European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

Final Meeting at PRAGUE (CZ), 5-7 October 2016

New Sensing Technologies for Air Quality Monitoring

Action Start date: 01/07/2012 - Action End date: 15/11/2016 - EXTENSION: 15/11/2016

Summary of research and innovations needs for WG1: Sensor Materials and Nanotechnology

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General inputs from WG1 session

Sensing material = key element for gas sensor

Modulation of physical and/or chemical properties

Possibility to shape the sensing material / target gas

To probe what material property is impacted by gas exposure

Great importance of transducing mode

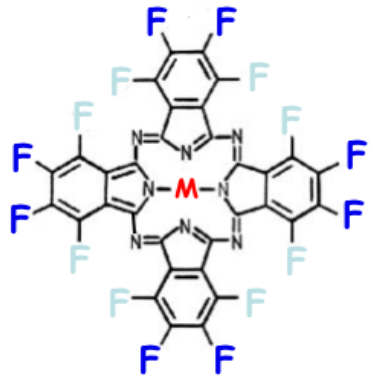
Sensing performances enhancement: How to proceed?

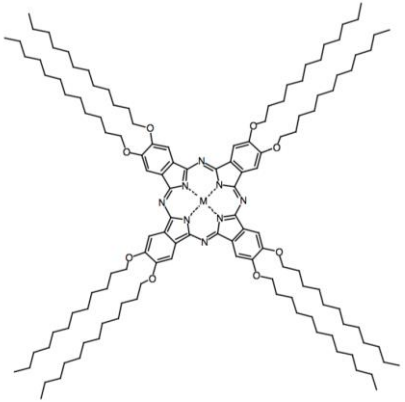
- Nanostructuration
- Molecular engineering
- Functionalization
- Hybrid materials
- Heterostructures

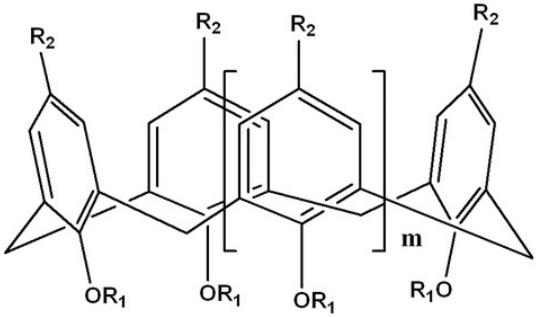
Enhancement by chemical engineering

Modulation of material properties (M. Bouvet, France)

Solubility, hydrophobicity, conductivity and sensing potentiality





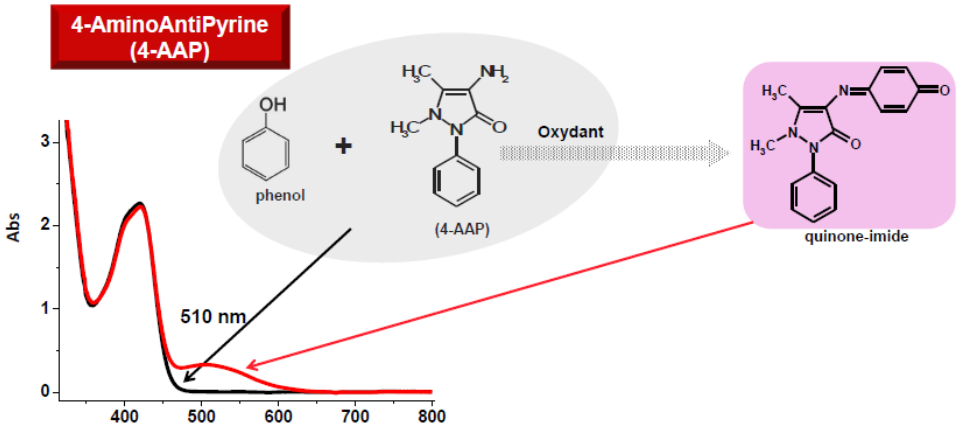


m = 1; 2; 3; 4; 5; 6

Tuning of chemical reactivity (C. Theron, France)

