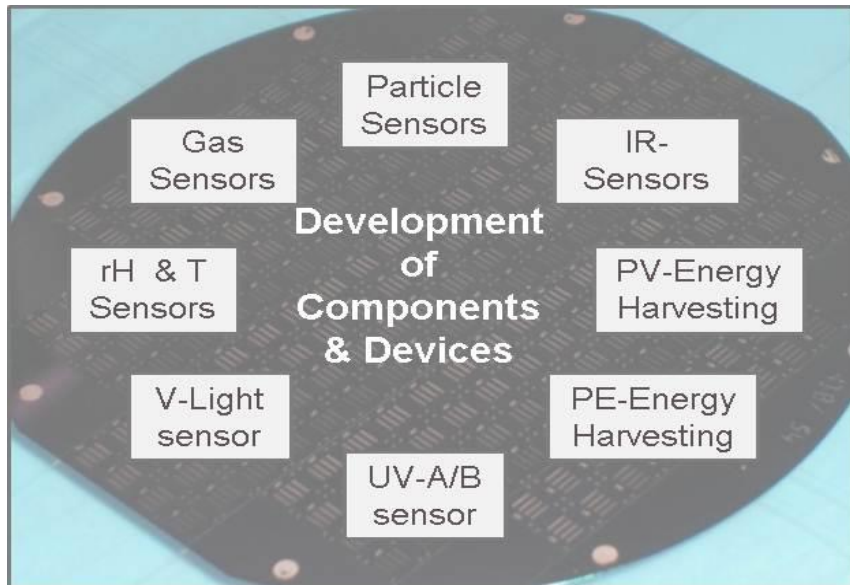
MSP CONSORTIUM



- 17 partners
- 6 countries
- € 18.5 Mio
- 1/9/2013 start
- 3.5 years

MSP "TOOL-BOX"

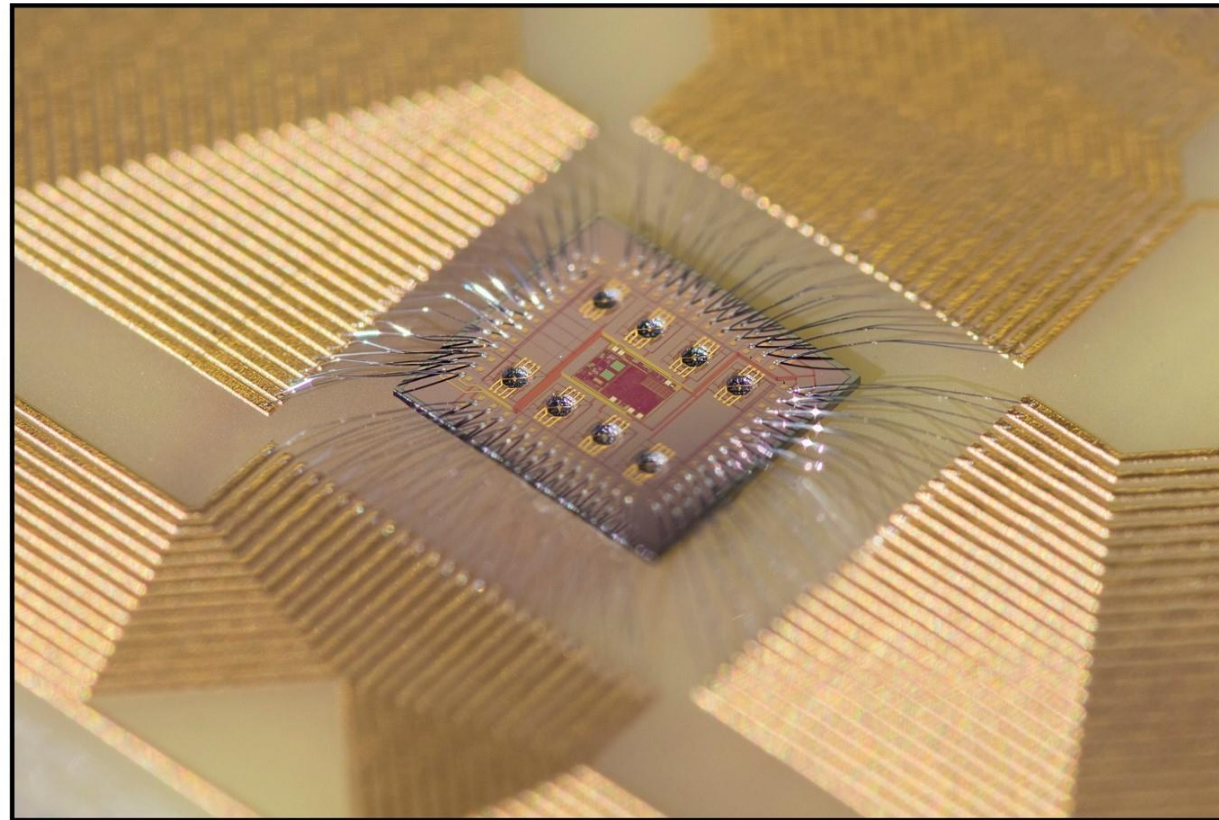
- Development of novel components & devices as „tool-box“ for 3D-system integration



