Advanced Ceramic Materials Brazil

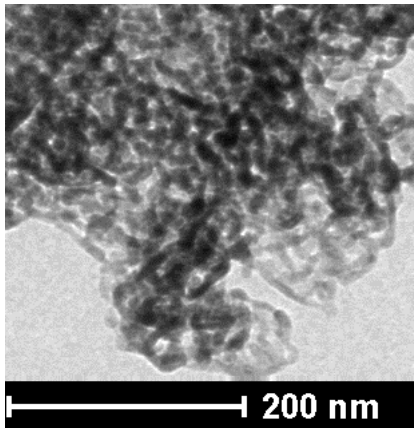
Nelcy Della Santina Mohallem

Laboratory of Nanostructured Materials

centro de microscopia da UFMG

EULANETCERMAT

UFMG



Advance Ceramics in Brazil

Between 1970 and 1980 – ~ 10 doctors ceramic specialist

2010 - 50 groups in different universities (more than 500 doctors)

1 - Universidade Federal de São Carlos –
Department of Material Engineering (DEMa) – 1972 – First in Brasil

Pioneer in the material field in Latin America –

- **Graduate, undergraduate and extension courses,**
- **scientific research, technological development, services of material characterization, consulting, etc.**

It was structured in three academic areas of Science and Engineering Materials: Metals, Ceramics and Polymers

Laboratory of Ceramics,

- **Synthesis of Ceramic Materials**
- **Special Ceramics and Refractories**
- **Ceramics Coatings (LaRC)**
- **Vitreous Materials (LaMaV) – Edgar D. Zanoto**
- **Material Processing by microwave**
- **Electrical and Electronics Ceramics**
- **Ceramic Characterization**

DEMa

Universidade Federal de São Carlos – DeMa

In the 40 years of existence, DeMa formed about 1750 engineers of material and in the program "Postgraduate Science and Engineering of Materials" titled about 950 maters and doctors.

DEMa had great influence on the growth of this area in Brazil. Doctors trained in San Carlos went to several Universities and Research Centers of Brazil, forming new research groups