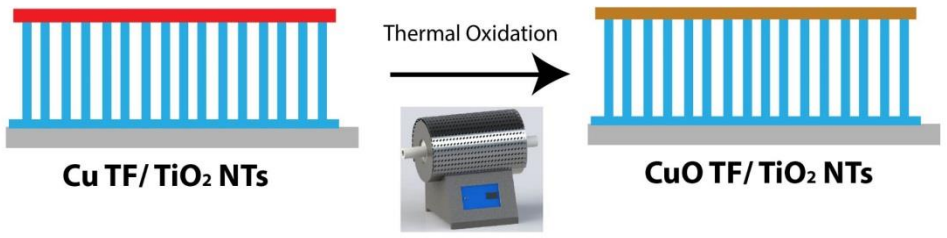
Targeted pollutant

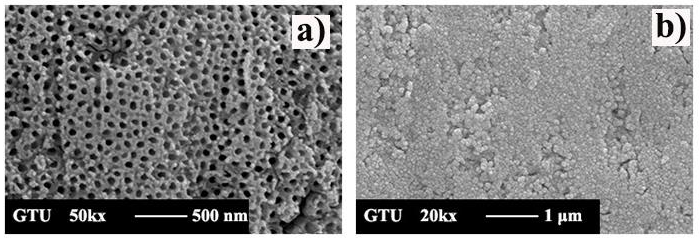
Probe molecule ?

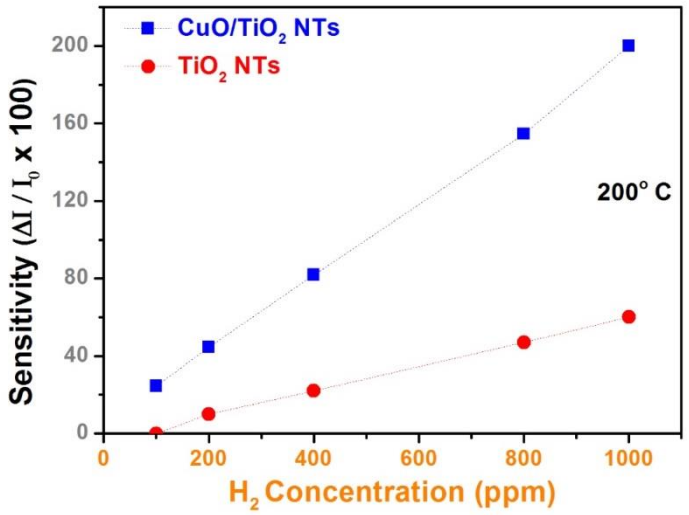


Enhancement by nanostructuration

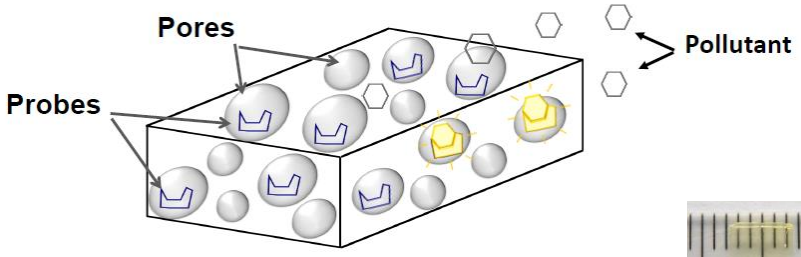
Heterostructures for hydrogen detection (Z.Z. Ozturk, Turkey)

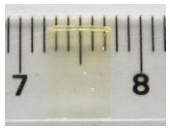




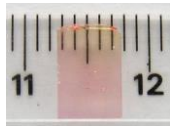


Nanoporous material for phenol detection (C. Theron, France)





