



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

COST Action TD1105

**1<sup>ST</sup> 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*)



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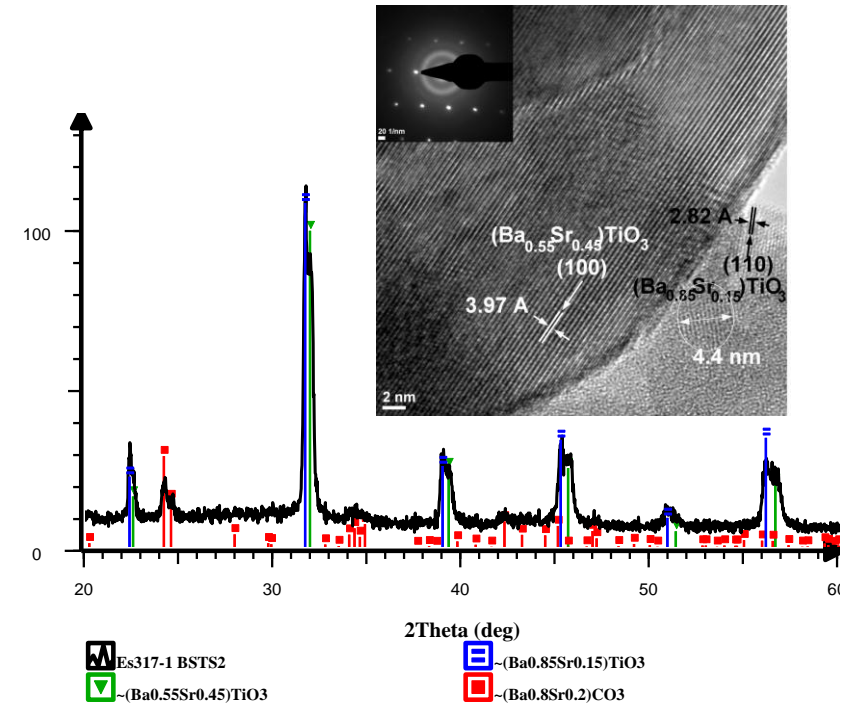
**INCDEMNR-IMNR / Romania**

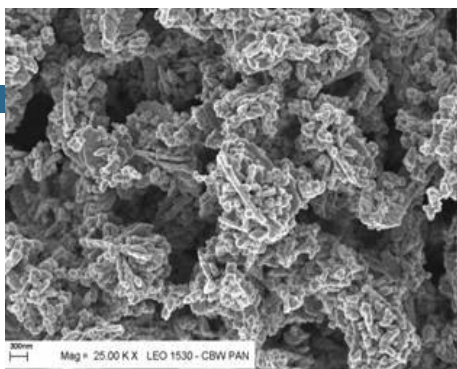
# Expertise of the Trainee related to the Action

- Hydrothermal synthesis of the nanostructured materials with controlled morphology and microstructure from the systems BST, PZT, oxides like: doped TiO<sub>2</sub>, doped ZnO, ZrO<sub>2</sub>.
- Thin layer deposition by spin coater on silicon gold coated substrates, on titanium alloys substrates, alumina substrates and glass substrates.
- Particle size distribution and zeta potential of colloids and nanoparticles using DLS technique.
- Thermodynamic analysis to correlate the synthesis parameters, with defects and electrical properties.

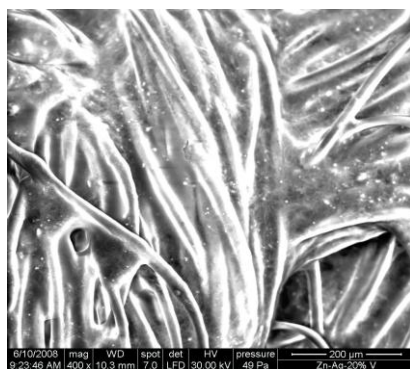
# Current research activities of the Trainee

- **IMNR** is the unique National R&D Institute for the field of Nonferrous Metals and Materials, having as main scientific directions:
- New eco-friendly technologies for processing primary and secondary resources;
- Nanomaterials and nanosystems for health (regenerative medicine, sensors for biomedical applications) and energy (high temperature applications, eco-active materials, photocatalysis);
- Composite nanostructured materials; obtaining of new high-tech metallic materials (intelligent alloys, metal matrix composites, metallic powders).
- Nanostructured Materials Laboratory:
- Preparation of ceramic, composites and organic-inorganic hybrid nanostructured powders by hydrothermal / solvothermal synthesis (nanostructured powders based on: pure and doped  $\text{TiO}_2$ , pure  $\text{ZrO}_2$  and  $\text{Y}_2\text{O}_3$  and rare earth doped  $\text{ZrO}_2$ , Ag doped  $\text{ZnO}$ ; doped  $\text{BaSrTiO}_3$ ; hybrid powders based on hydroxyapatite and natural or synthetic polymers)



