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

COST Action TD1105

WGs and MC Meeting at Rome, 4-6 December 2012

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year: 2012-2013 (*Starting Action*)

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COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

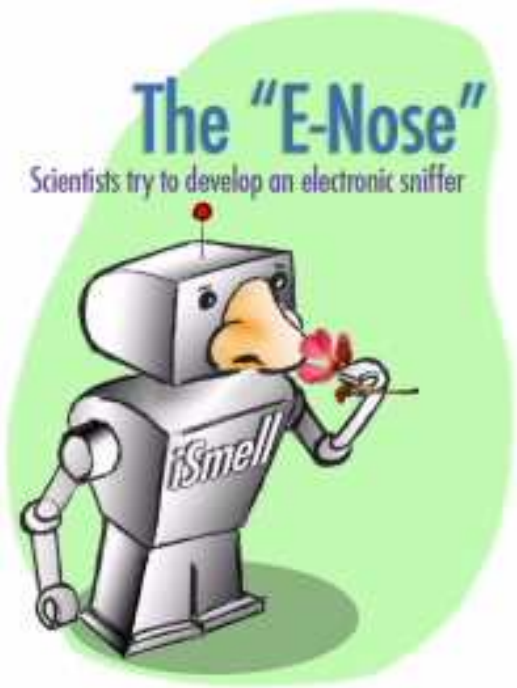
Scientific context and objectives in the Action

- **Background / Problem statement:**

  Development of gas sensor technologies able to fulfill target in terms of limit of detection for identified target gases, selectivity and low-cost

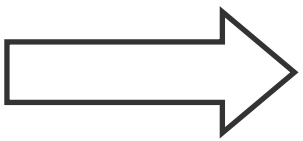
Brief reminder of objective:

- Development of miniaturized sensor systems for air quality monitoring



Sensor System Definition

- Sensor (single or array of sensor)
- Pre-concentrator
- Sample delivery (pump, fan, …)
- Data processing (filter, compensation, …)
- Analysis



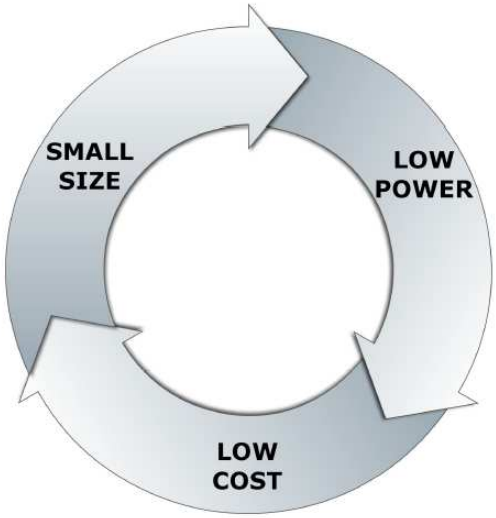
Miniaturization

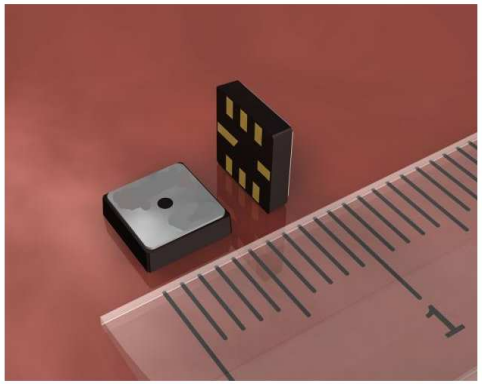
- Readout unit (data acquisition, data storage)
- Power management unit (battery, battery charger, voltage regulator, …)
- Data retrieval system (GPRS, Ethernet , hardwired, …)
- Geo-localization chip
- Display
- Package (protection, fixture)

Technically feasable

Why miniaturize?