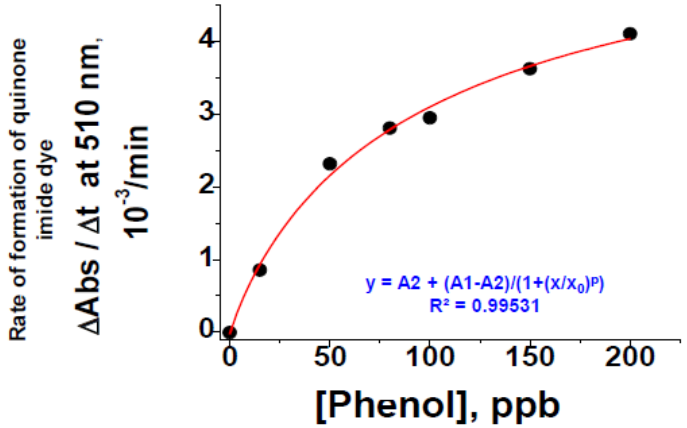
Original material



After phenol exposure

Calibration curve for PhOH detection in air

Conditions: 500 mL/min, 22 °C, 50% relative humidity



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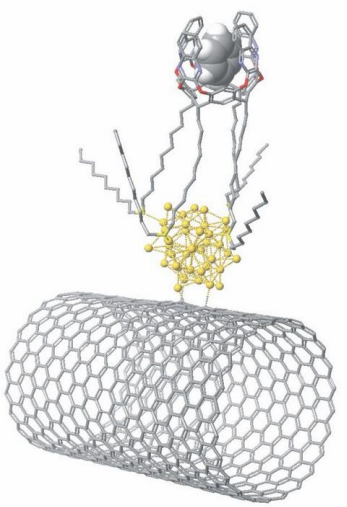
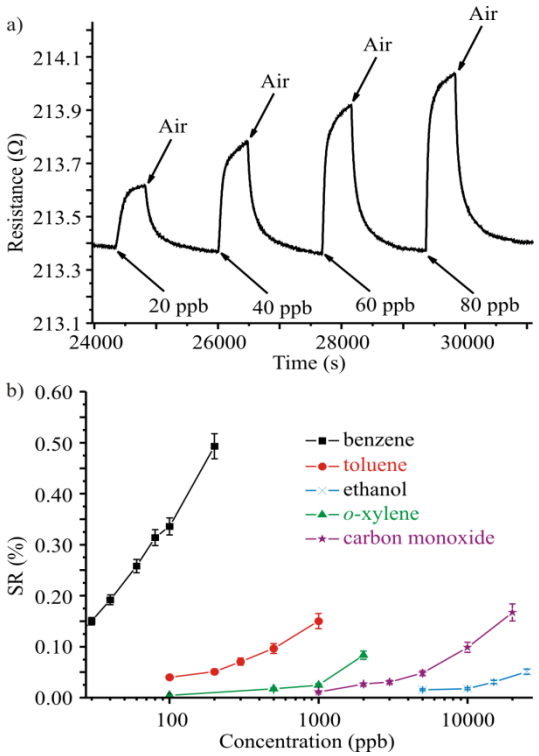
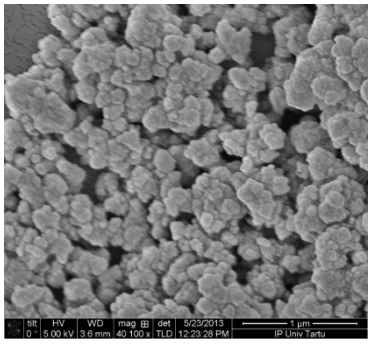
Enhancement by functionalization

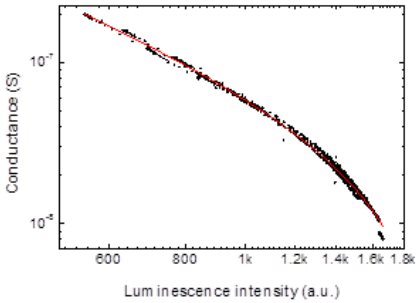
Cavitands
for molecular recognition
(E. Llobet, Spain)