- Gas sensors and rH-sensor based on SnO_2 , CuO , ZnO , WO_3 ,...-NWs, (bi)metallic NPs, Graphene, CNTs, & AlGaIn/GaN
- Thin film bulk resonator (FBAR) particle sensor
- Thermopile IR-sensors
- Photovoltaic energy harvester with interdigitated back contact (IBC) structure
- Piezoelectric energy harvester based on ZnO-NWs and PVDF films
- SiC- and ZnO-NW based UV-A/B sensor

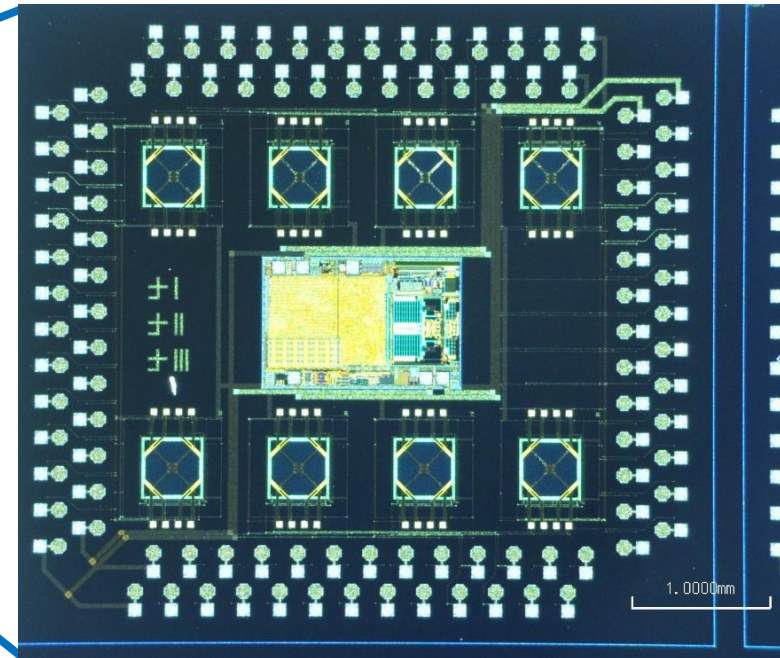
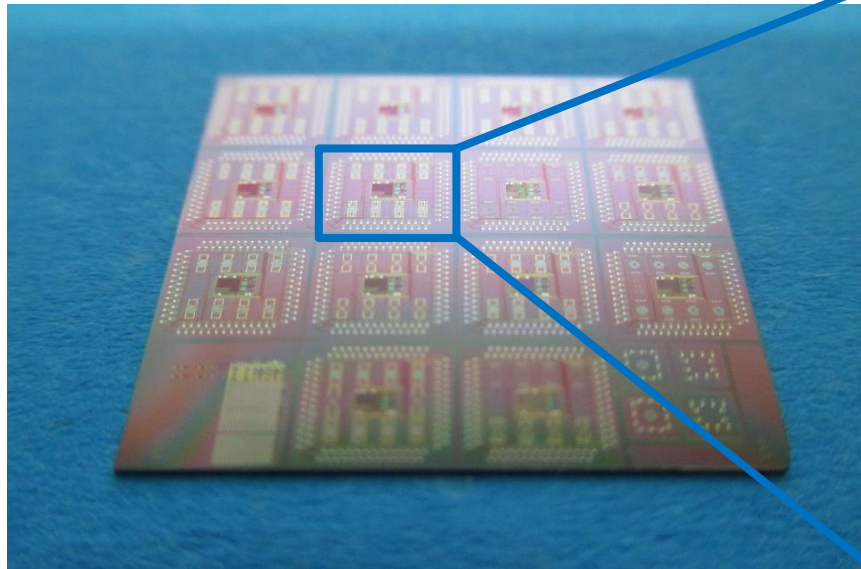
Multi Gas Sensing Device

- Worldwide unique CMOS based micro-hotplate Chip
- 8 micro-hotplates for 16 gas sensors (up to 400°C) (MCL, AMS, UNIBS)