Crescimento de Cristais e Materiais Cerâmicos

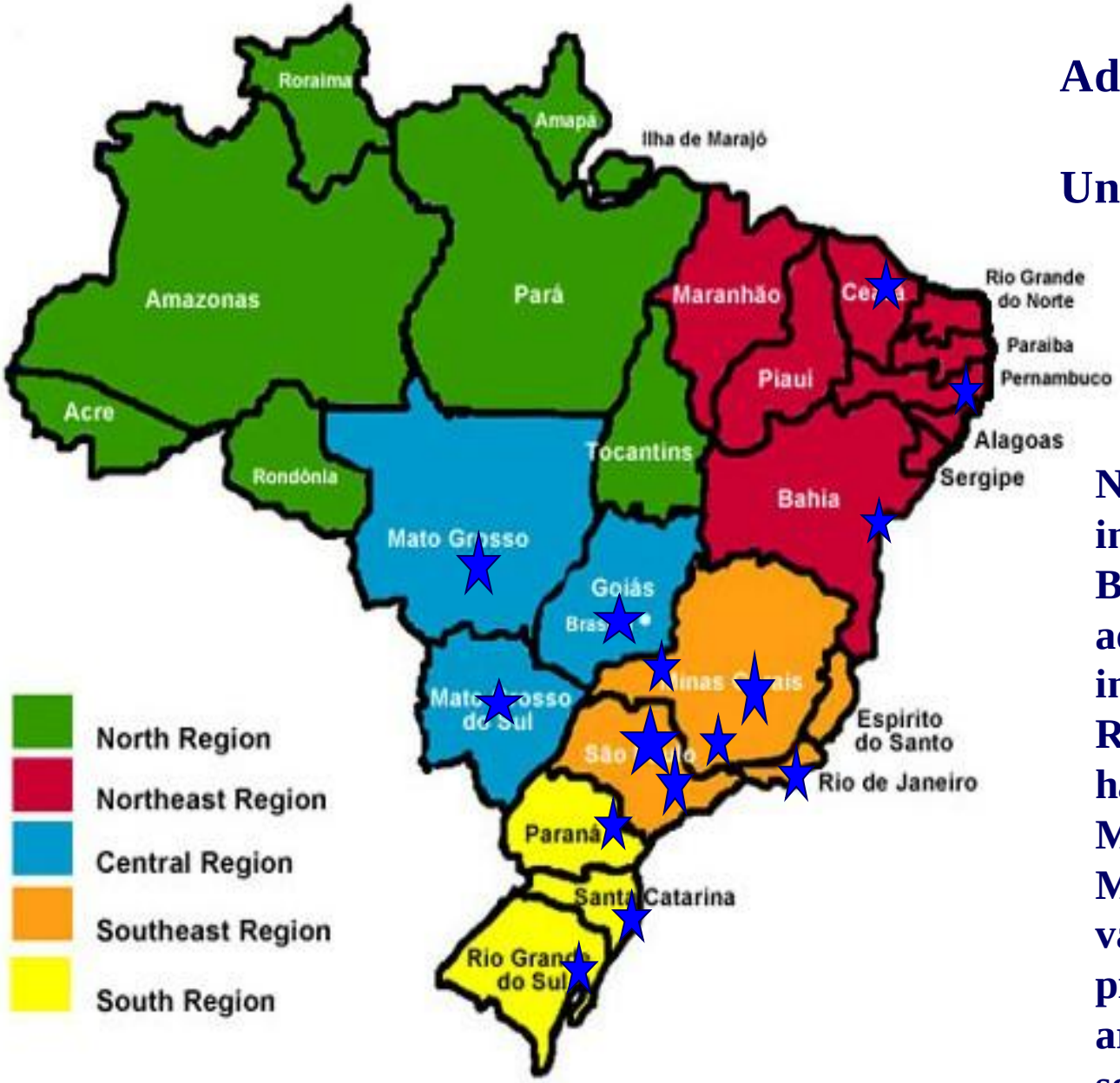
Universidade de São Paulo/ São Carlos

Physics Institute and Department of Material Engineering

CMDMC - Center Multidisciplinary for Development of Ceramic Materials

Advanced Ceramics

Universities of Brazil



Now we have several important groups in Brazil, working in advanced ceramics areas in the Universities and Research Centers. And we have new courses of Material Engineering and Material Chemistry various regions. The principal research groups are in the southeast and south of the country.

2 - Instituto de Pesquisas Energéticas e Nucleares (IPEN) - 1982
Center of Science and Technology of Materials

- *Biomaterials*
- *Fuel Cells*
- *Electroceramics*
- *Structural Ceramics*
- *Composites*
- *Magnetic Materials*
- *Glasses, etc*

4 - Universidade Federal de Santa Catarina – 1991

CERAMIC & COMPOSITE MATERIALS RESEARCH LABORATORIES

Biomaterials
Traditional Ceramics
Composite of Matrix Ceramic (CMC)
Fast-Firing
Electric isolating
Ceramic Laminates
Mathematical Modeling
Vitroceramics, etc

CERMAT
CERÂMICA

LiEC Araraquara - UNESP

4 - Laboratory Interdisciplinary of Electrochemistry and Ceramics

Universidade Estadual Paulista - Araraquara

- Processes and synthesis of new materials - multidisciplinary

- correlation between synthesis, properties and morphology,
- control of morphology and properties of materials with complex structures;
- development of new methodologies for the preparation of ceramic systems;
- optical, electrical, ferroelectric, superconducting, and refractory properties

Labiomat
Laboratório de Biomateriais
& Cerâmicas Avançadas

5 - Biomaterials Laboratory (LaBiomat) was grounded at Federal University of Rio Grande do Sul, Materials Engineering Department in November, 2002.

- **biomaterials and implantable devices:**

calcium phosphate cement, hydroxyapatite, porous hydroxyapatite, biopolymers, scaffolds for engineering tissue, coatings, titanium and prosthesis for mandible replacement.

Labiomec

The University of Campinas

Material for odontology and orthopedic

Synthesis and characterization of:

- **hydroxyapatite**
  calcium phosphate cement
- **Composites: Alumina/Zirconia**
  Alumina/ hydroxyapatite
  Titania/ hydroxyapatite

UNICAMP

Material Engineering

UFPE

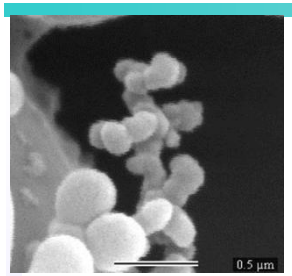
UNIVERSIDADE FEDERAL DO CEARÁ

CDTN
CENTRO DE DESENVOLVIMENTO DA TECNOLOGIA NUCLEAR

UNIVERSIDADE FEDERAL DA BAHIA - UFBA

UFRJ

UFPR



Universidade Federal de Minas Gerais

Several laboratories of ceramic materials distributed in the Chemistry Department, Physics Department and Department of Metallurgic and Material Engineering.