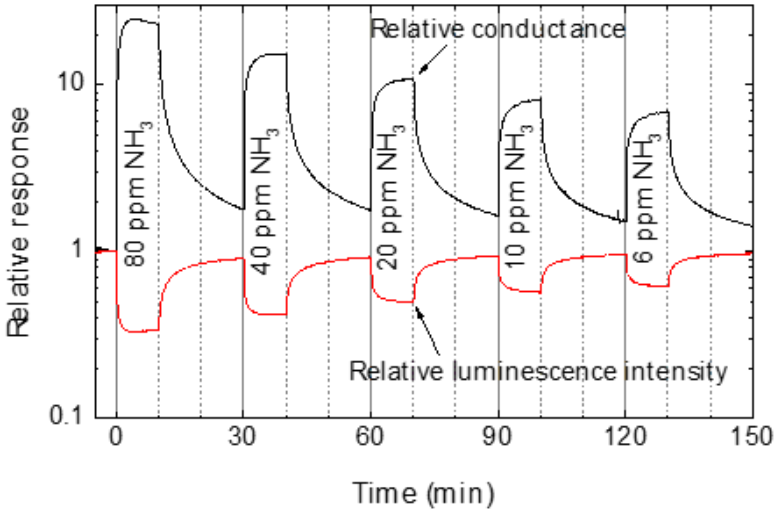




Doping by rare-earth
for strong luminescence
(R. Jaaniso, Estonia)

