CENTRE d'ELABORATION de MATERIAUX et d'ETUDES STRUCTURALES

CEMES – Toulouse, France

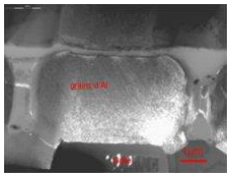
69 Researchers, 40 Technicians and engineers, ~ 25 PhDs, ~ 20 Post-Docs

Scientific Objectives :

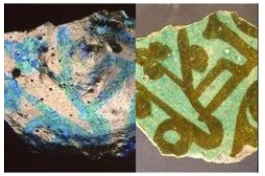
- ➔ To elaborate new (nano)materials (phyiscal route) and develop devices to demonstrate their properties
- ➔ To establish relationships between (nano, micro)structure and physical properties of materials and nanomaterials
  - ➔ Design of new instruments and measurement techniques/methodologies to investigate these « objects » at pertinent scales (spatial and temporal)
  - ➔ Synthesize, and image the prototypes of molecular nano-machines

7 research groups:

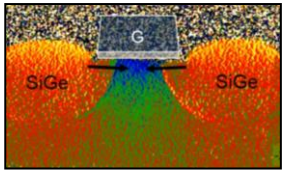
NANOALLOYS



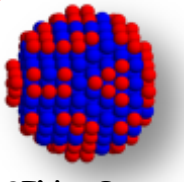
PPM:
Physique de la Plasticité & Métallurgie



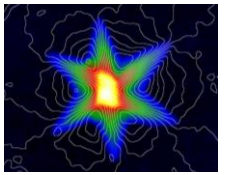
M3:
Matériaux Multi-échelles Multifonctionnels



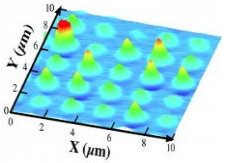
MEM:
Matériaux et dispositifs pour l'Electronique & le Magnétisme



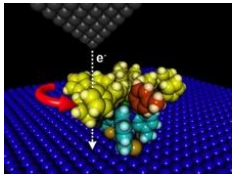
SINanO:
Surfaces, Interfaces & Nano-Objets



I3EM:
Interférométrie, In situ & Instrumentation pour la MET



NeO:
Nano-Optique & Nanomatériaux pour l'Optique



GNS:
Groupe Nanosciences

"Surface, Interface and nano-objects" group SINanO

- **Pluridisciplinary** group (physics, chemistry and biology) dedicated to the study of functional nano-objects, with special emphasis on the physics and reactivity of their surfaces and interfaces.
- **Theory and experiments**

People

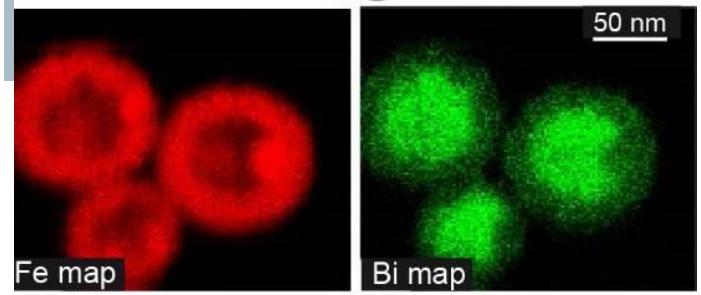
- 12 permanent researchers: 5 theorists and 7 experimentalists
- 3 PhDs
- 1 Post-doc

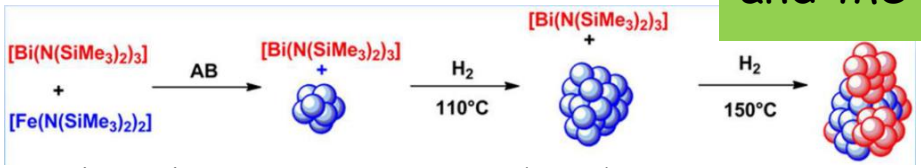
Research Topics

- Nanoparticles: formation mechanisms, size effects, properties.
- Interfaces: formation mechanisms and impact on the mechanical, magnetic, electronic and optical properties.
- Self-assembling and self-organization at surfaces.
- Interaction between crystalline surfaces and their environment : functionalization and reactivity.