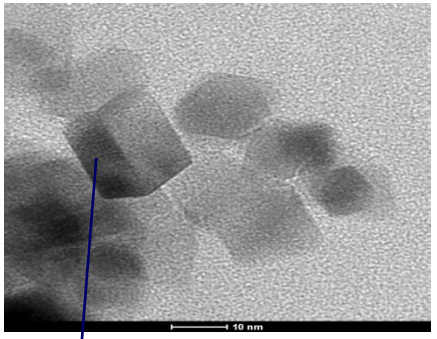
Synthesis of ceramic powders
Sol-gel Process, Hydrothermal Process, Coprecipitation
Special drying: Supercritical drying, freezing drying and spray drying

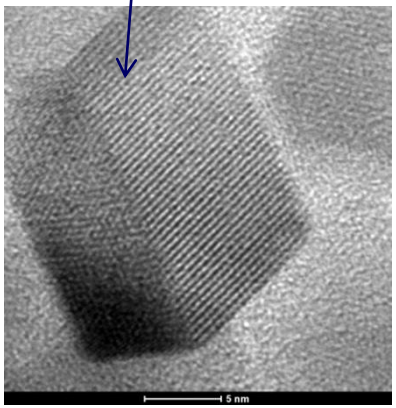
Characterization of materials
X-ray diffraction, spectroscopy in the infrared region, gas adsorption,
SEM, HRTEM, EDS, WDS, EBSD, electron difraction , AFM, MFM, EFM, Nanoindentation, etc

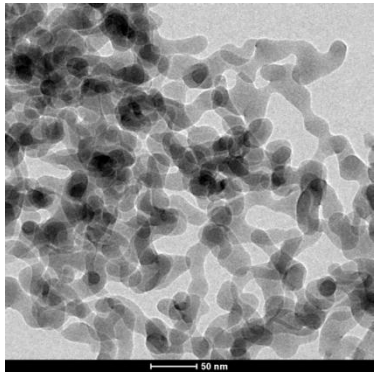
Nanoparticles –size<100nm

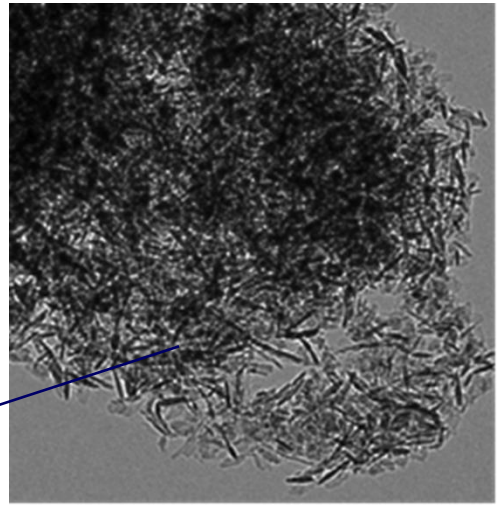
Al_2O_3, SiO_2, TiO_2, ZnO, $BaTiO_3$, $LiAlO_2$, $CaCO_3$, ferrites, etc

