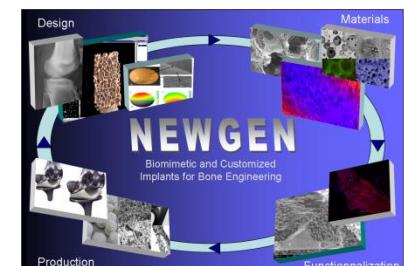


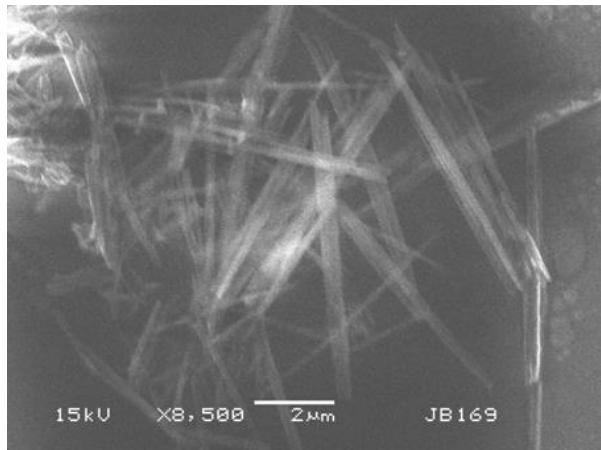
## GENERAL PRESENTATION

- **Complete denomination:** Laboratoire d'Ingénierie et Sciences des matériaux
- **Location (city, country):** Reims, Charleville-Mézières, Troyes, FRANCE
- **Director:** Prof. Jean-Paul CHOPART
- **Contact person in NEWGEN:** Dr. Anne-Lise DALTON
- **Working Group involvement:** WG1, Design and synthesis of raw materials
- **Staff:** 48 staff (14 Profs, 18 Ass profs, 6 Res Assistants, 8 Ph D, 2 temporary researchers)
- **Research topics:** Elaboration & characterisation of materials & biomaterials  
Multiscale modelisation
- **Researchers expertises:** Electrochemists: alloys, oxides, polymers, nanoparticles synthesis ; Physicians et mechanicians: surface analyses, mechanical modelisation  
Dentistry: implants, facial repair ; Plasturgists: polymers, biopolymers, agro-composites

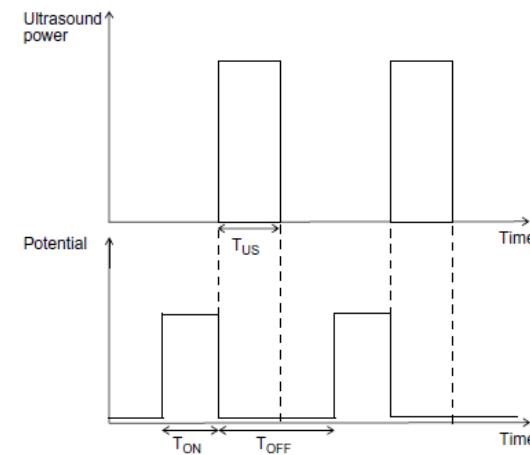


# CaP nanowires and nanopowders electrosynthesis

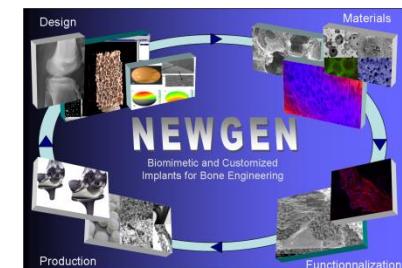
- Nanowires by template method (40 µg batch)
- Nanopowders by pulsed sonoelectrochemistry (40 mg batch)



SEM micrograph of CaP nanowires (8µm ; Ø 260 nm)