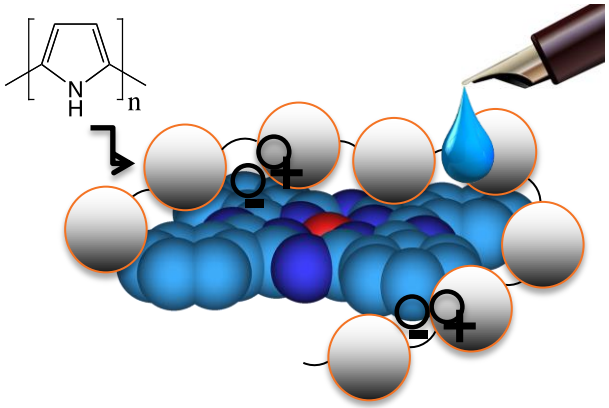


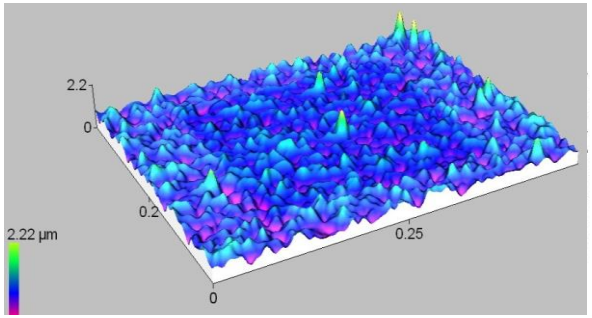


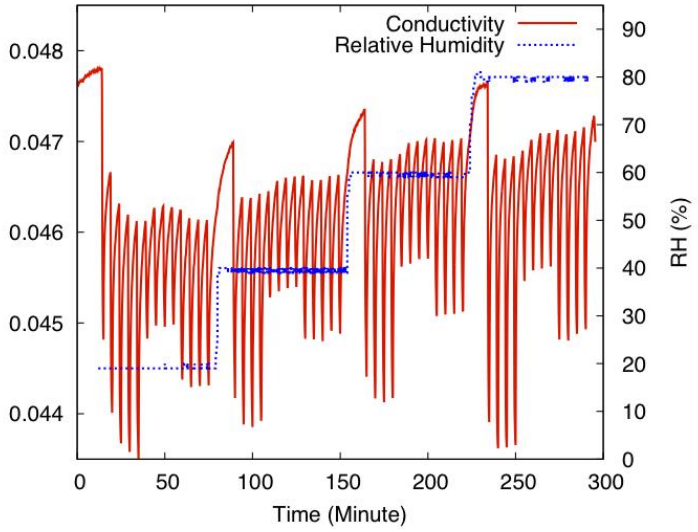


Enhancement by hybrid materials

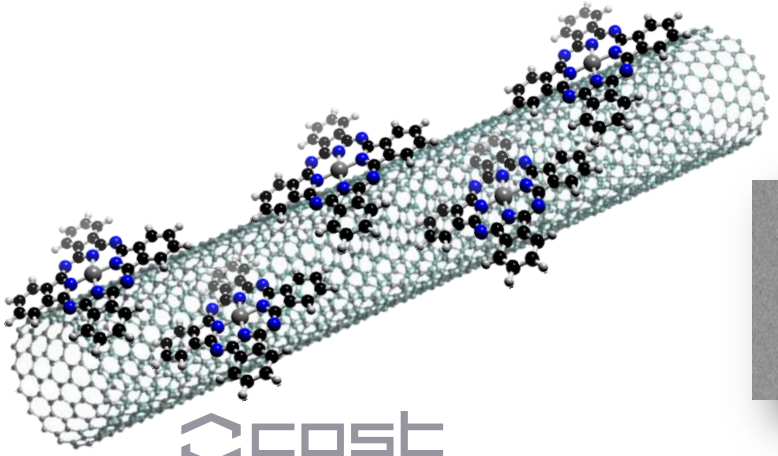
➢ Ammonia detection with low impact of RH (M. Bouvet, France)

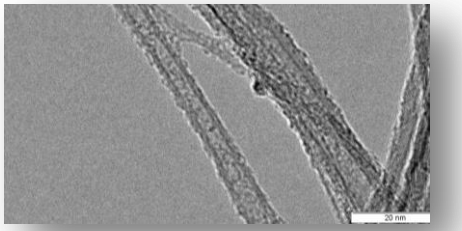


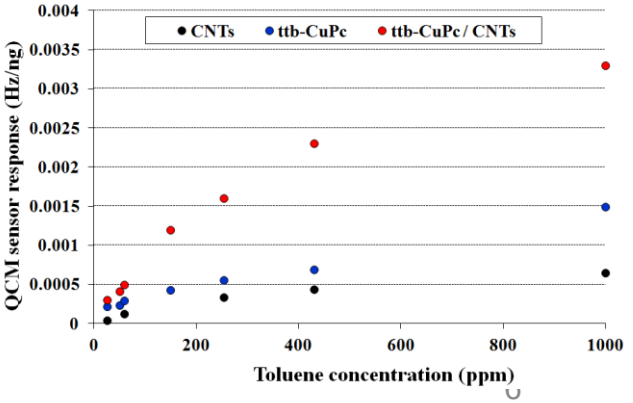




➢ BTEX detection with high sensitivity (J. Brunet, France)







Suggested R&I needs for future research

- Explore further the nanostructures and nanoparticles *of MOS's, CN's, and metals*

  Mechanism of interaction

  Development of original hybrid material

- Detailed structural modification and characterization of materials *in order to optimize sensitivity and stability*

  Effect of morphology change

  Robustness / aggressive gases

- Shaping of materials to promote specific reaction with targeted gases for selectivity improvement

  Decoration, functionalization, probe molecules

Suggested R&I needs for future research

- **Development of mixed-phase-, hybrid materials composites, and utilization, *for example, heterostructures in gas sensing process***

  Not additive contribution but synergy

- **Converging towards standard methods for synthesis and integration *into low-cost mass-production processes***

- ***Efforts must be concentrated on reproducibility***