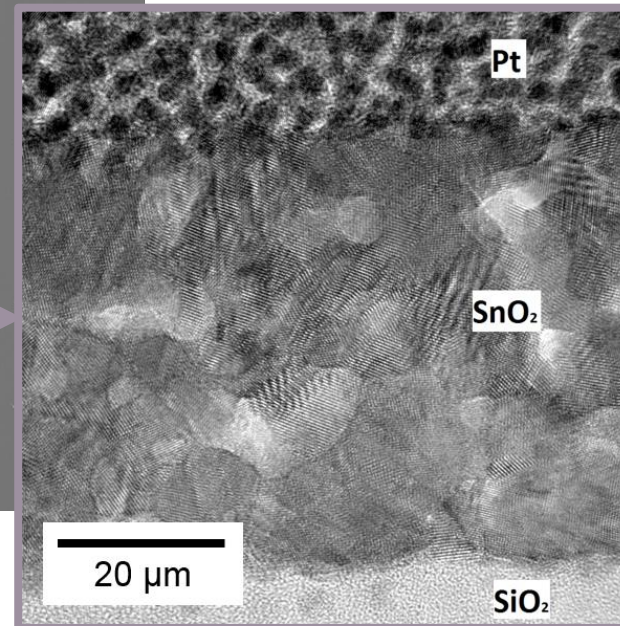
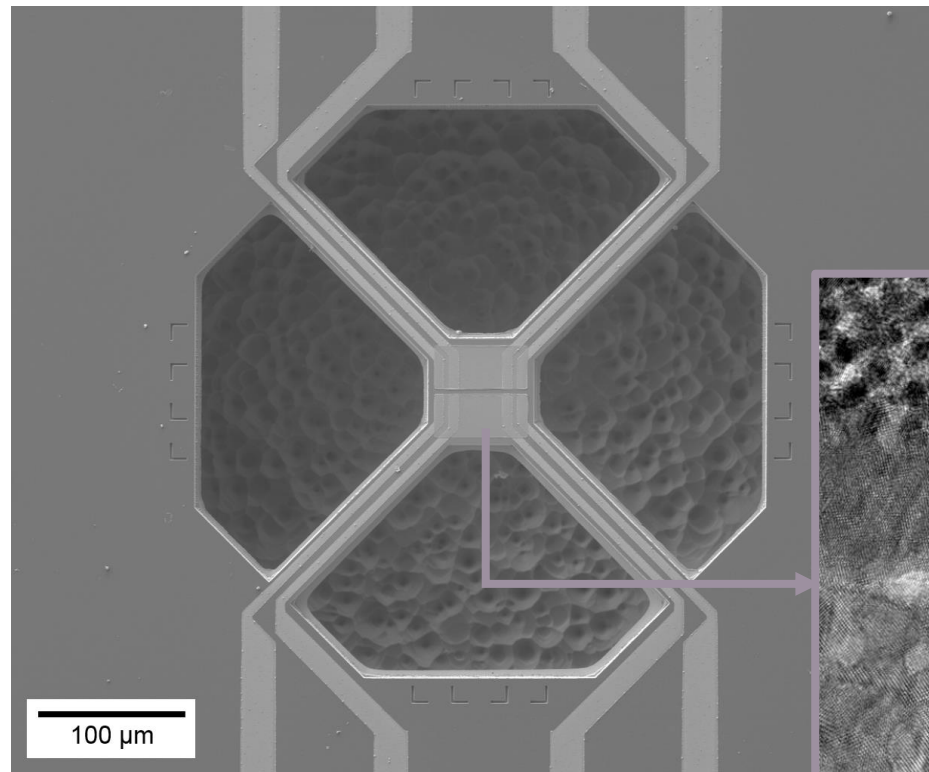
Multi Gas Sensing Device

- Employment of integrated μ hp arrays
- Employment of Through-Silicon-Via (TSVs) technology
- **Unique μ hp-array chip worldwide !**



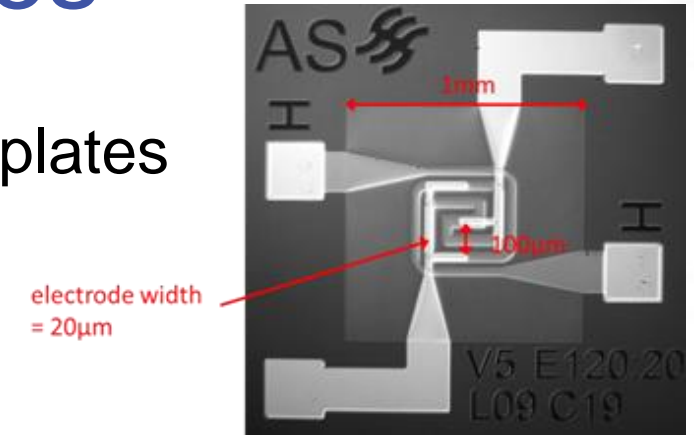
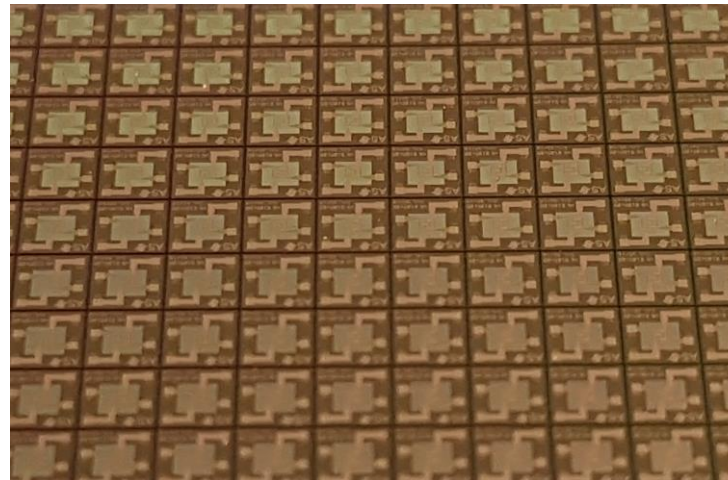
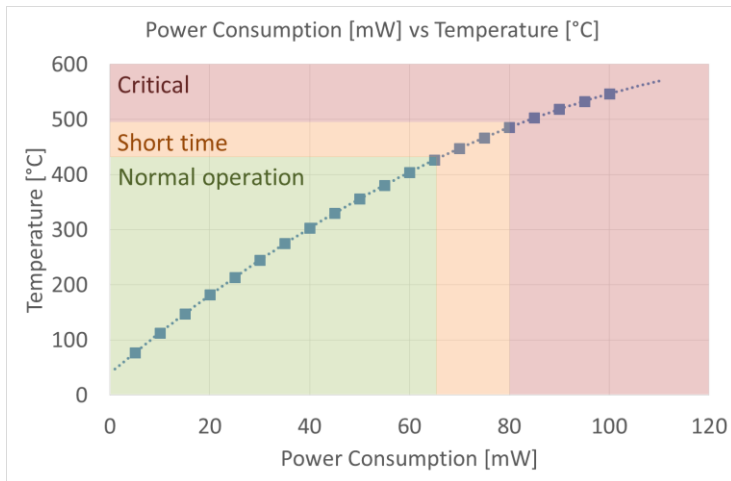
Multi Gas Sensing Device