Nanoalloys in SINanO

BiFe@Fe

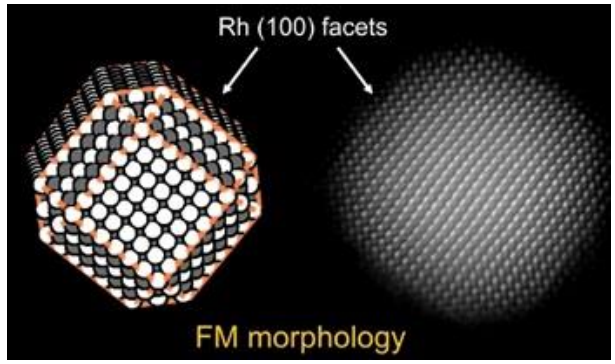




J. Phys. Chem. C ***117****,1477–1484 (2013)*
Faraday Discuss. **175**, 97-111 (2014)

Effects of size, composition and morphology on the atomic structure and the properties

B2-ordered FeRh

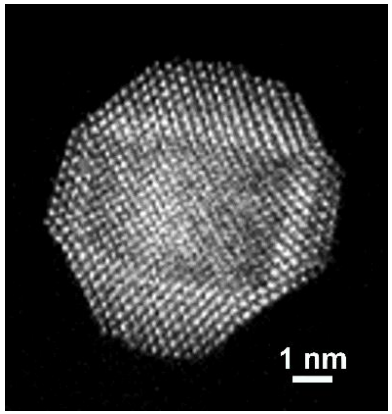


EPL ***116****, 27006 (2016)*
Nature Comm. ***8****, 15703 (2017)*

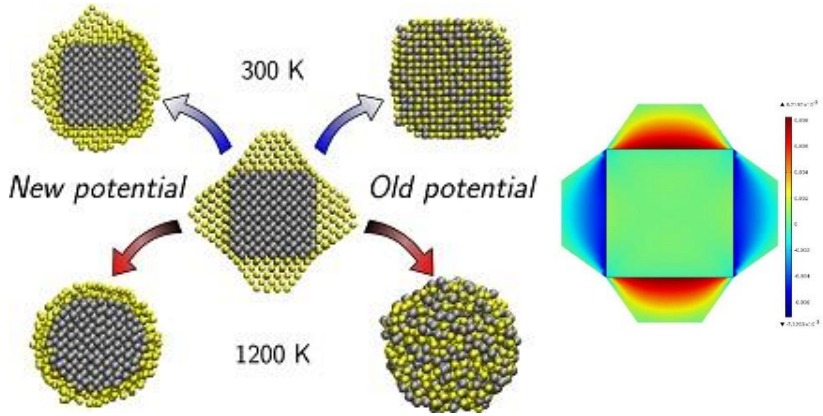
Elementary mechanisms occuring in the formation and stability of the nano-objects

Phys. Rev. B ***90****, 165437 (2014)*
Nano Lett., **15** (8), 5075–5080 *(2015)*
PCCP. ***18****, 9112-23 (2016)*
JPC C, ***121****, 4680 (2017)*

Fe@Au



Epitaxy of a Au shell on a Fe core: Fe@Au (UHV sputtering)

