



European Network on New Sensing Technologies for Air Pollution
Control and Environmental Sustainability - *EuNetAir*
COST Action TD1105

INTERNATIONAL WG1-WG4 MEETING on

New Sensing Technologies and Methods for Air-Pollution Monitoring

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POSTER SESSION

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**MSDI HETEROJUNCTIONS FOR RELIABLE AMMONIA
SENSING IN MOIST ENVIRONMENT**

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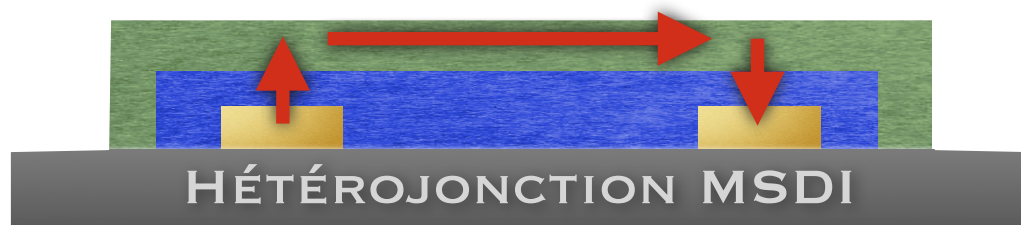
Function in the Action: (MCS France, Member of WG2.1 and SIG 2)

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Scientific Context and Objectives

MSDI (**M**olecular **S**emiconductor | **D**oped **I**nsulator) heterojunctions are new sensing devices featuring interesting sensing properties.



Patent : PCT / FR2008 / 001325 M. Bouvet,
V. Parra, (UPMC, CNRS)

Top layer (outside) :

Lutetium *bis*phthalocyanine

p-type intrinsic semiconductor

Bottom layer (inside) :

p- or n-type doped insulators

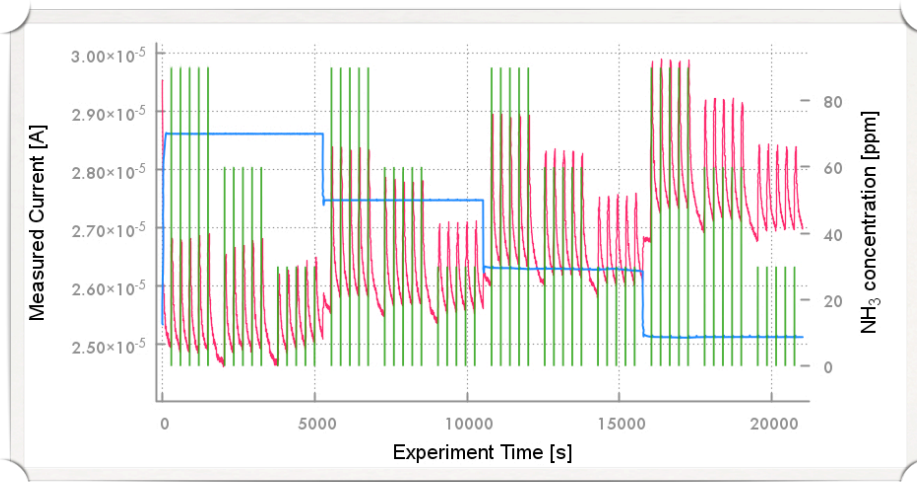
Thought only the p-type molecular semiconductor (LuPc_2) is exposed to the gas, MSDI exhibit the behavior of the bottom layer (n or p). This is because of the electrical current flow pathway (red arrows) and the existing barrier energy at the heterojunction. This gives MSDIs interesting sensing properties.

V. Parra, J. Brunet, A. Pauly, M. Bouvet, *Analyst*, **2009**, 134, 1776-1778

M. Bouvet, V. Parra, J.-M. Suisse, *Eur. J. Appl. Phys.*, **2011**, 53(3), 34103

RESULTS

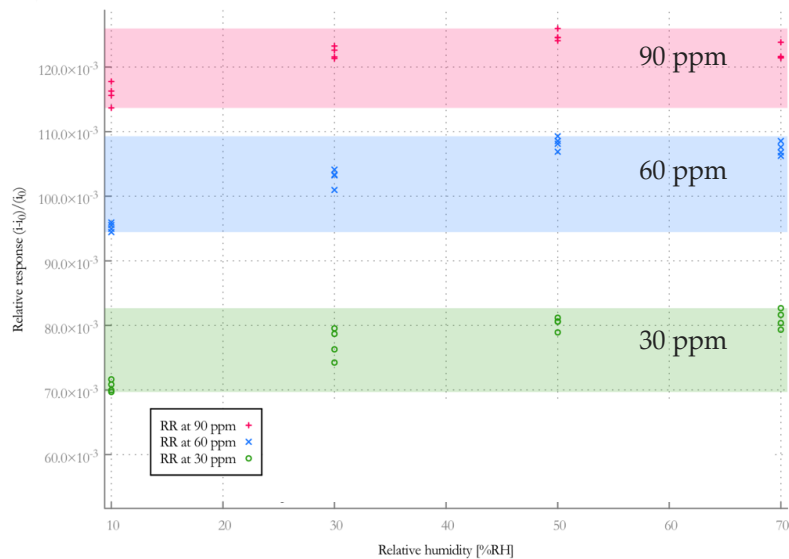
MSDI with n-type sub layer. Exposition to ammonia in moist environment.



Steady current. Almost no drift.

Highly reproducible.

Almost no effect of humidity (5000 – 20000 ppm) on the sensing properties (30 – 90 ppm NH₃)



Good discrimination of ammonia levels between 30 and 90 ppm, without knowledge of the humidity level.

We obtained similar results and discrimination for 15, 30, 45, and 60 ppm. Also up to 180 ppm of ammonia.



CONCLUSIONS and Future Activities

- MSDIs are organic devices with no equivalent in inorganic electronics.
- They exhibit interesting sensing properties
- An MSDI with p-type lutetium *bisphthalocyanine* as top-layer and n-type hexafluorinated copper phthalocyanine was tested as ammonia sensor in humid environment.
- This sensor exhibits ammonia sensing properties that are nearly independent from the humidity level.
- This sensor exhibits a rise in current (relative response) of ca. 12% after 60 seconds of exposure to 90 ppm NH₃.