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

COST Action TD1105

1ST TRAINING SCHOOL

Universitat de Barcelona, Spain, 13 - 15 June 2013

organized by UB, MIND-IN2UB - Dept. of Electronics and CSIC-IDAEA

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

Year 1: 2012 - 2013 (*Ongoing Action*)

UNIVERSITÄT PADERBORN
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Expertise of the Trainee related to the Action

- **Bachelor- Thesis:**

(Photo-)conduction measurements during the growth of evaporated BHJ

- **Master-Thesis:**

Influence of the Contact metal on the characteristics of OFETs

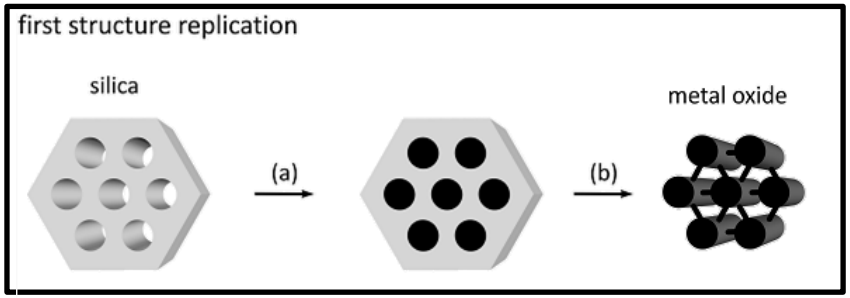
- **Preparation Methods:**

Chemical vapor deposition, nanocasting, drop/spray-coating

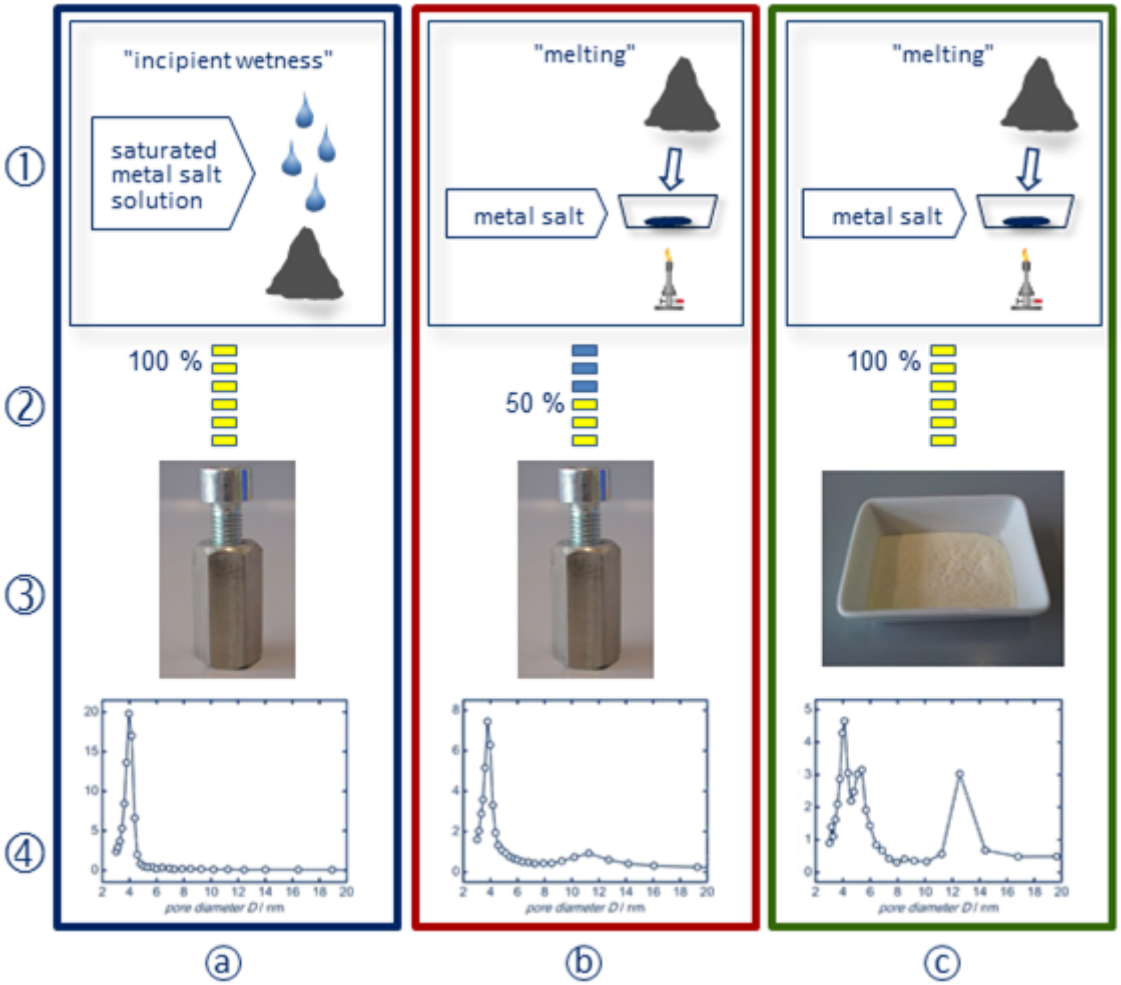
- **Characterization Methods:**

P-XRD, physisorption, conductivity measurements (gas sensor)