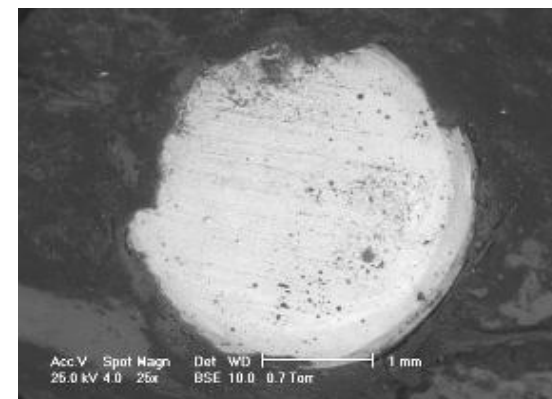


SEM image of ZnO nanopowder



Textile structure impregnated with Ag doped ZnO nanopowder

Ag doped ZnO bandage, on the market. IMNR has a joint Patent with VELFINA S.A.



Macroscopic image of a cylindrical implant made of hybrid organic-inorganic nanopowders deposited on TiAlNb alloy, inserted in rabbit's bone.



HAP deposited on Ti by MAPLE



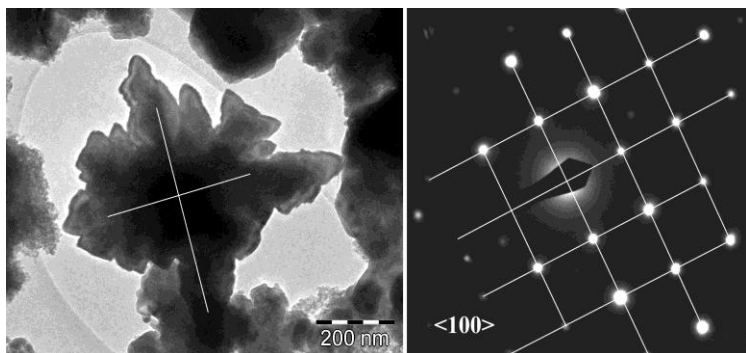
HAP-ZrO<sub>2</sub> deposited on Ti by RF-sputtering



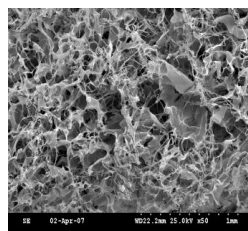
HAP-polymer deposited on TiAlNb by spin coating



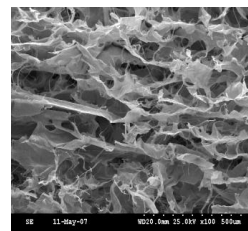
HAP-polymer on TiAlNb by hydrothermal-electrochemical method



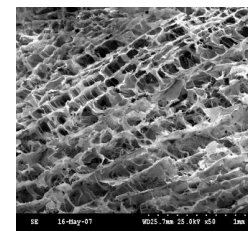
Cubic BST, lobes crystallites 50-100 nm



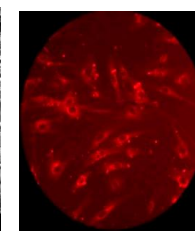
X 50 collagen



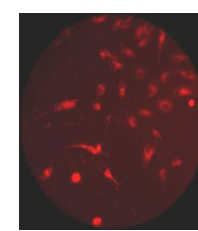
X 100 (COLTER with HAP/silicate)



X 50 (COLTER HAP/ collagen hydrolized)



Control after 24 h



HAP + Collagen-48 h



## Brief list of ongoing research topics

- Sensor based on complex perovskitic structure for detection and identification of hazardous substances - SENSGAS. National project (2012-2015)
- Sugar alcohol materials for seasonal energy storage - SAM.SSA FP7 (2012-2015)
- Contrast agents for imagistic: Bilateral Romania - Switzerland (2012-2015)
- Materials for actuators FP7 -*under contracting* (2012-2016)





## Achieved RESULTS and future activities

### Activities directions as results:

- Phd thesis is related to the perovskite type materials having gas sensing properties
- Knowledge regarding thermodynamic process at the interface between nanostructured materials and substrates.

### Innovation

- Gain the fundamental understanding of the details of the surface gas interactions in operation conditions close to the ones found in day-life science since these affects the sensing properties and then to translate this knowledge to the doped nanostructured BST based multifunctional gas sensor platform
- It is important to understand how the surface reaction kinetics and charge transfer mechanism between gas species and nanostructured doped BST influence the selectivity of the material for detecting a specific gas (H<sub>2</sub>S, SO<sub>2</sub>, NH<sub>3</sub>).

- I gained experience in nanostructured materials synthesis but I need to improve my knowledge regarding correlation between perovskitic materials with complex structure and their electrical properties. For nanostructured materials characterization there is no standards available.
- One of the open problems is concerning the tailored properties of the nanostructured materials.

