



NANOMATERIALS FOR REGENERATIVE MEDICINE: FROM BASIC RESEARCH TO INNOVATION AND E.U. COOPERATION

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PRESENTATION OUTLINE

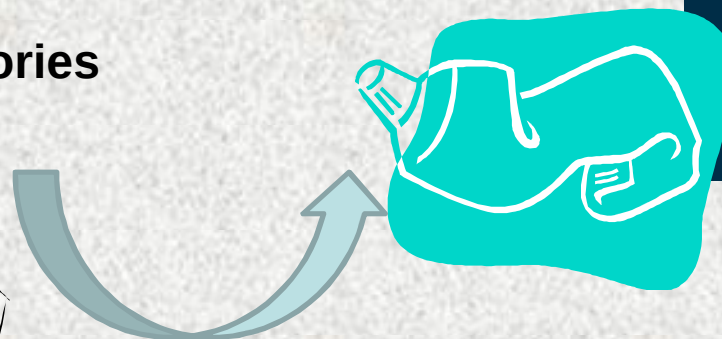
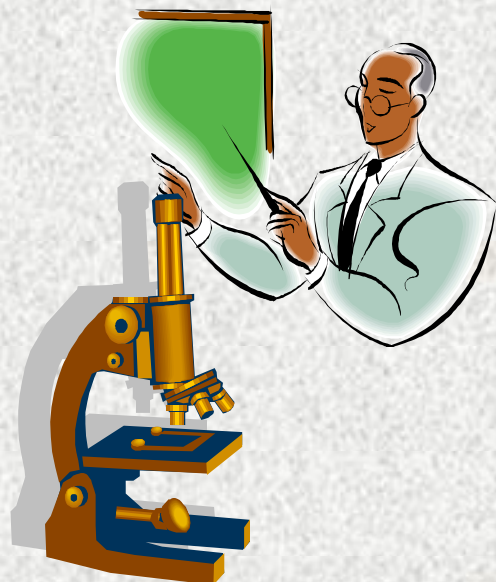
1. Introduction
2. Experience of IMNR in the synthesis and development of nanobiomaterials.
Fundamentals and research infrastructure.
3. Hybrid inorganic-organic and ceramic nanomaterials for regenerative medicine: original method, original results
4. European cooperation in the field of nanomaterials
5. NANO futures Technological Initiative
6. Conclusions and future prospects

Introduction

Why Nanomedicine ?

Clinic, Healthcare

Academia Laboratories



Nanomedicine enables the translation of the research results by cost effective novel therapies

Introduction

Barrier to rational design and controlled synthesis of nanomaterials is the lack of fundamental understanding of thermodynamic and kinetic processes at the nanoscale

✓ IMNR human resources: chemists, physicists, material science engineers

✓ IMNR expertise in biomaterials field
(precious metals based alloys, titanium based alloys, chromium and nickel based alloys that were implemented on the market)

✓ IMNR certified analytical methods for compositional and microstructure characterisation of nanobiomaterials (a unique laboratory at national level)

✓ IMNR focused the R&D activities to develop cost effective manufacturing methods using chemistry and material science knowledge

Market niche: hybrid nanomaterials for regenerative medicine and tissue engineering



Introduction

Why chemical processes?

The wet chemical methods, which are used to produce nanophase particles and to functionalize them, will have a great impact upon fields like power industry and electronics, being followed by applications in cars manufacturing, aeronautics and life sciences. From the total number of entities applying chemical methods about 80% activate in the research field while only 20% are represented by big industry and other types of organizations. *In the year 2013 the colloidal chemistry will be used at pilot level.*

[source: Roadmap Nanomanufacturing, European Technological Platform MINAM, August 2006].



The chemical technological process at high pressures (developed in IMNR) assures high purity materials, increased production yields and it can be easily implemented in practice due to its low costs and power consumption. In the same time it allows the quality control during the technological flow.