Current research activities of the Trainee (1/2)

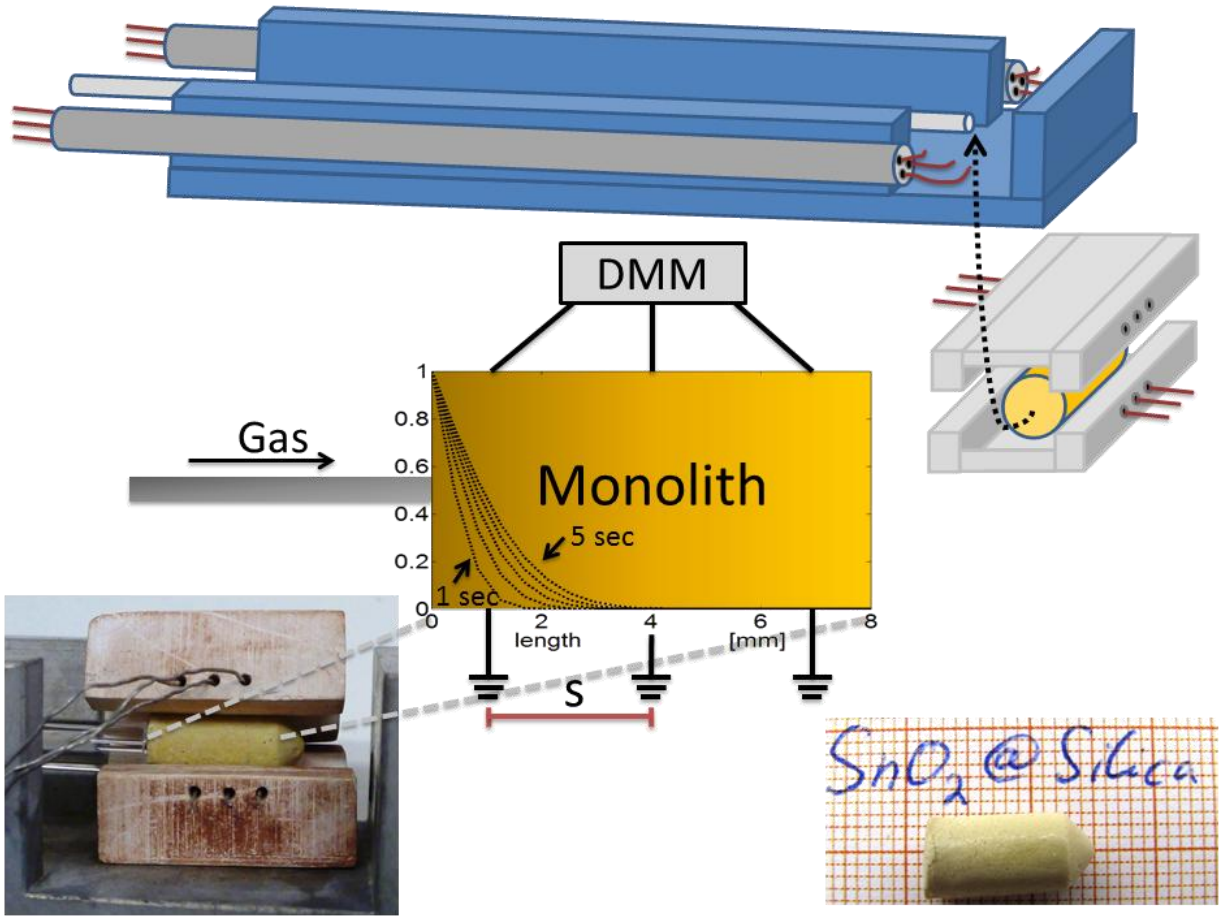


Synthesis of ordered mesoporous In_2O_3 with controlled porosity by systematic variation of synthesis procedure.



Current research activities of the Trainee (2/2)

Diffusion studies in semiconducting gas sensing layers based on centimetre-sized mesoporous silica/SnO_2 composite monoliths.