- Patterning by photo lithography and Ar ion etch
- Release of the microhotplate by XeF_2 etching



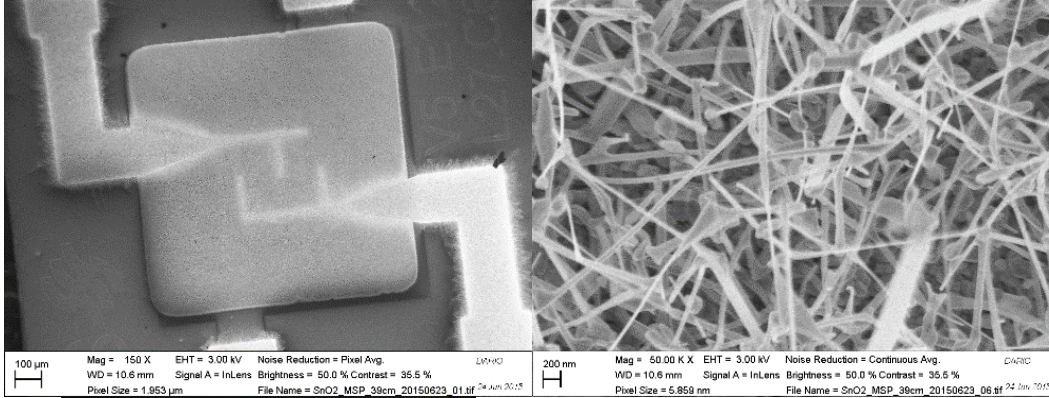
UNIBS Gas Sensing Devices

- **AppliedSensor** company (now **AMS Germany**) microhotplates
- Already used in commercial devices (thin & thick films).