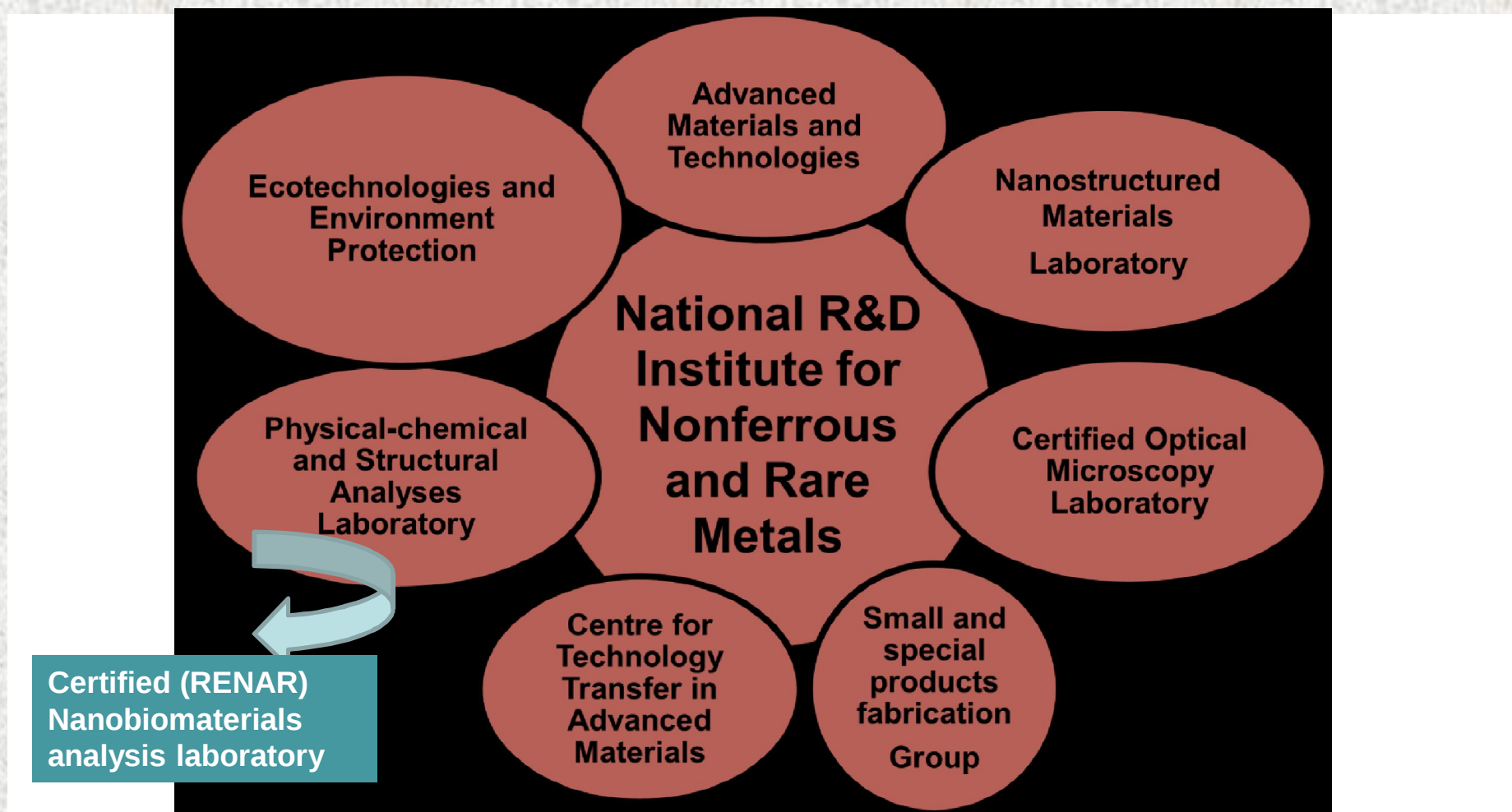




Experience of IMNR in the synthesis and development of nanobiomaterials Fundamentals and research infrastructure



Brief description of the National R/D Institute for Non-ferrous and Rare Metals

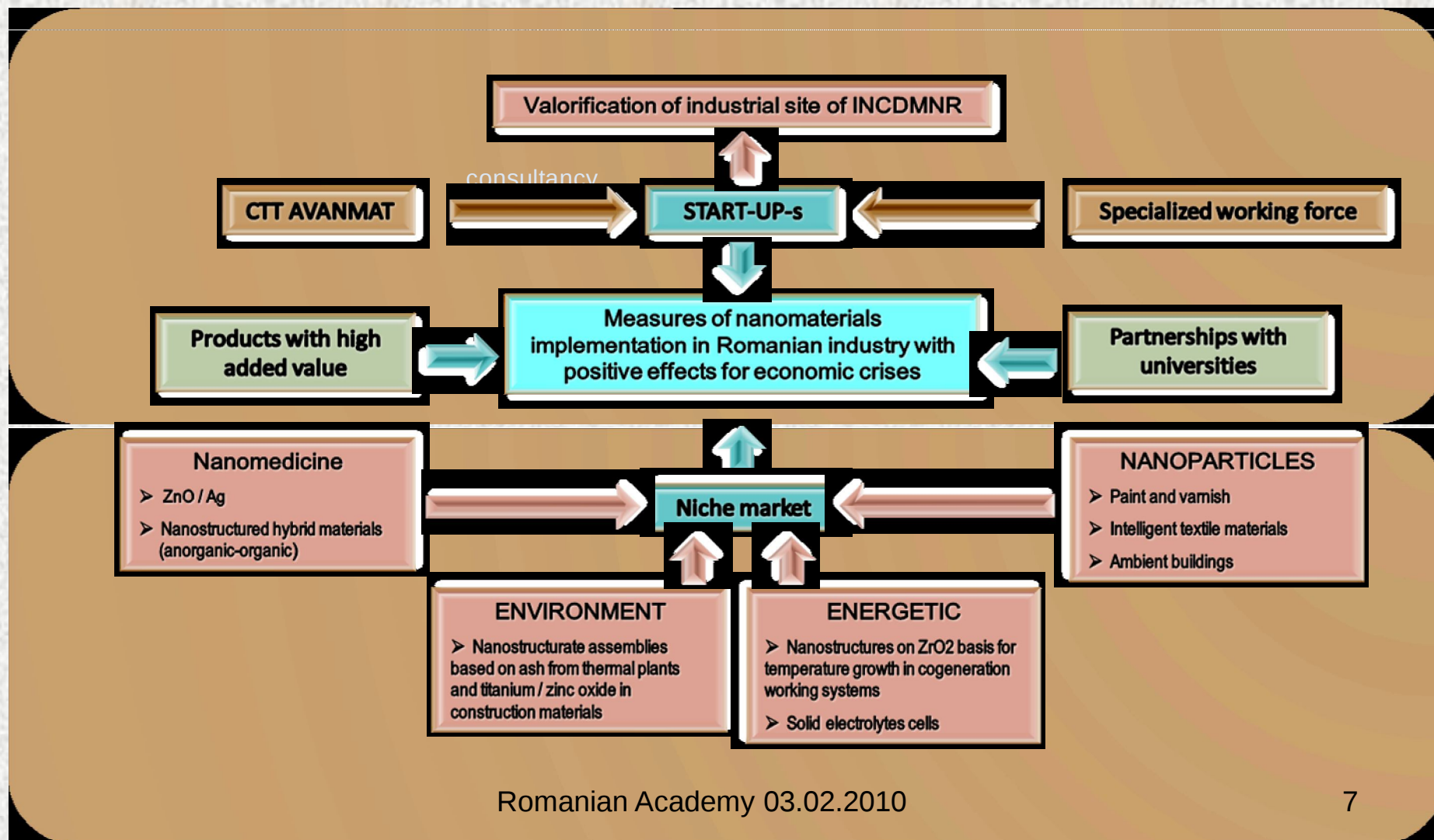




Experience of IMNR in the synthesis and development of nanobiomaterials Fundamentals and research infrastructure



Laboratory of Nanostructured Materials – object of activity and results





Experience of IMNR in the synthesis and development of nanobiomaterials . Fundamentals and research infrastructure



AAS ZEEnit 700 Analytik Jena



D8 XRD Bruker diffractometer





Experience of IMNR in the synthesis and development of nanobiomaterials . Fundamentals and research infrastructure



**EU
Programmes
FP6, FP7,
COST-ESF**

**National
Projects-
Innovation
Programme**

**Physical-chemical
basis**

**High pressure
Research
Infrastructure**

**Technology
Transfer
Centre**

**National
Projects-
Partnership
In Priority
Domains**



Hybrid inorganic-organic nanomaterials for regenerative medicine: original method, original results



Physical-chemical basis

National Projects:

- BIONANOCOM-
ctr.138/MATNANTECH

- **Main results:** patent, ISI papers, definition of potential applications
- **Human resources:** chemists, biochemists, industry

Precompetitive research

National Projects:

-CEEX/ctr.16-RETEBDENT

Main results:
experimental model – dental implants in vivo tested
ISI papers
training workshop for young researcher

Human resources:
chemists, biochemists, physicists, material science engineers, doctors, industry

Competitive research

National Projects:

- PNCD II- Complex Partnership in Priority Fields/ ctr 71-004-
HINAMASENS

Main results:

Functional model of the nanostructured material for sensors with potential use in therapy and diagnosis

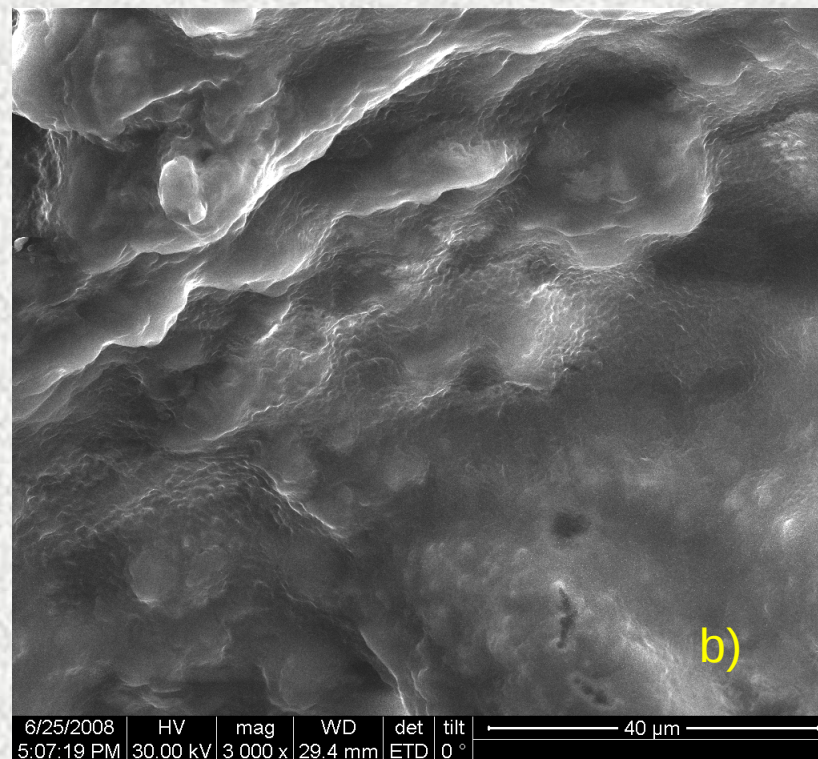
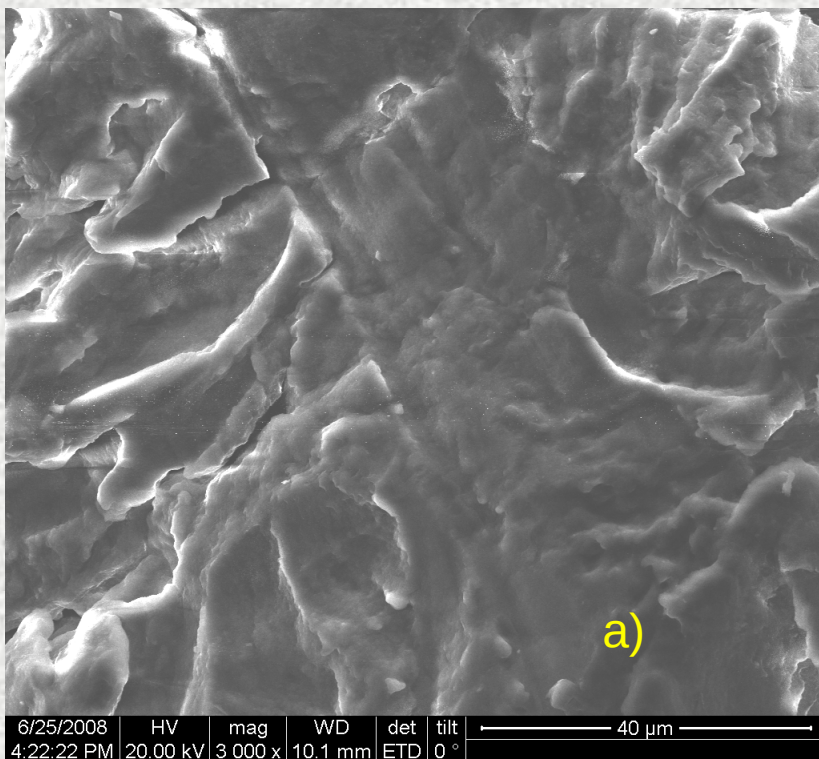
Generate new knowledge on bio/nonbio reactions at the interface cell/nanostructured hybrid bioactive layer
ISI papers, patent

Human resources:

chemists, biochemists, physicists, material science engineers, electronic engineers, industry



Hybrid inorganic-organic nanomaterials for regenerative medicine: original method, original results