Macroscopic dimensions:

space-resolved conductivity measurements

allow

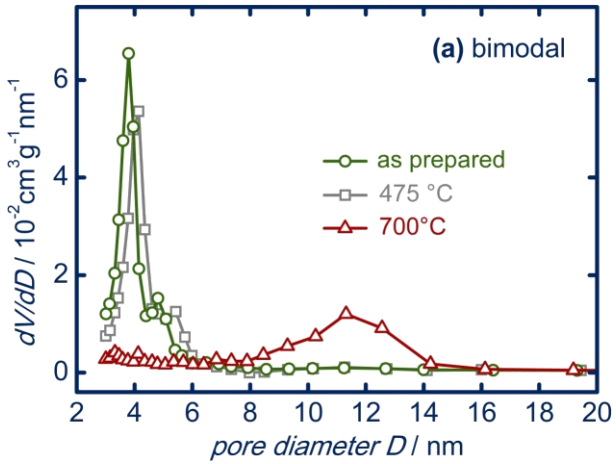
time-resolved monitoring

of the gas propagation inside the porous monolith.

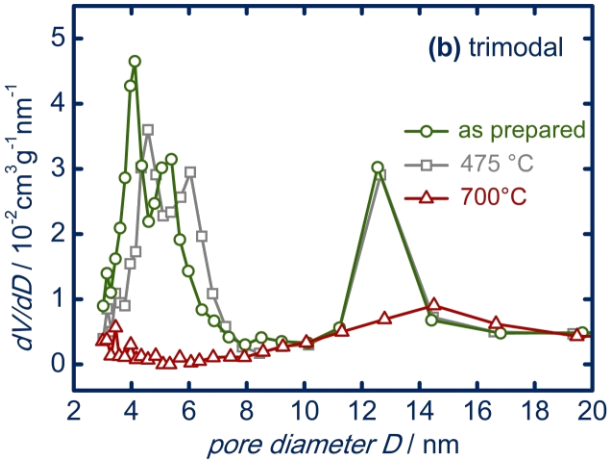
Theoretical calculations based on Knudsen Diffusion.

Achieved RESULTS and future activities

The integrated pore volume of all mesopores up to 16 nm is used as a measure for structural quality.



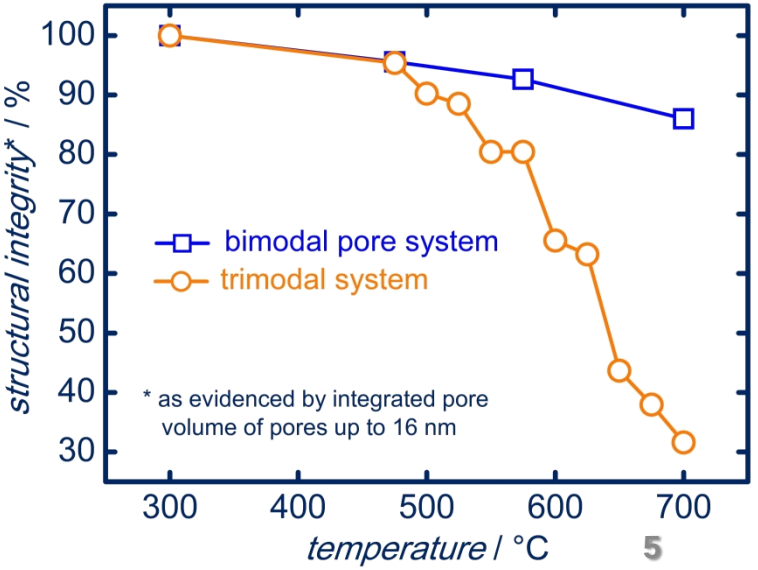
- Loss is much less pronounced for the bimodal system (ca. 15 %)
- Structural integrity of the trimodal porous In_2O_3 decreases drastically (by 68 %)