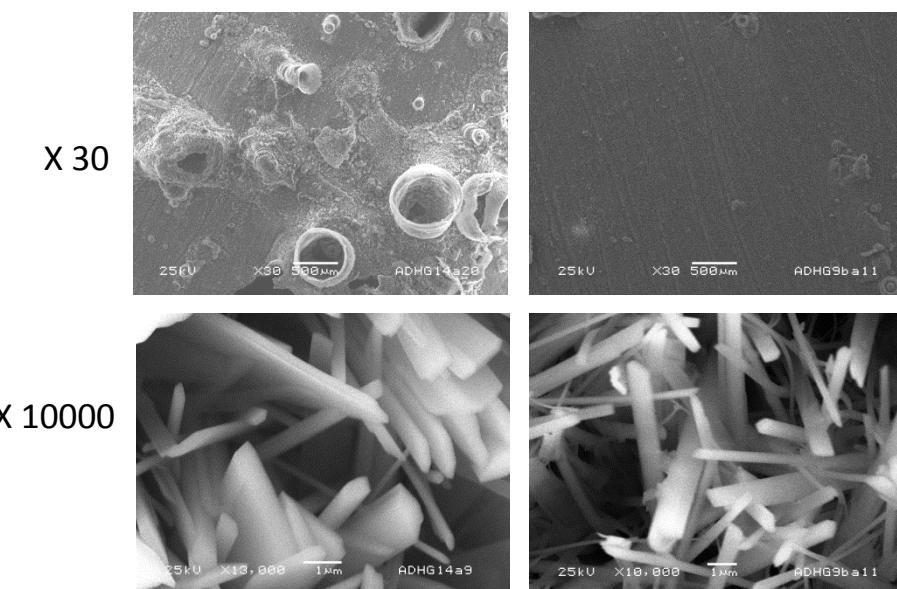
Out-of-phase electrochemical and ultrasound pulses



# CaP coating by magnetoelectrolysis

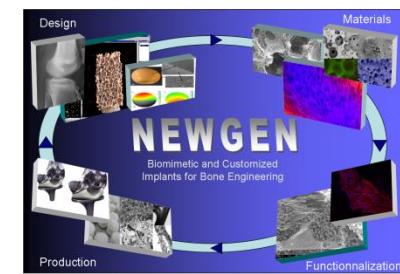
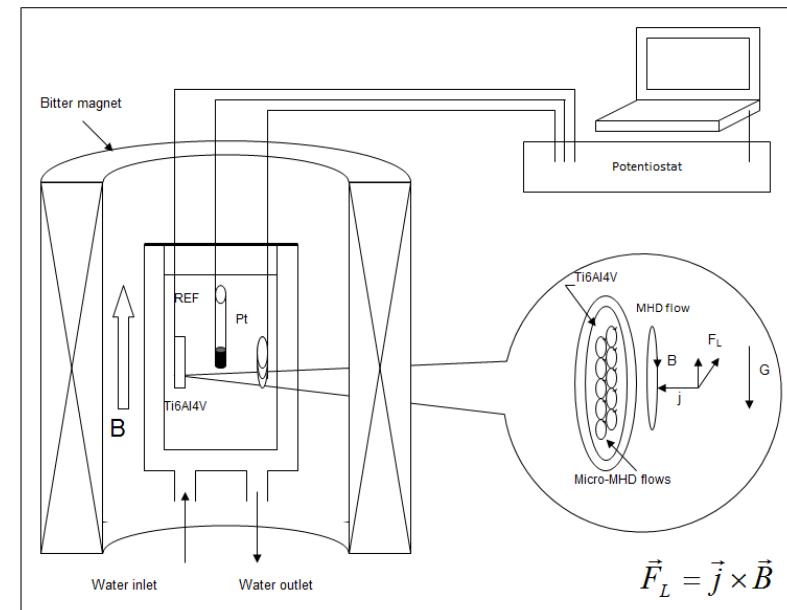
## SEM images