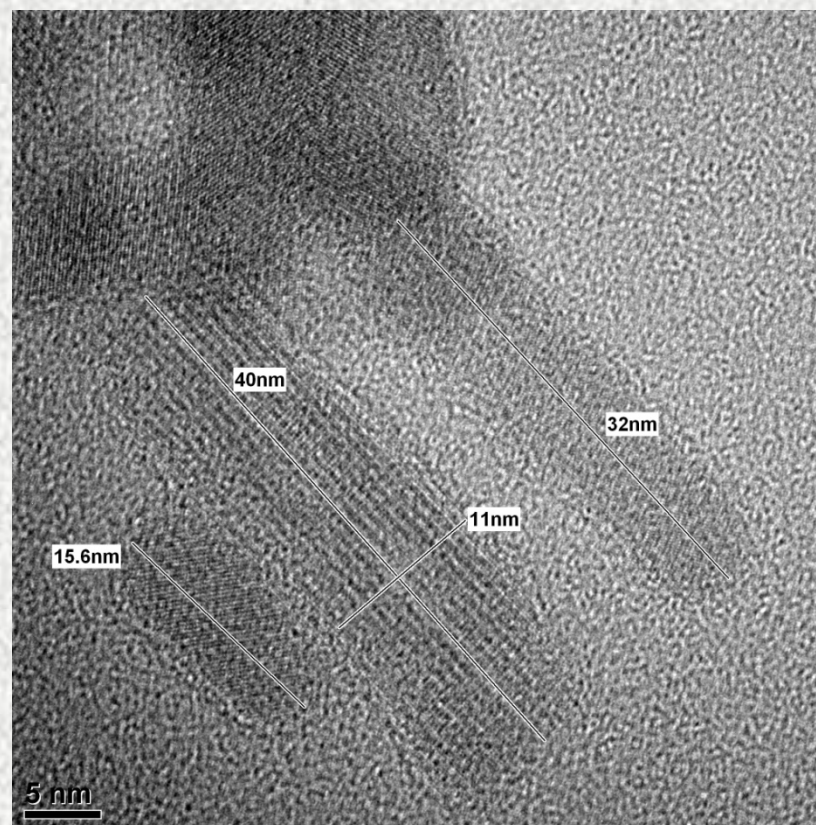
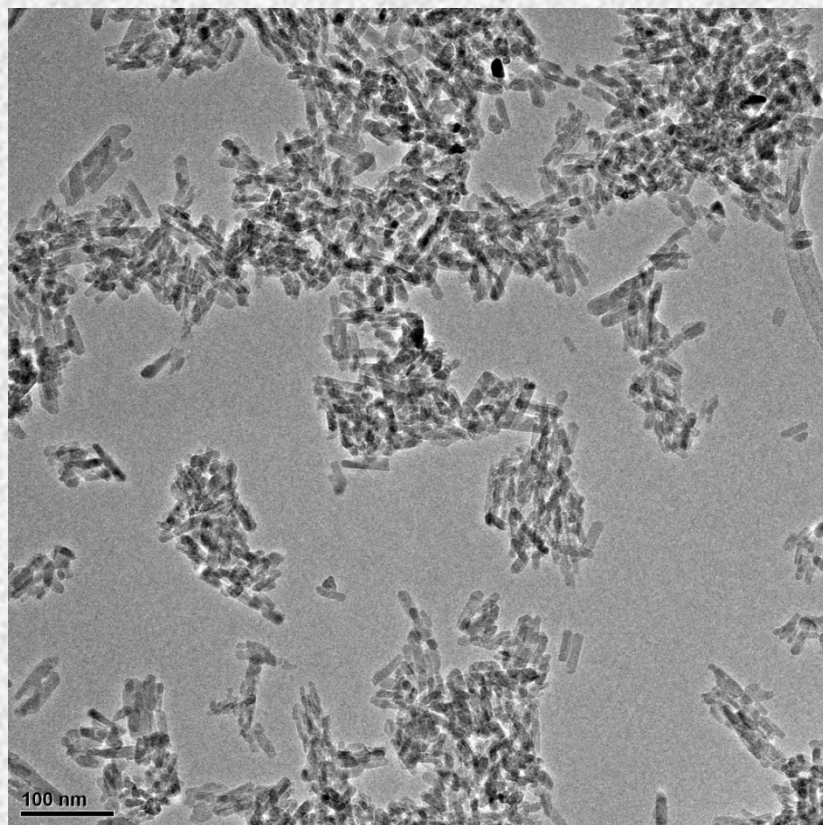
PU2- polyurethane functionalised with COOH groups

a) After hydrothermal treatment

b) Before hydrothermal treatment



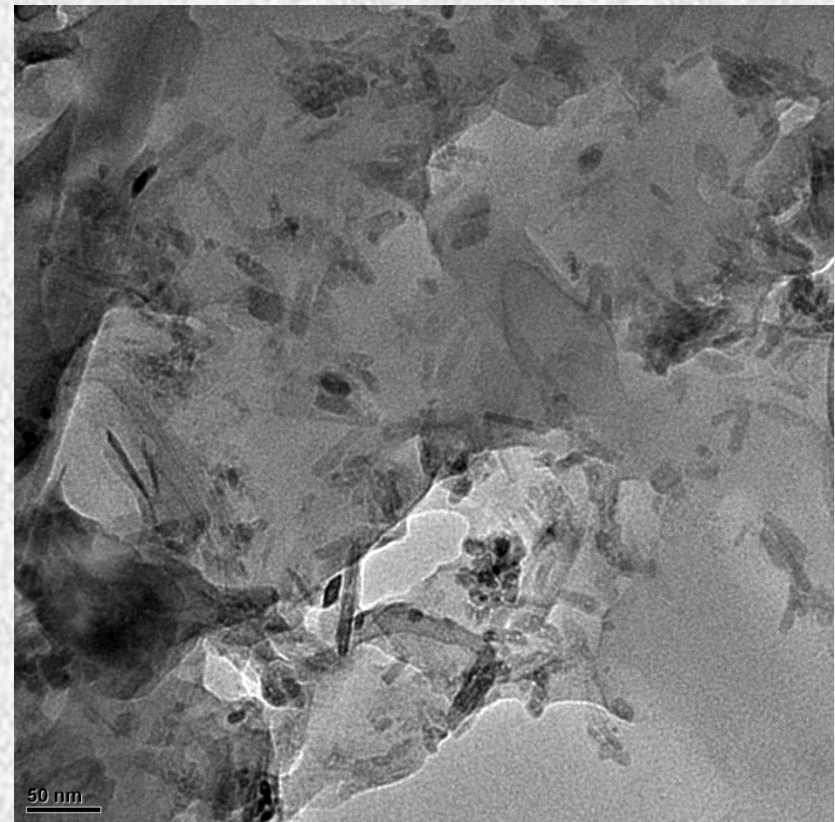
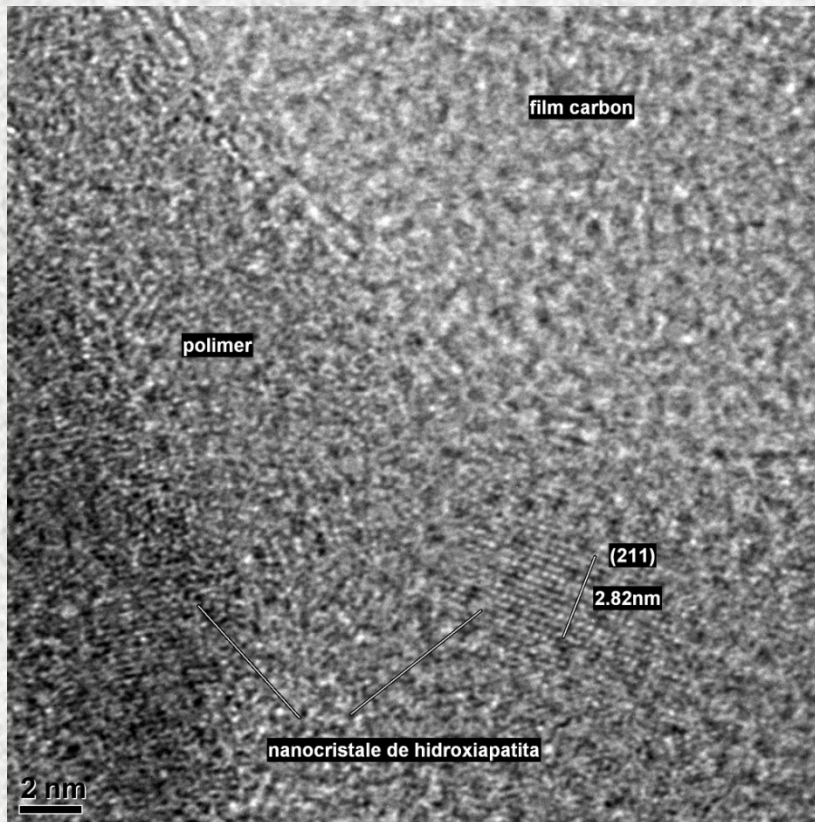
Hybrid inorganic-organic nanomaterials for regenerative medicine: original method, original results