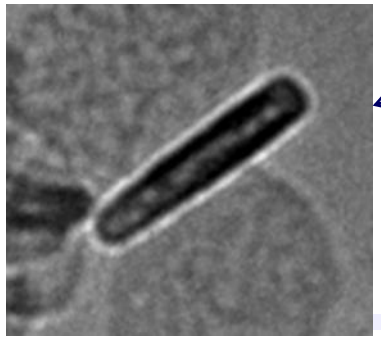
Production in pilot scale

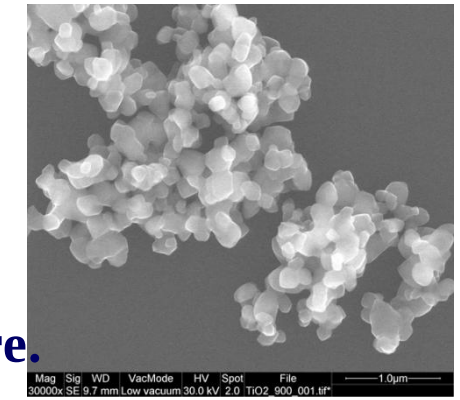






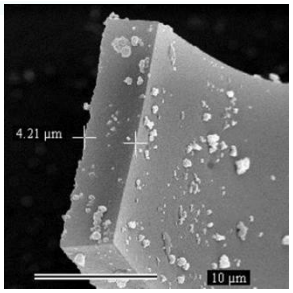






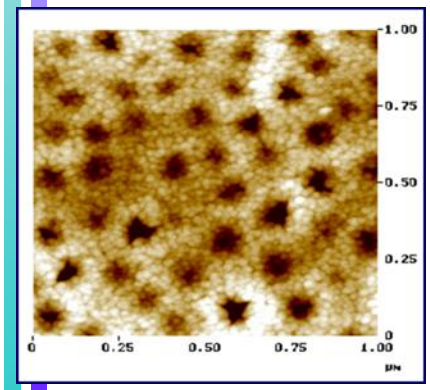
Controlled size, shape and texture.

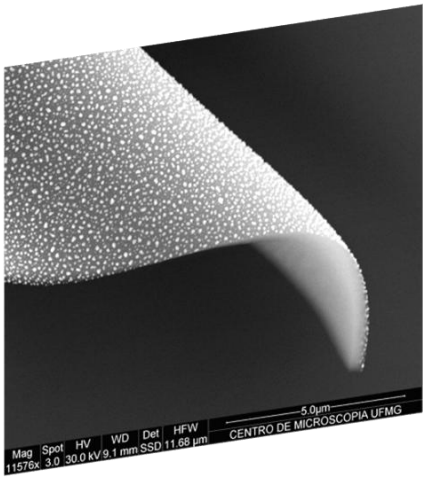
UFMG

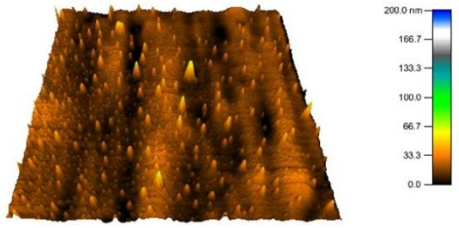


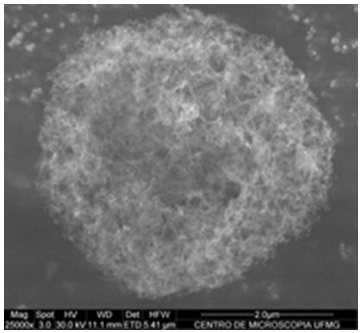
Thin films (ceramic coatings) - Al2O3, SiO2, TiO2, Ag/TiO2, ZnO, BaTiO3, ferrites, etc

Properties: photocatalysis, bactericide, magnetics, ferroelectrics, protective, anticorrosion, etc