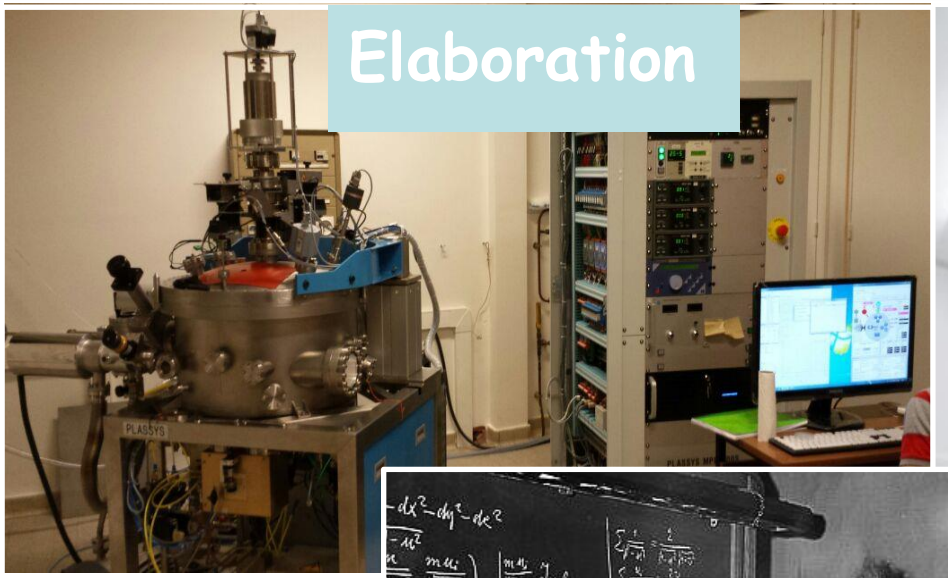


Atomistic modelling and FEM

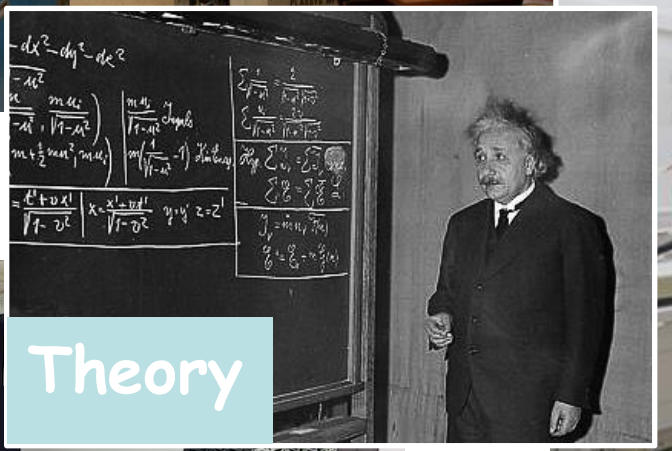
Techniques

Atomic structure

- *Advanced AC TEM –STEM CEMES- UMS Castaing-LMA Zaragoza*
- *X-rays : WAXS (PDF) - EXAFS*



Elaboration

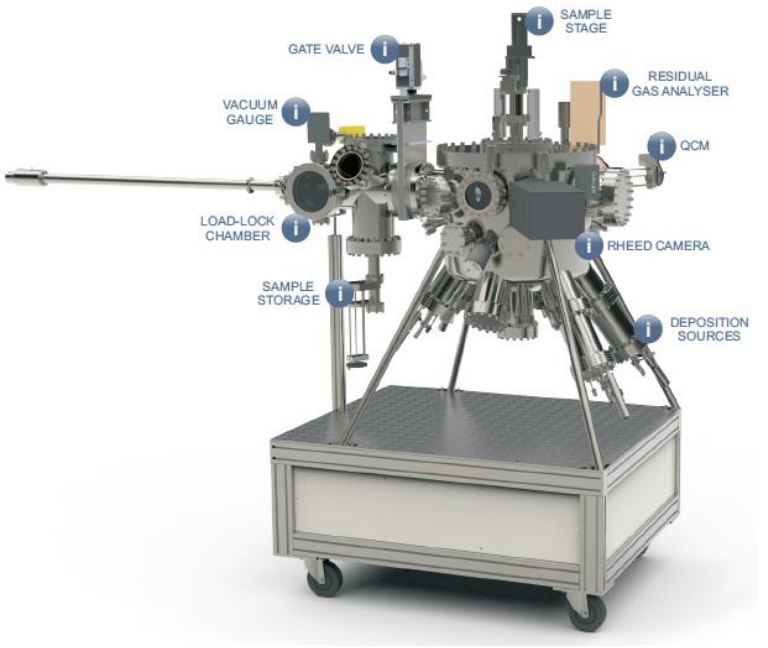


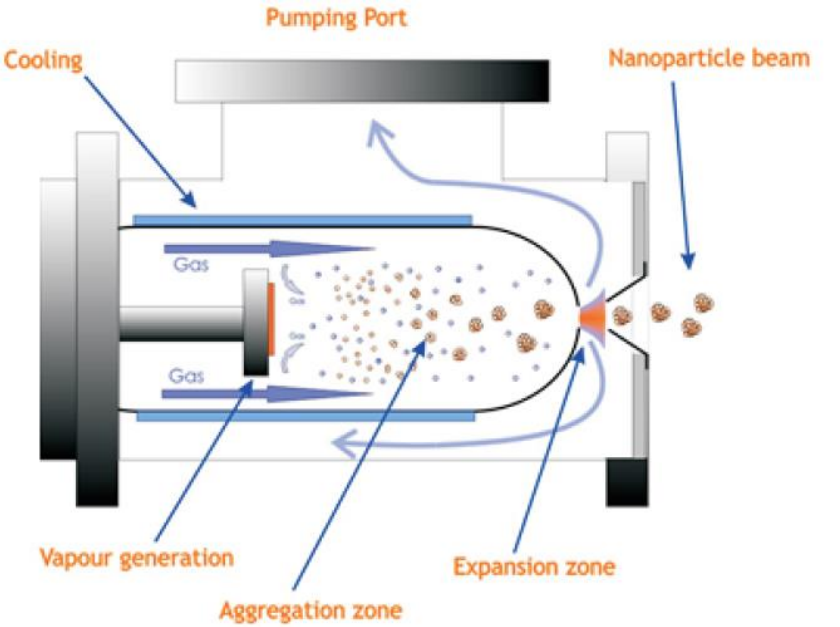
Theory

HCP

New elaboration equipment (sept. 2018)

Elaboration of thin films (metallic and dielectric) and of nanoparticles





- 5 sources for metallic deposition
- 2 sources for insulator deposition
- 1 source of NPs
- Temperatures from $T_{ambiante}$ to 900°C
- Gaz: Ar, O, N

+ analysis tools