PU –Hap
(nanostructured hybrid synthesized in situ
in hydrothermal conditions)



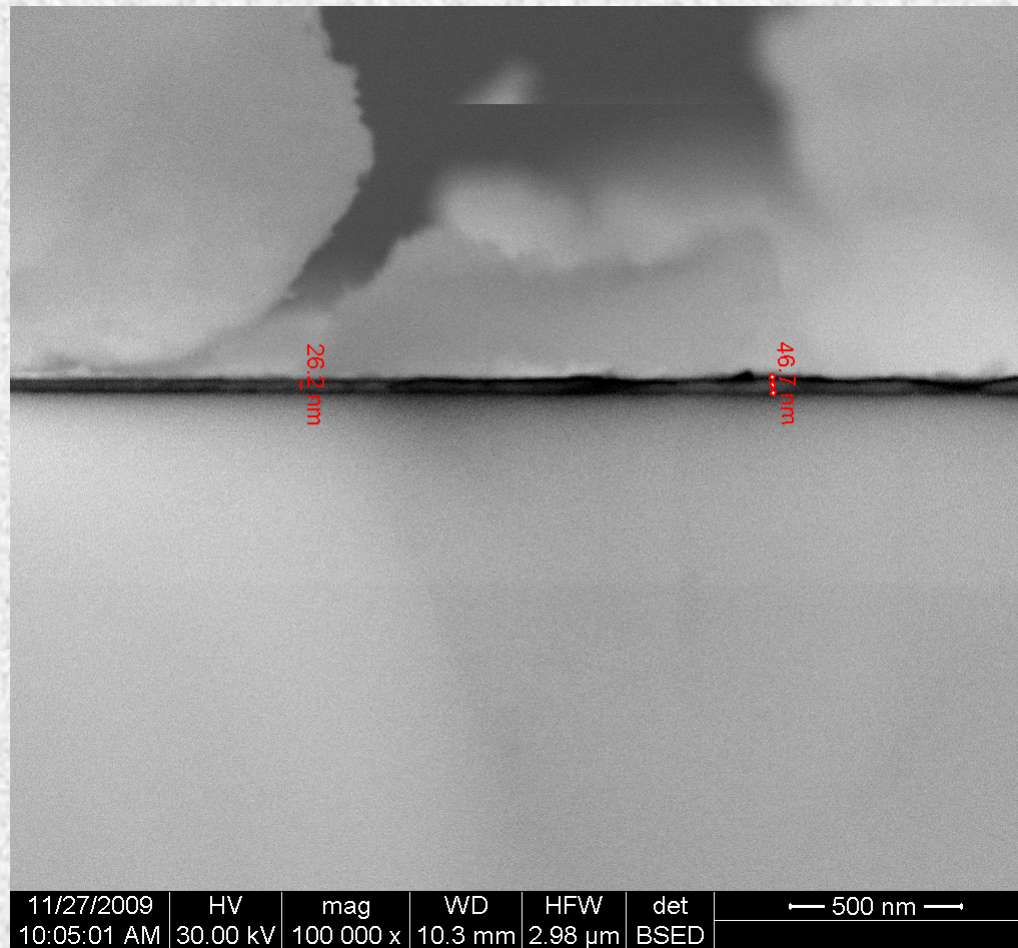
Hybrid inorganic-organic nanomaterials for regenerative medicine: original method, original results



Thin film PU –Hap
(nanostructured hybrid thin film deposited on Si/SiO₂/Ti/Au by spin coating)



Hybrid inorganic-organic nanomaterials for regenerative medicine: original method, original results



Thin film PU –Hap - section
(nanostructured hybrid thin film deposited on Si/SiO₂/Ti/Au by spin coating)



Ceramic nanomaterials for regenerative medicine: original method, original results



Physical-chemical basis Competitive research

**National Projects:
-CEEX/ctr.69-SINAPS**

Main results:

**experimental model – technology for
nanostructured doped ZnO powders
ISI papers**

Human resources:

**chemists,
physicists, material
science engineers,
industry**

Innovation

**National Projects:
- PNCD II- ctr 202-PANSAG**

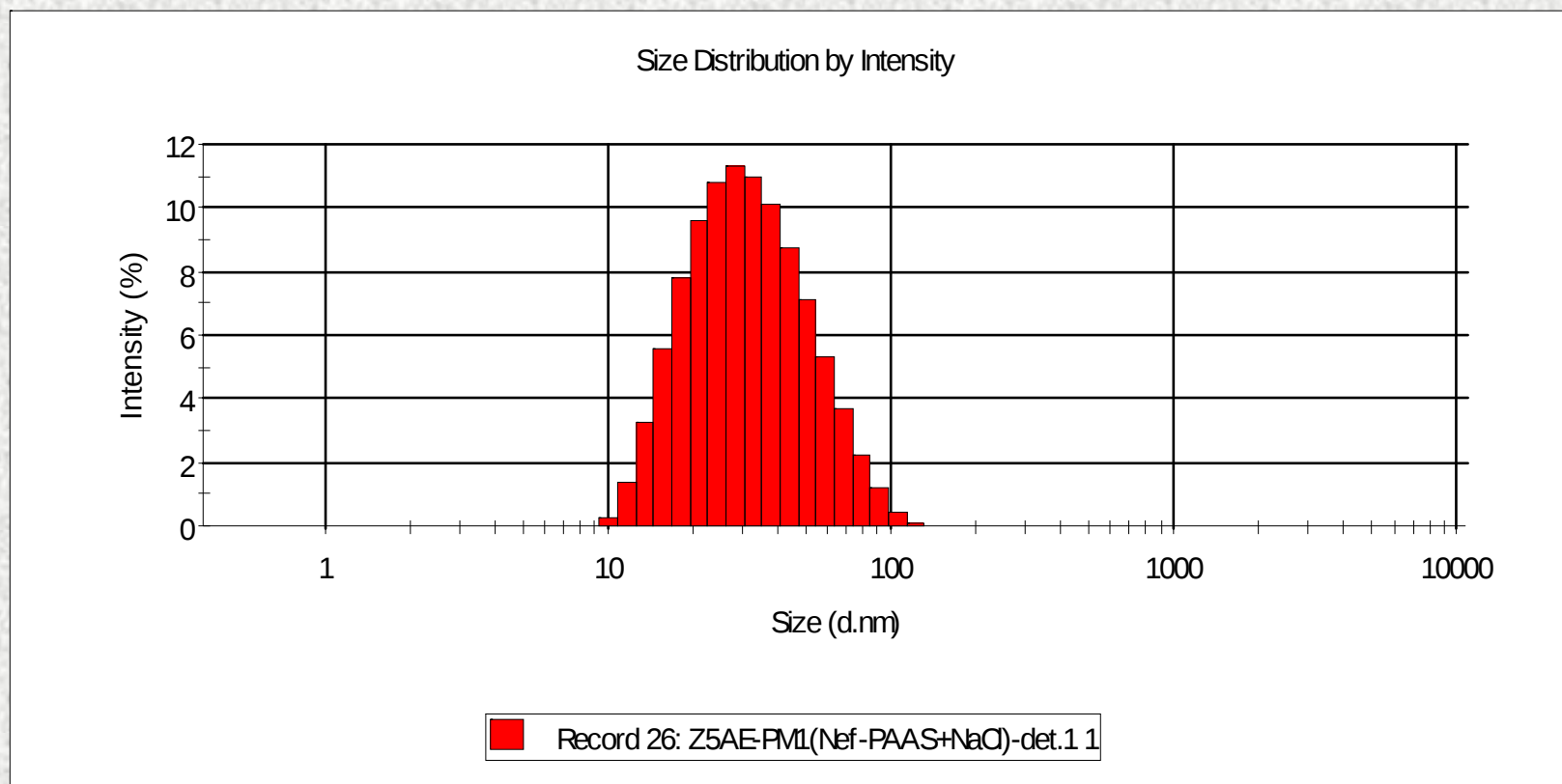
Main results:

**External medical device for plug cure
with enhanced antibacterial and
antifungal properties
Patent**

Human resources:

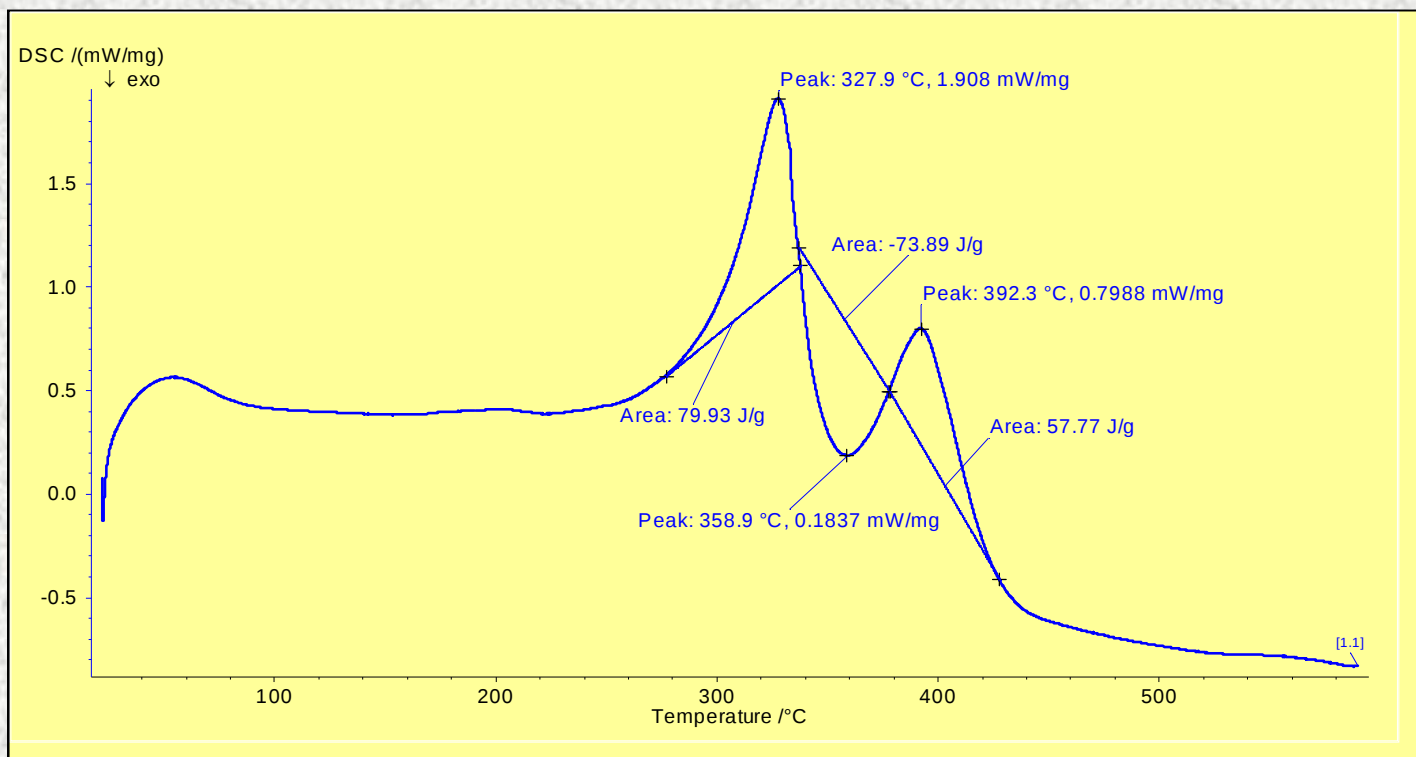
**chemists, biochemists,
physicists, material
science engineers,
Industry - coordinator**