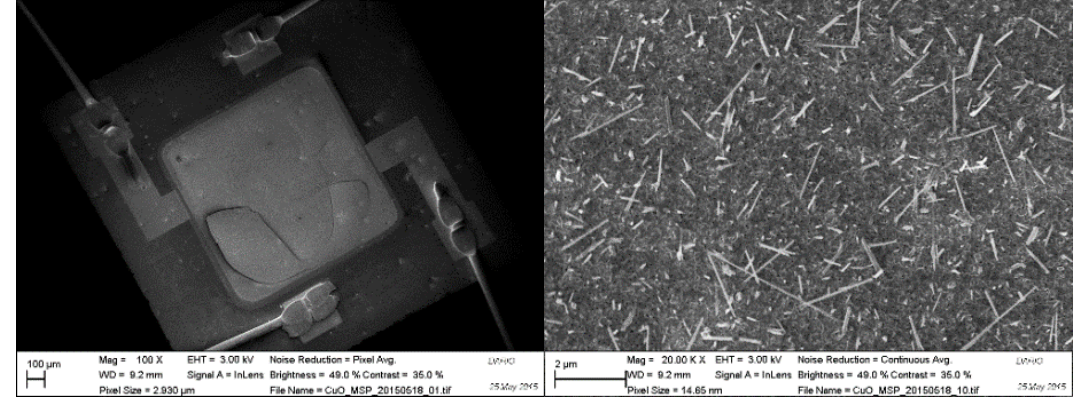


UNIBS Gas Sensing Devices

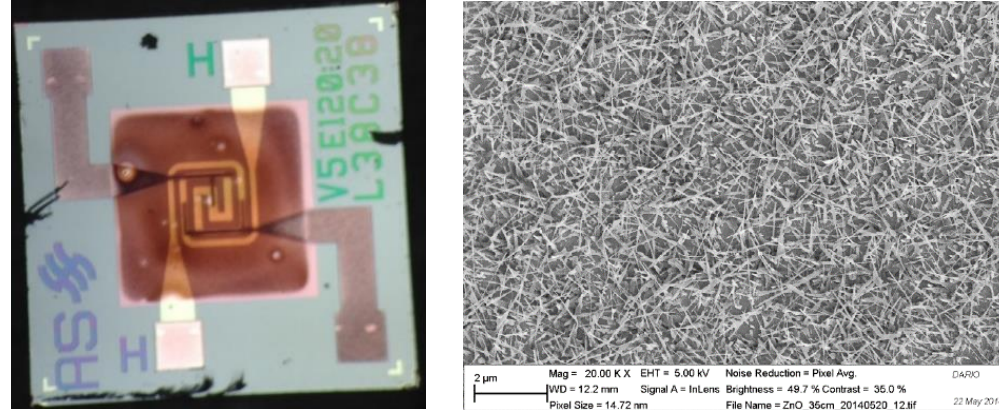
SnO₂



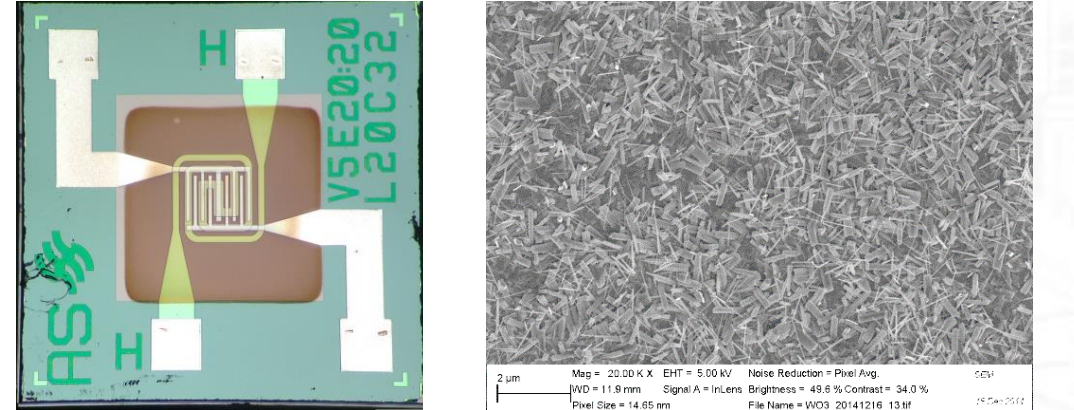
CuO



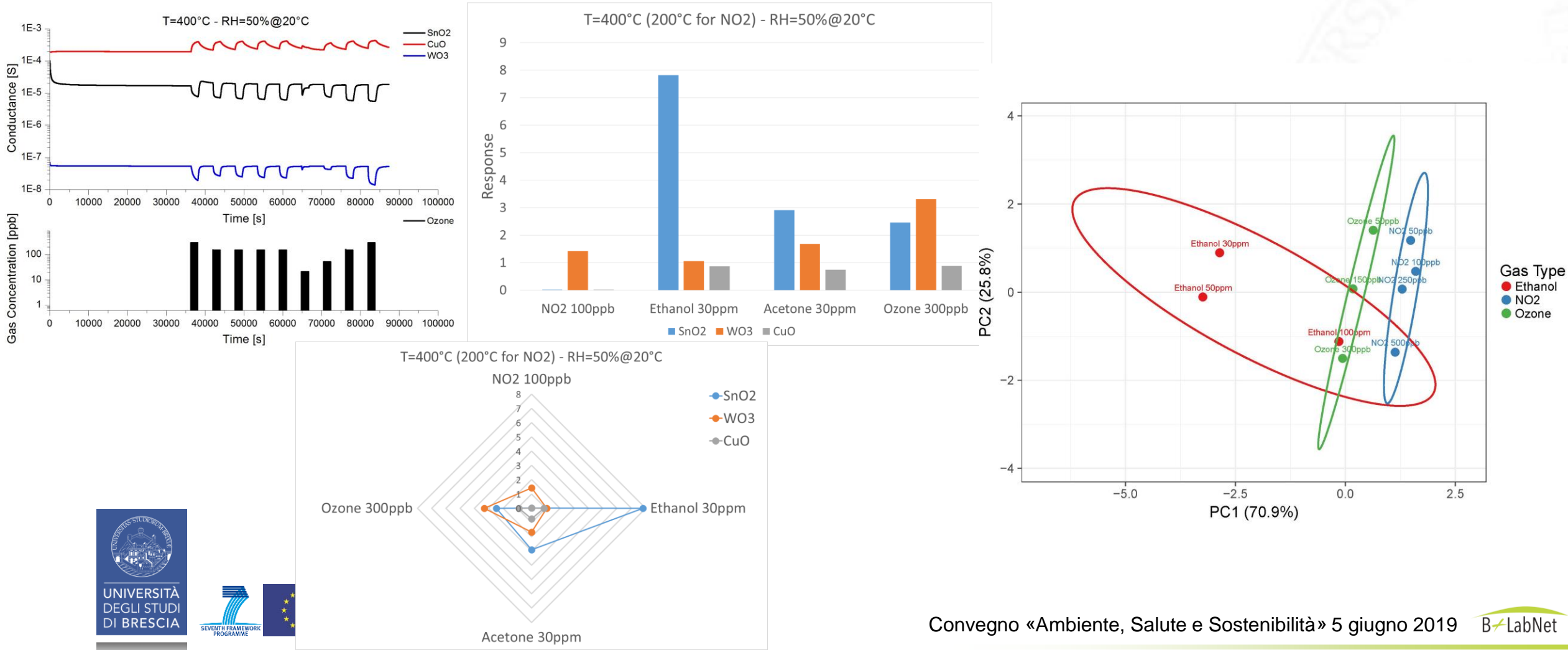
ZnO



WO₃

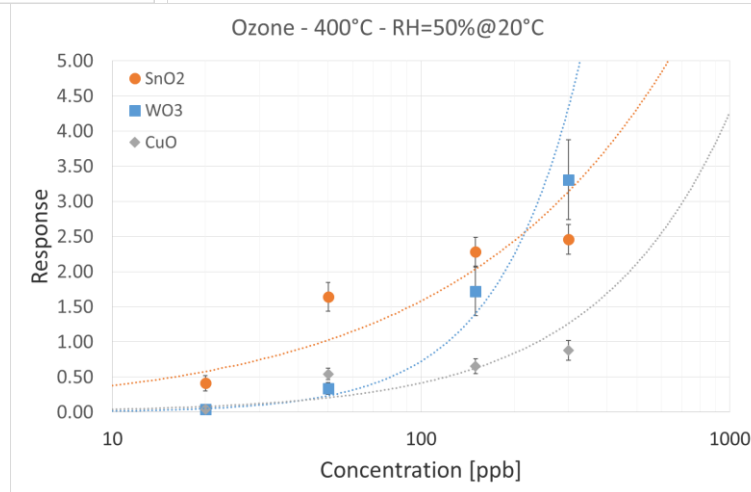
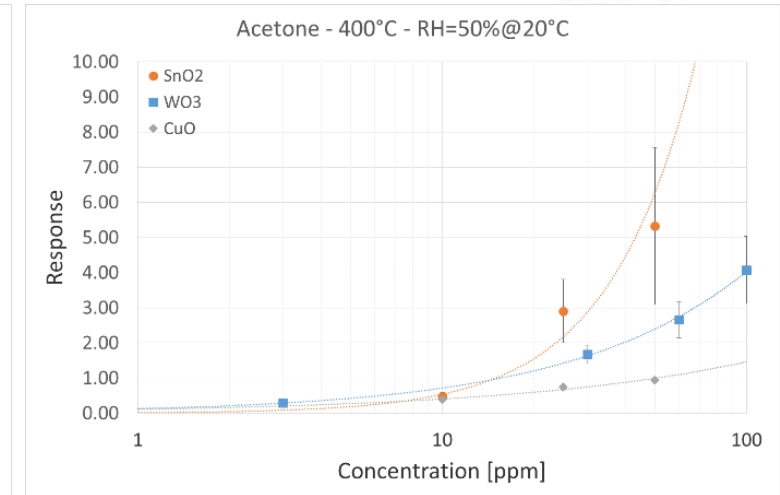