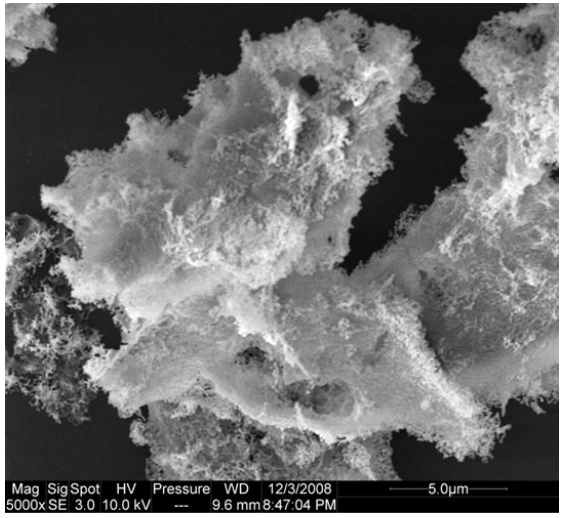


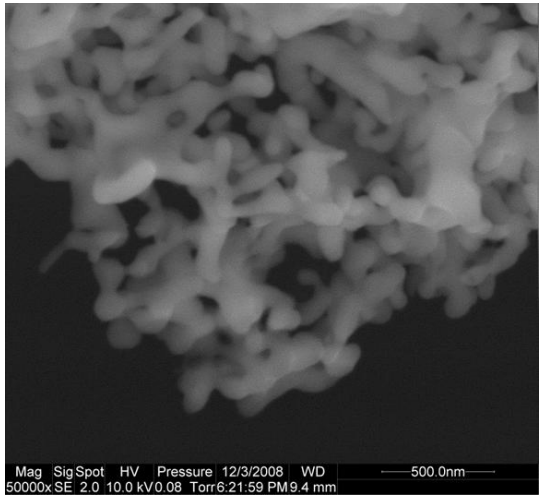


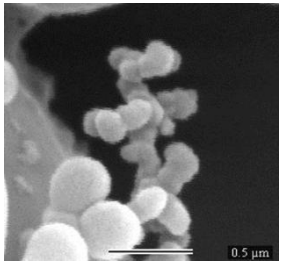




Porous Materials – filters , catalysts, drug delivery, sensors.







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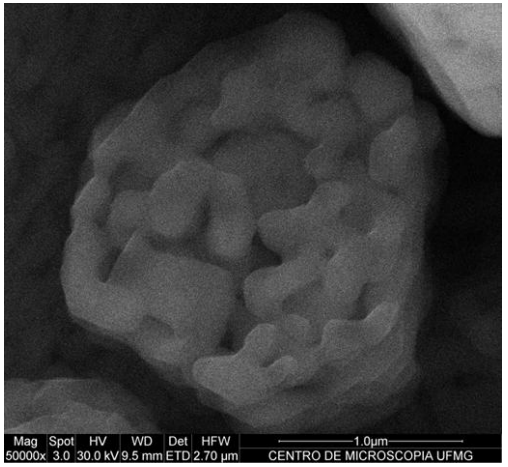
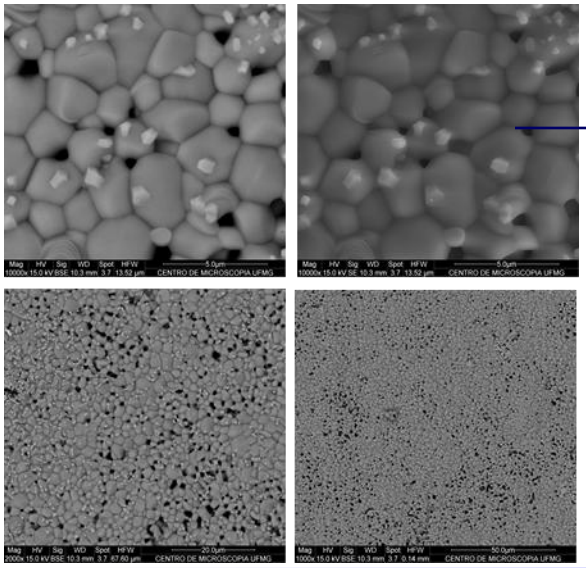
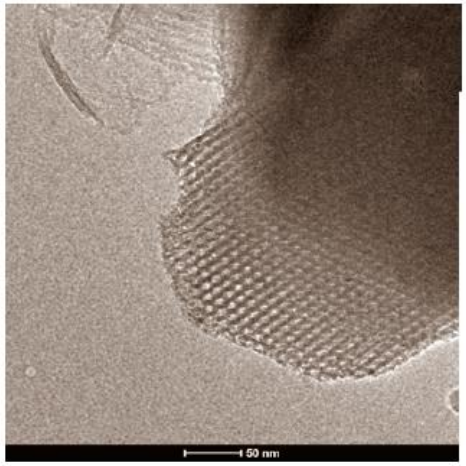


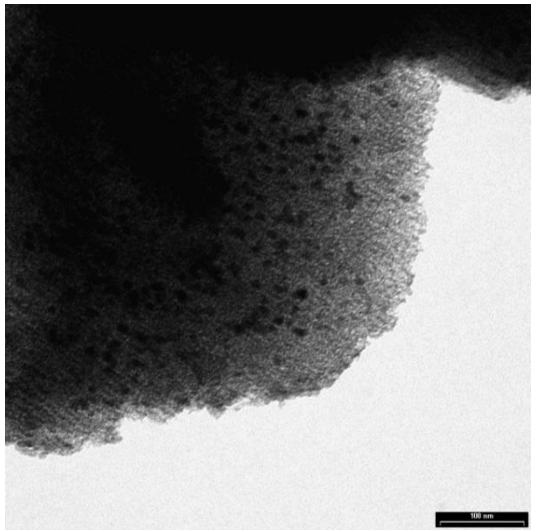
Magnetic Ceramics
Ferroelectric Ceramics
Ferroics
Biomaterials
Fuel Cells
Varistors