Innovation-AgZnO



***Ceramic nanomaterials for regenerative medicine:
original method, original results***

Innovation-AgZnO

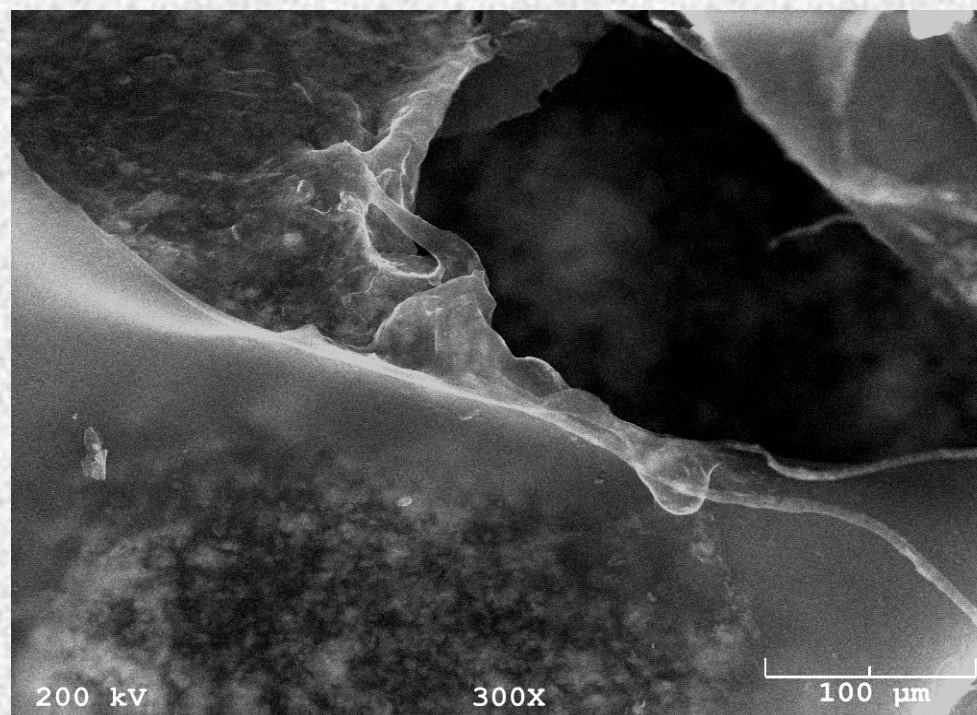
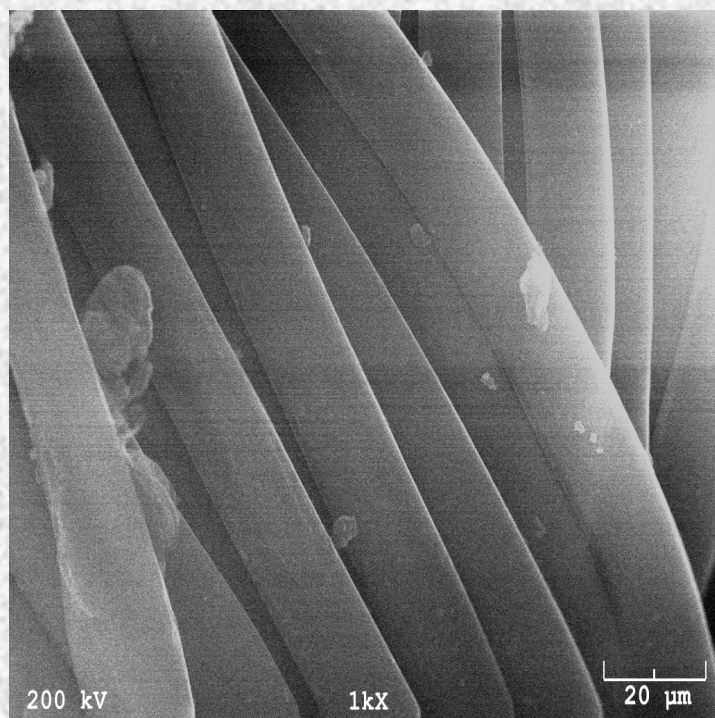




***Ceramic nanomaterials for regenerative medicine:
original method, original results***



Innovation-AgZnO



Micrografii de inalta rezolutie a nanostructurilor cu continut de Ag-ZnO



Technology transfer – CTT AVANMAT



MISSION

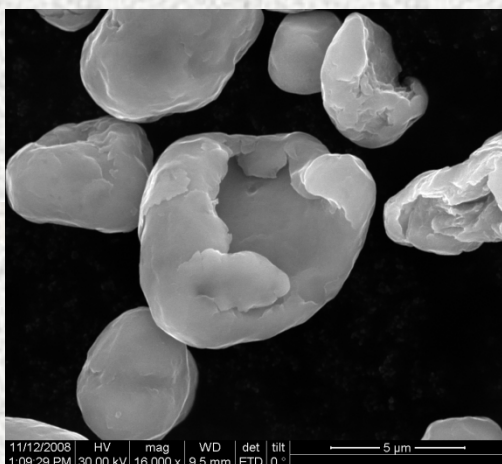
Development of advanced nanomaterials in Romania by valorisation of R&D results by technology transfer toward enterprises (mainly SMEs including start-ups)