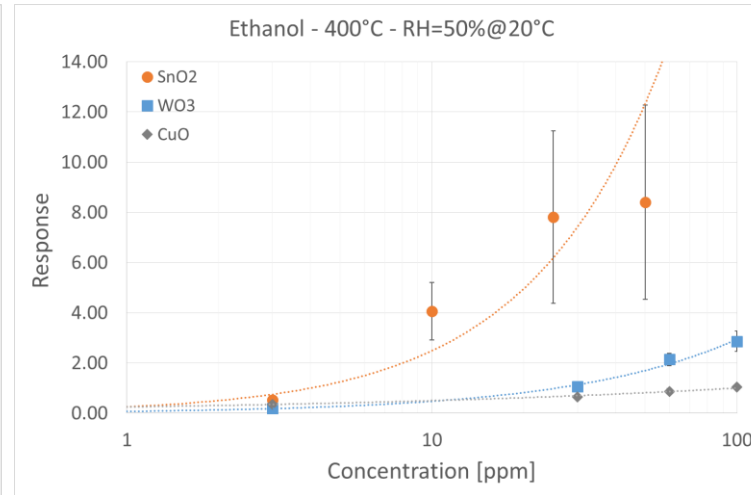
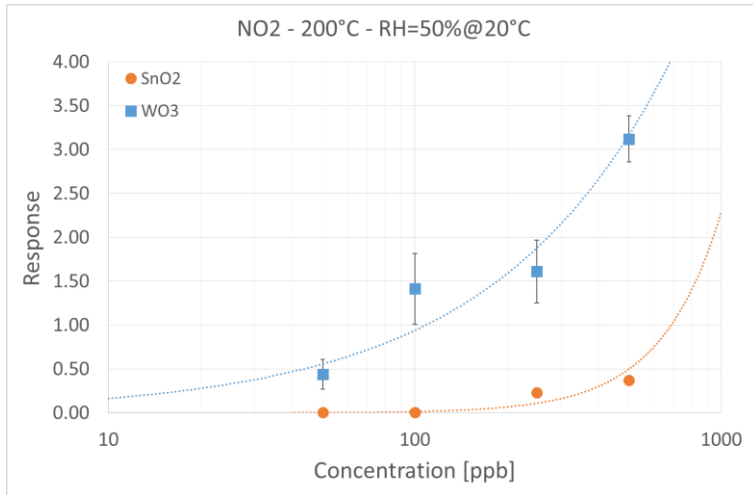


■ Proof-of-concept gas sensing measurements toward Ethanol, Acetone, CO and O₃.



UNIBS Gas Sensing Devices

- Proof-of-concept gas sensing measurements toward Ethanol, Acetone, CO and O₃.