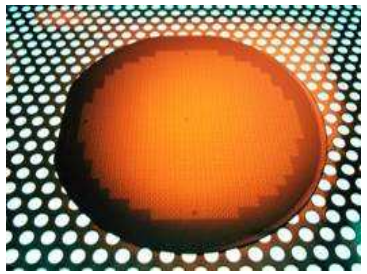
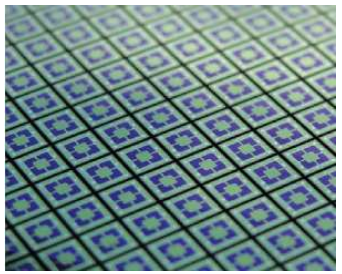
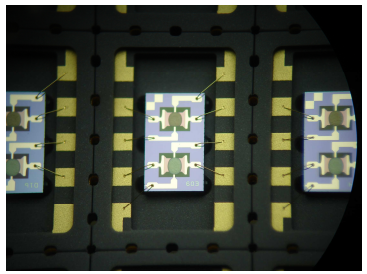
- **Need for:**
  - **Compact monitoring station**
  - **Handheld detectors (standalone unit, portability feature)**





How miniaturize?

- **Electro-chemical cell**
  - Size is limited by electrolyte volume (define lifetime, sensitivity)
- **NDIR sensor**
  - Size is limited by rays path length (emitter and detectors can be miniaturized)
- **Nanomaterials onto electrodes (large specific area)**
  - Metal oxide, carbon nanotubes, GasFet sensors
  - Miniature size
  - Batch production possible

Current development to miniaturize (1/2)

- Development of MEMS ultra-low power micro-hotplate using polysilicon, platinum, or tungsten heater resistor
- Use of intermittent operation mode for power savings
- Mass production sensitive layer deposition technique (screen printing, inkjet, dispense)
- Novel nanocrystalline materials deposition technique (evaporation)

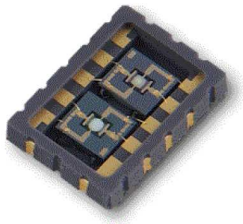
Current development to miniaturize (2/2)

- Use of molecular imprinted polymers (MIPs) and metal-organic frameworks (MOFs) as pre-concentrators for improved selectivity of relevant molecules

- Combined technology to have MEMS sensor and analog/digital chip on the same substrate

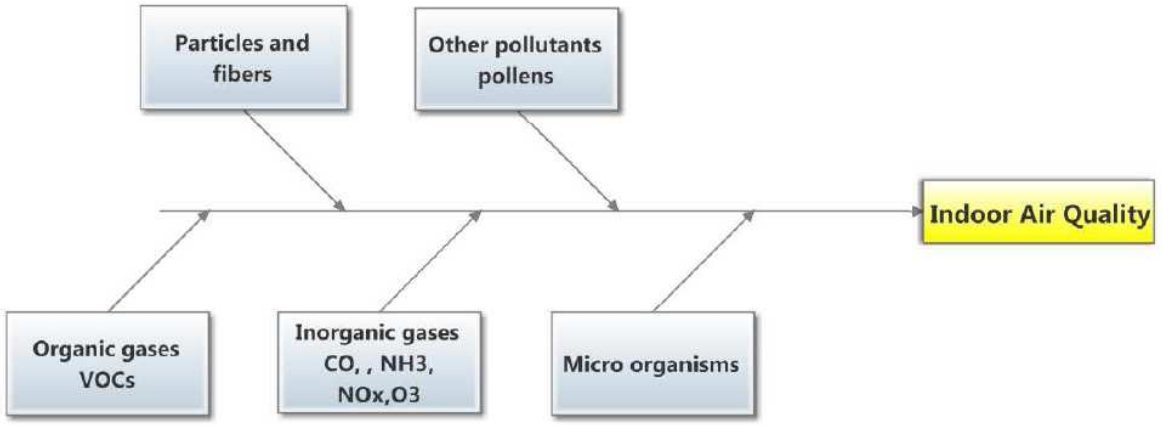
- Sensor packaging improvement

  (cost effective solution with minimal volume)



Limitation of the reflexion

- Development of miniaturized gas sensors is not covering the solid detection
- Large part of pollutants are solid and miniaturized low cost particles detector is a must to monitor AQ at large scale



Function of hygrothermal conditions:
T°air, relative humidity, air flow, air renewal