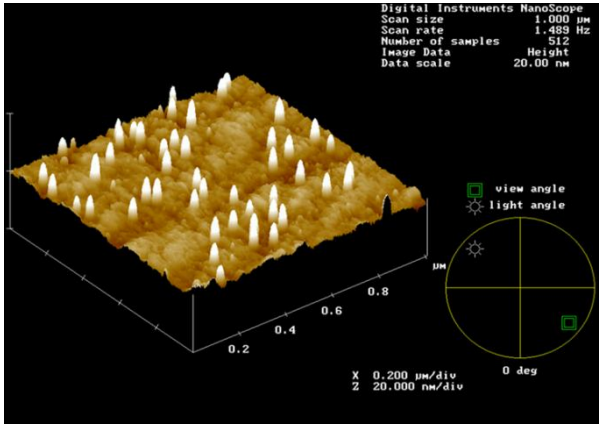
ZnO porous Ceramic to production of Ga by Irradiation – Used in PET (positron emission tomography)

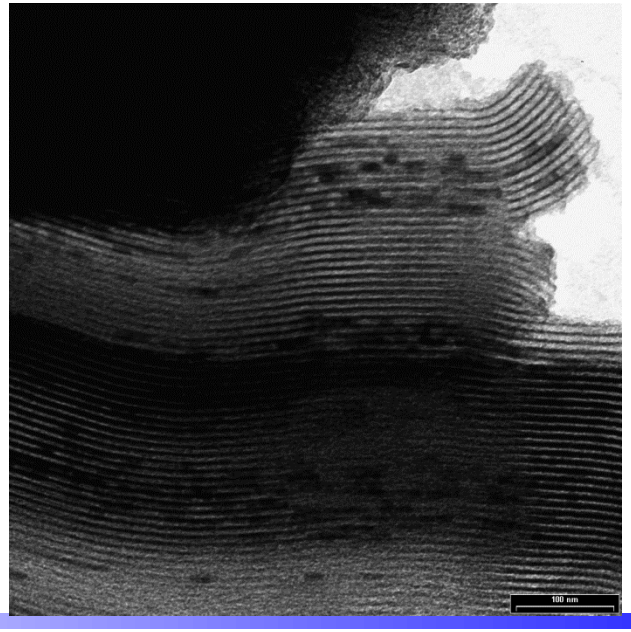
Composites ferrite/SiO2





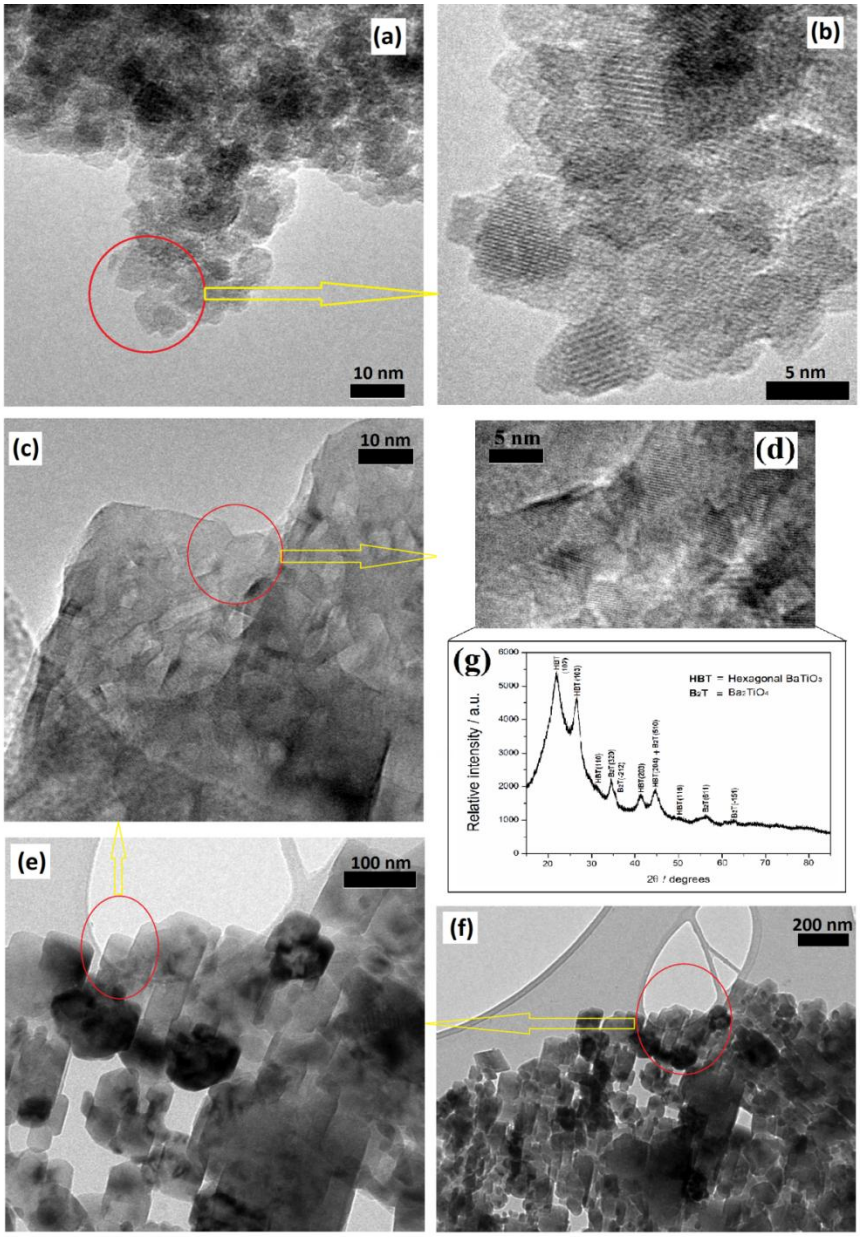
Application: Hyperthermia, Catalysis

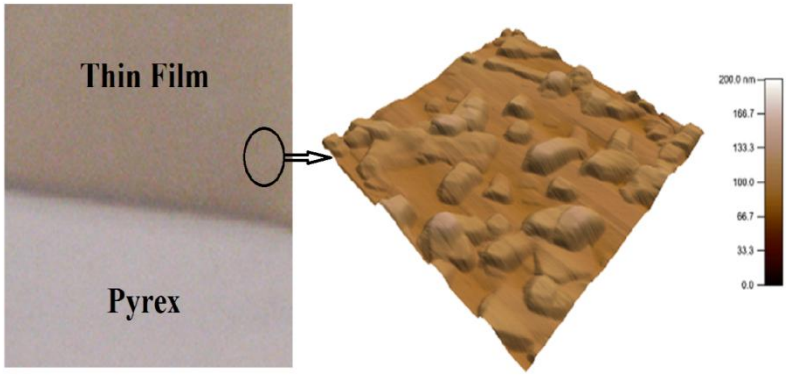




BaTiO3

Sol-gel process



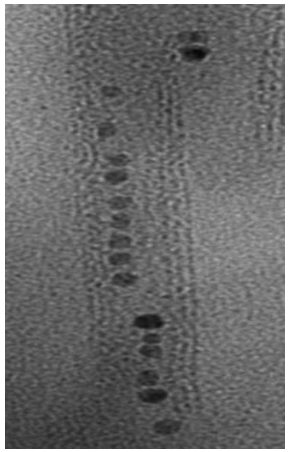


Capacitors

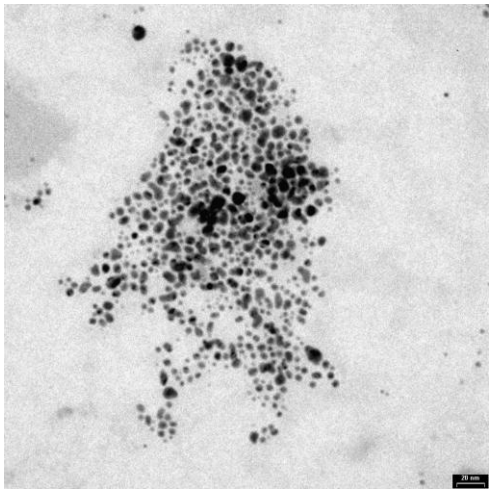
- **UFMG has large interaction with companies.**

- **Large production of papers and patents**

- Several researchers created companies with nanotechnology Base.



Ferrofluids



Acknowledgment

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Thanks for your attention

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