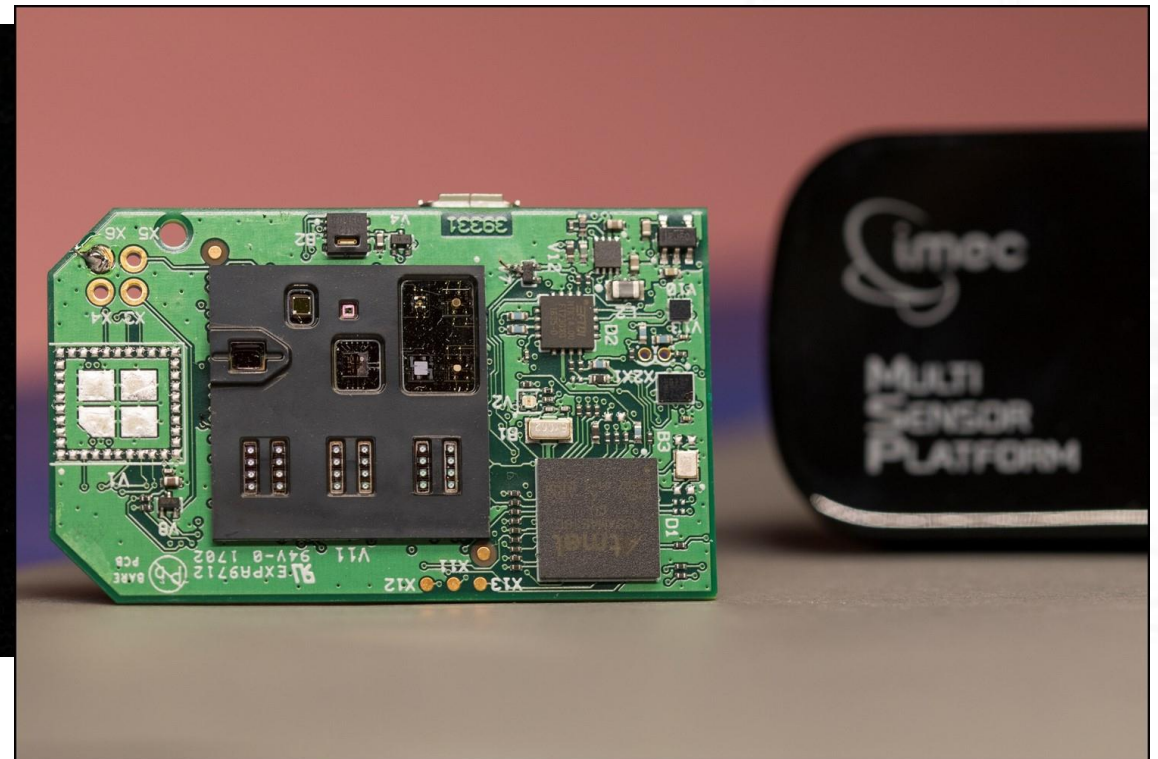
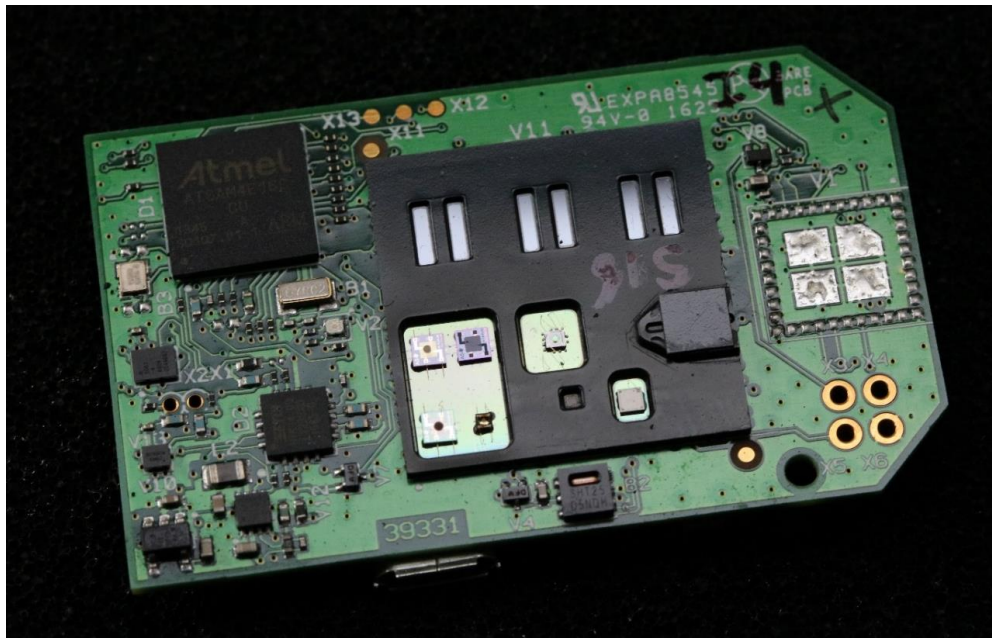


■ Estimated detection limits

	NO ₂	Ethanol	Acetone	Ozone
SnO ₂	>1ppm	5ppm	15ppm	40ppb
WO ₃	100ppb	25ppm	15ppm	150ppb
CuO	>1ppm	40ppm	50ppm	300ppb