$B = 0\text{T}$



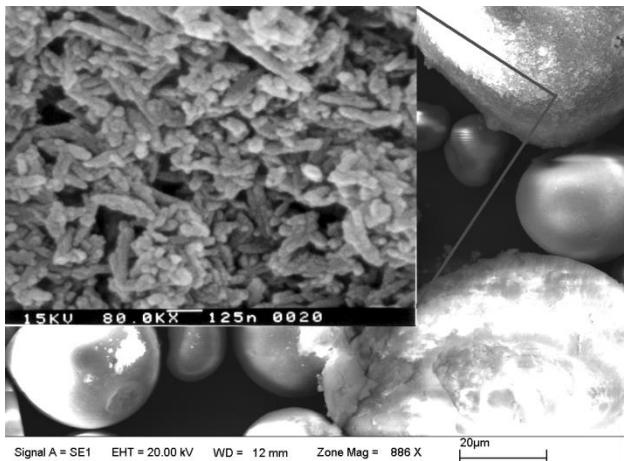
*With the LNCMI high magnetic field facilities*

Magnetohydrodynamic convection used during potentiostatic deposition of CaP coatings could reduce considerably formation of volcano-like structures, generate more uniform deposits without changing Ca/P ratios and change shape crystallites from belt to needle

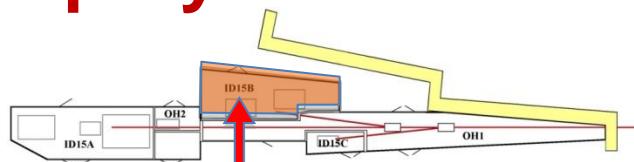


# Nano-HA plasma sprayed on titanium substrate

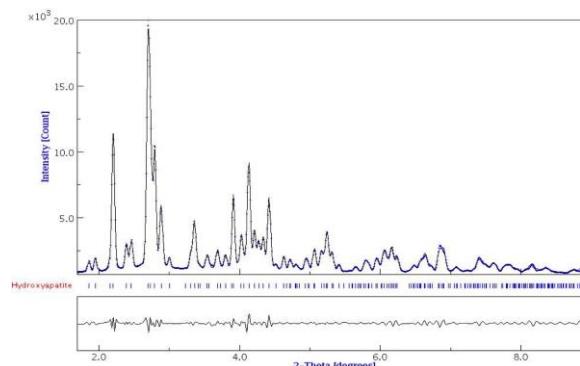
## SEM images



N-HA coating plasma sprayed on titanium alloy substrate. Spherical agglomerated particles (35 $\mu$ m average diameter) composed of nanocrystals (100 to 135nm).



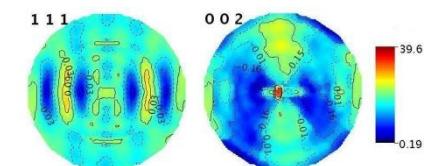
ESRF Synchrotron ID15B (high energy 88.4 keV)



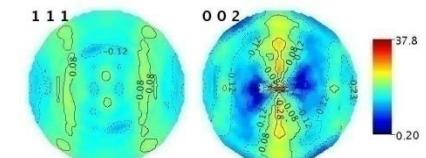
*With the ESRF facilities*

Cortical bone healing after implantation is compared to a reference of non implanted cortical bone. After 60 days (sheep), with HA or nano-HA, crystallinity index was similar to non implanted bone. Nano-HA only allowed a similar crystal texture to non implanted bone.