SUCCESS STORIES

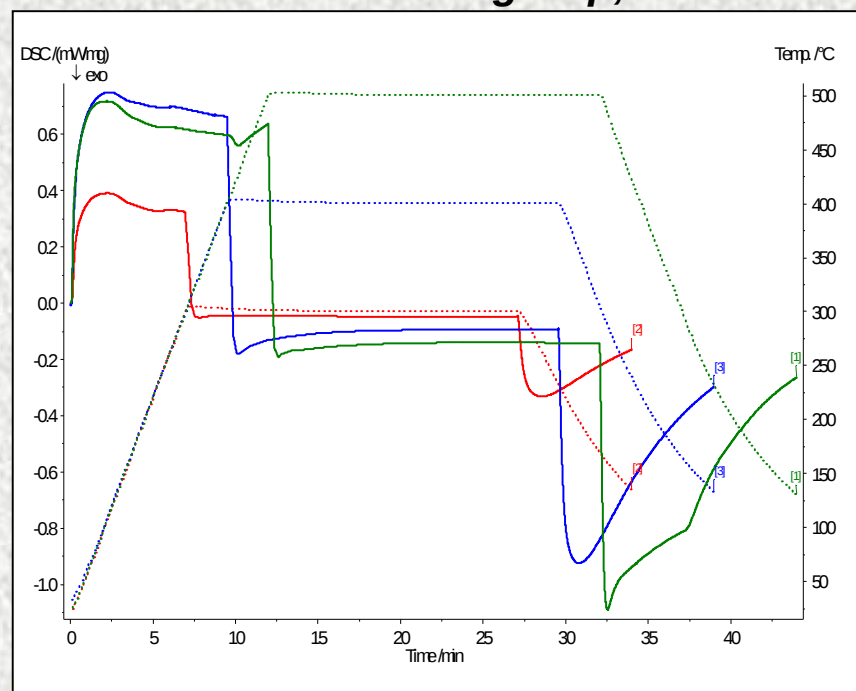
- Institutional Development of CTT AVANMAT, 2004-2005, ctr. 09/2004, General services in the field of biomaterials (2006-2007), ctr. 306/2006, Technological Services Contract 410/2006
- Innovation Simulation Cluster, ctr. PN II 92-096 CLUSTINOVA (2008-2011)
- **PN II INOVATION ctr.202/2008 PANSAG** regarding external medical devices based on Ag-doped ZnO nanoparticles and tri-glycerides for plague cure, beneficiary S.C.VELFINA SA Campulung, jud. Arges

	Project title	Acronym	Period	Pagina WEB
1.	Ultraprecise Direct Manufacturing (FP6 – NMP2-CT-2006-026467)	MANUDIRECT	2006-2011	www.manudirect.eu
2.	SUPERSONIC deposition of nanostructured surfaces (FP7-228814-2)	SUPERSONIC	2009-2013	<u>Under cosntruction</u>

IMNR is member of ETP NANOMEDICINE-Regenerative medicine workgroup, ETP Additive manufacturing and ETP EUMAT



DSC-modelling



Nanostructured Fe-Cu powders



NANOfutures Technological Initiative



Nanofutures initiative would become a European multi-sectorial, cross-ETP, integrating platform with the objective of connecting and establishing cooperation and representation of all relevant Technology Platforms that require nanotechnologies in their industrial sector and products.

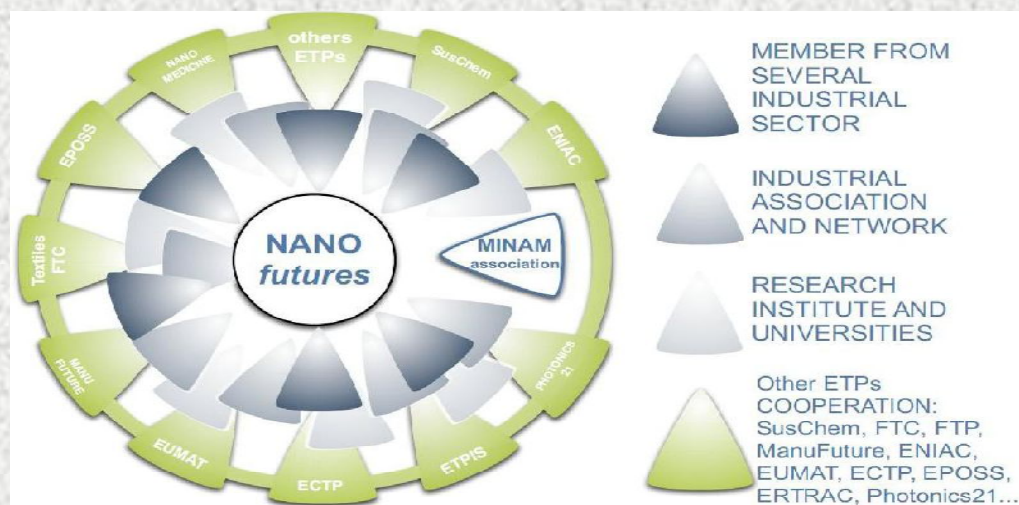
Nanofutures and its secretariat, the MINAM association will act as a “Nano-Hub” by linking external entities (JTIs, associations, ETPs) with experts group under an industry-driven management structure and a strong operational secretariat.

Nanofutures at its base will be open to industry, SMEs, NGOs, financial institution, research institution, universities and civil society with an involvement from Member States at national and regional level. It will be an environment where all these different entities would be able to interact and come out with a shared vision on nanotechnology *futures*. Nanofutures collaborate with the other ETPs on the basis of a Memorandum of Understanding.



**IMNR-
contact point
for Nanofuture-
Romania**

Details on
www.imnr.ro
(under construction)





***NANO*utures Technological Initiative**



Launching the "NANO*utures*" European Initiative - The European Technology Integration and Innovation Platform (ETIP) in Nanotechnology



Time: June 15-16th 2010

Place: Conference Center of Gijón – Asturias (SPAIN)

Organisers: The European Commission, the Spanish EU Presidency, the Government of Principality of Asturias, the NANO*utures* association and PRODINTEC are jointly preparing this Official Launch of the NANO*utures* initiative.

During the event, FP7 research project coordinators will have the possibility to make dissemination activities of their respective project objectives/results. In particular, project coordinators are invited to present posters during the networking session on June 15th informing attendees of the latest developments and allow them to meet with project managers.



Conclusions and future prospects

Hydrothermal chemical method that were developed in IMNR are single steps and cost effective processes enabling nanophase particle production and their functionalisation.

Bottom –up approach recommending this procedure as key enabling technologies for nanomaterials

Standardisation of characterisation methods- one of the key parameters of large – scale production of nanomaterials and transfer to innovative SMEs

Hybrid nanomaterials and ceramic nanostructures have a clear and define market niche, starting with medical field to energy and environment.

IMNR considers the nanomaterials a strategic area for its future activities.



THANK YOU FOR YOUR ATTENTION

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