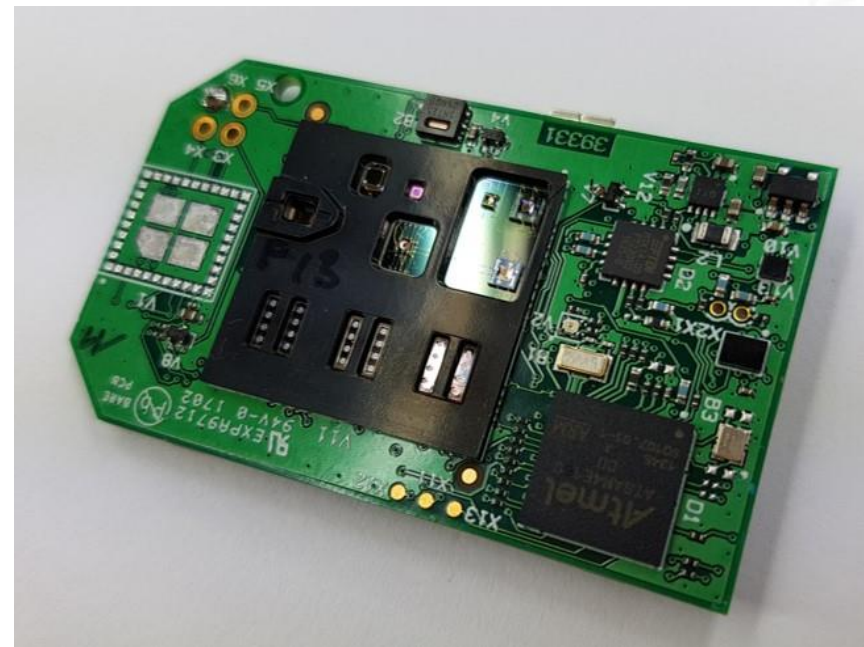
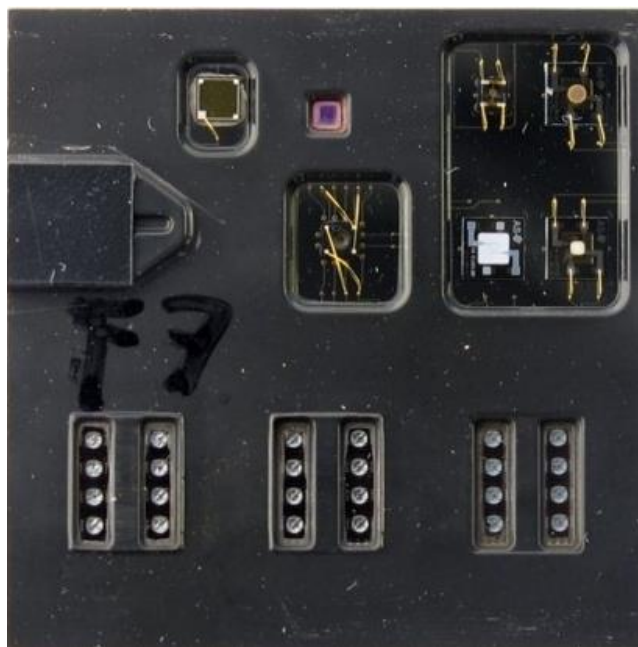
MSP DEMONSTRATOR

- MSP demonstrator on PCB designed to fit into the housing of the wearable wristband device (IMEC)
- Wireless system with best-in-class performance



MSP DEMONSTRATOR

- The final MSP demonstrator device represents a unique integrated system worldwide
- MSP demonstrator on PCB designed to fit into the housing of the wearable wristband device

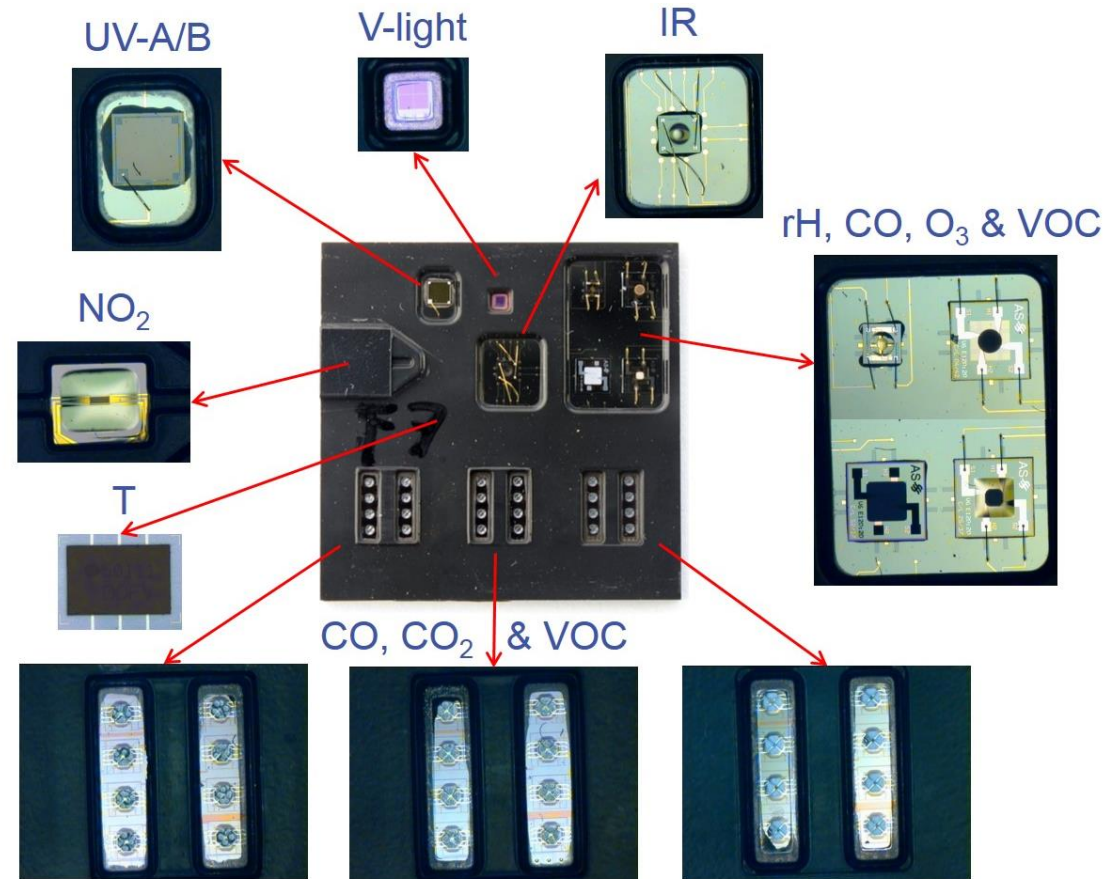


MSP DEMONSTRATOR



MSP DEMONSTRATOR

- Fully 3D-integrated overmolded MSP demonstrator device implementing 57 sensor devices!



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+ Few others missing!