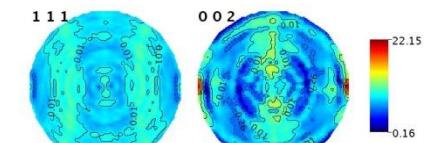
Reference : cortical bone



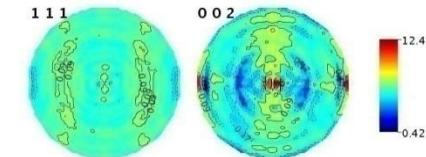
Bone at nano-HA interface



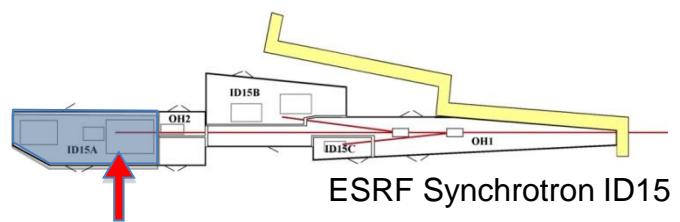
Bone at HA interface



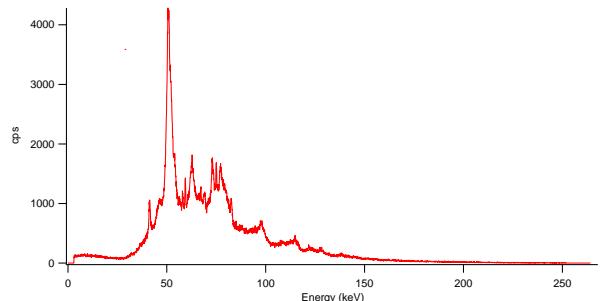
Bone at Ti6Al4V interface



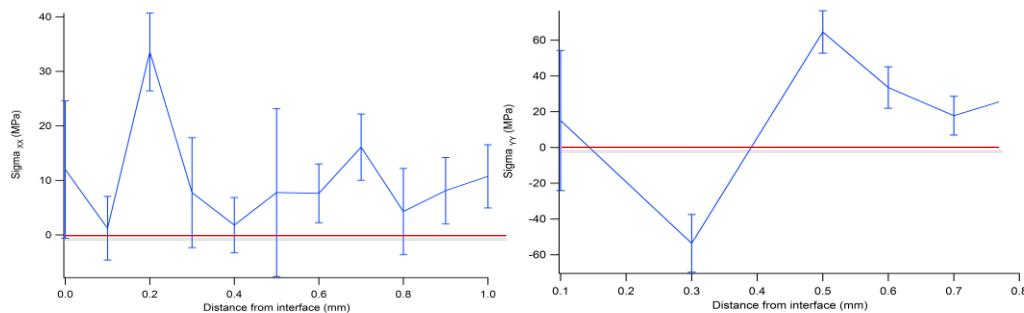
# Residual stress evaluated at Nano-HA implant – bone interface



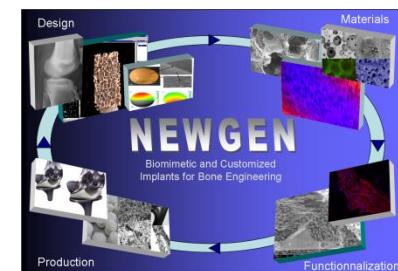
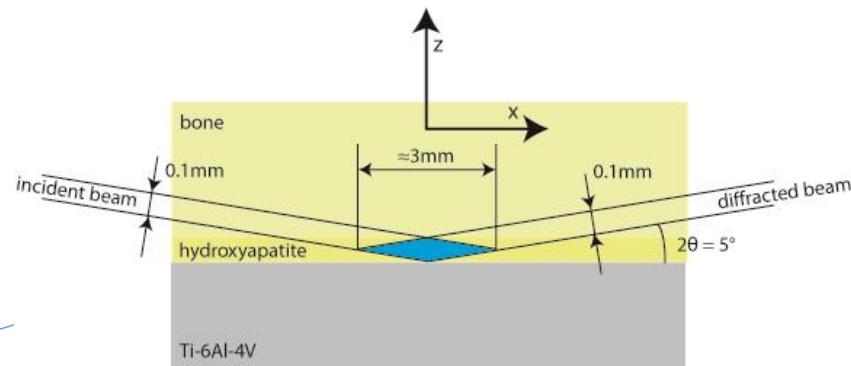
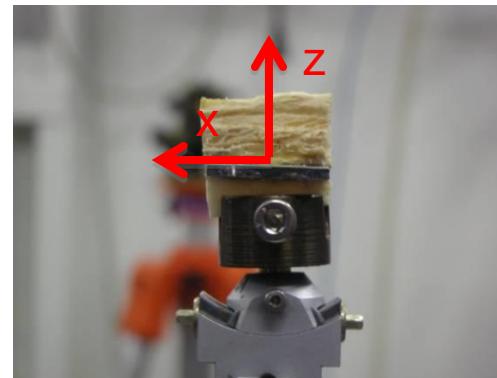
ESRF Synchrotron ID15