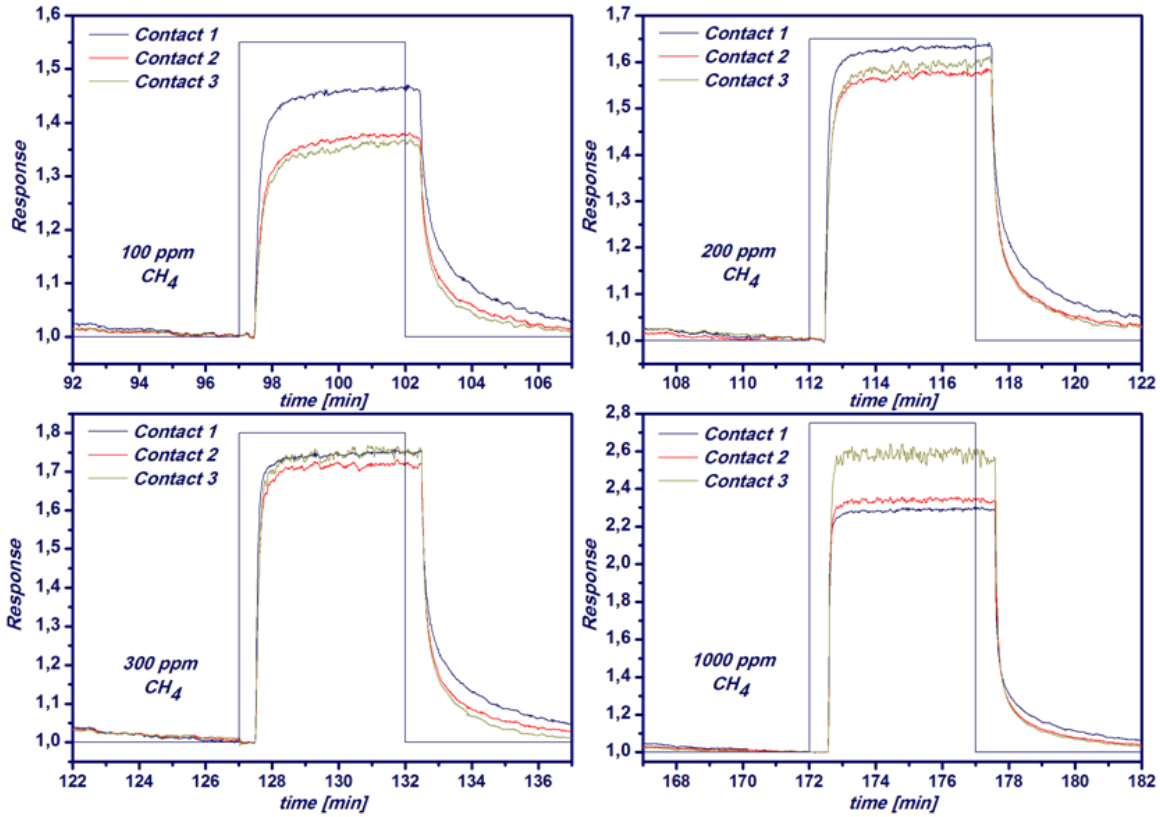
High thermal stability seems to result

(i) from the absence of large mesopores
- lower pore interconnectivity

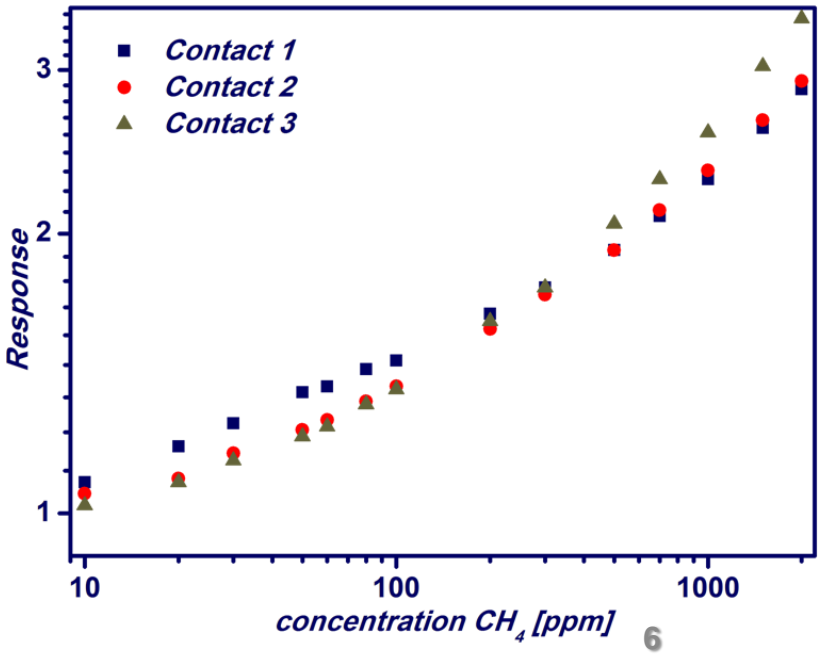
(ii) from larger particle sizes
- longer pore channels



Achieved RESULTS and future activities



Response for the different contacts on one monolith in dependence of the concentration of the offered test gas.



Change in the order of the measured response is observed.

CONCLUSIONS

CONCLUSIONS:

Multi-Modal Pore Systems

- Various pore modes and particle sizes in mesoporous In_2O_3 by variation of synthesis parameters.
- *Thermal stability* of the products depends on the pore system.
- *Loss of mesostructure/porosity* is quantified by a decrease in the measured pore volume (modeled by assuming Ostwald-type ripening).

Monolith

- First results show differences in response to methane (stable) and carbon monoxide (reactive).
- Setup is qualified for studying diffusion processes in mesoporous metal oxides.