Bone : energy-dispersive X-ray diffraction spectrum



Calculated residual stress in healed bone  
(60 days) at nano-HA interface  
X (left) and Y (right) axes



## FACILITIES

### Raw materials synthesis

- \* Powders
- \* Coatings

Sonotrode and potentiostats



Sonotrode\*



Pulsed sonoelectrochemical apparatus\*

### Characterisation

- physical: grain size, Zeta potential, morphology...
- chemical and structural: EDX, XRD, ...



JSM 6460LA & EDS JEL 1300



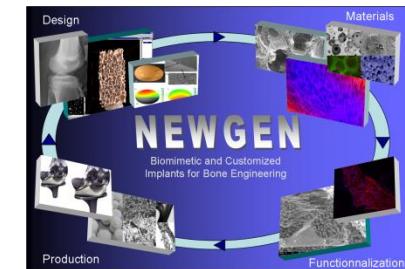
D8 Advance Diffractometer



Delsa Nano C Particle Analyser\*



\* With the financial support of FRM



COST Action MP1301

## Shaping and sample preparation

- Electrodeposition, electrodeposition under magnetic field ( $B < 6T$ ) or in controlled atmosphere
- Sol-gel coating method: « spin-coating »
- Twin-screw extrusion
- thinning and ion polishing
- furnaces



Potentiostat



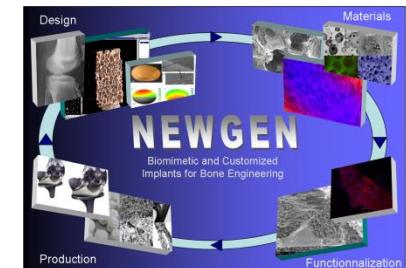
Electromagnet



Glove box



Sol-gel



COST Action MP1301

## FACILITIES

### Characterisation of bulk materials, coatings and surfaces

**Electrochemical analyses:** voltammetry, impedance spectroscopy, corrosion...

**Physical:** electronic insulating materials behavior, thickness, optical constants

**Microstructure:** SEM, chemical composition

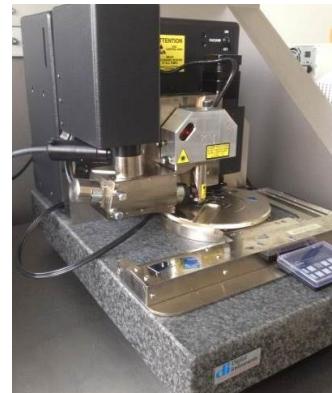
**Mechanical properties of surfaces:** hardness ( $\mu$  & nano), fretting, rugosimetry, analyzes of mechanical stresses in advanced materials



Video traction



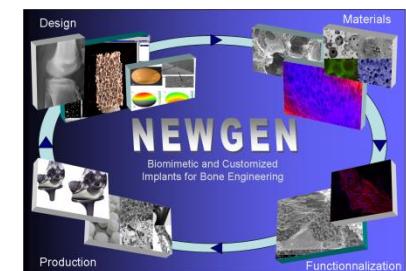
Ultra Nanoindentation



AFM Digital Inst.



Spectroscopic  
ellipsometer



*With the financial support of*