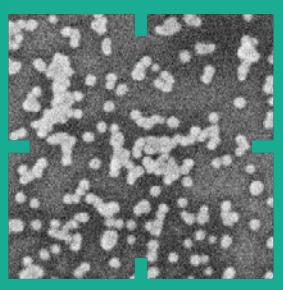
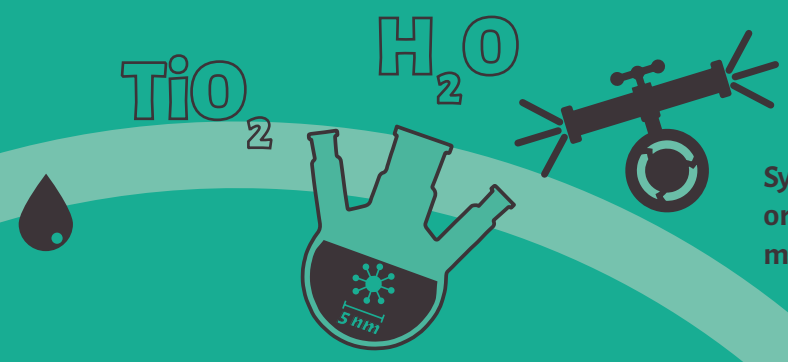
MINOS

Inorganic Materials and Nanostructures

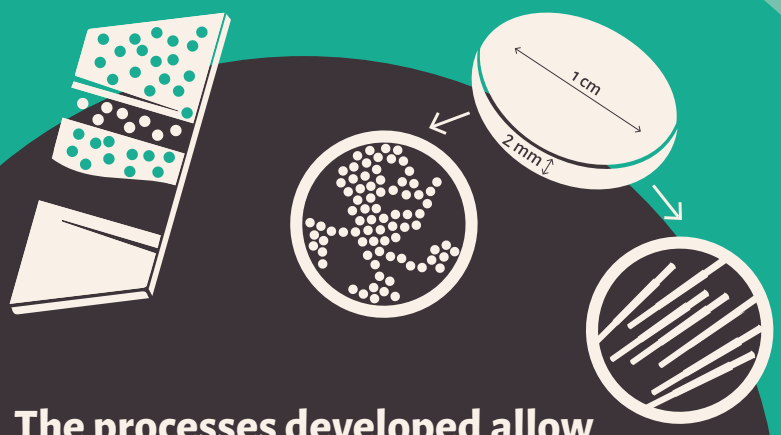
Researchers in the MINOS axis develop chemical processes for manufacturing nanoparticles, three-dimensional objects no larger than one or two hundred nanometers in size.

They are made by using chemical reactions in solutions that cause atoms to come together and create nanoscale assemblies, halfway between the macroscopic and atomic scales.

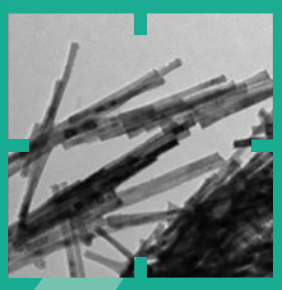




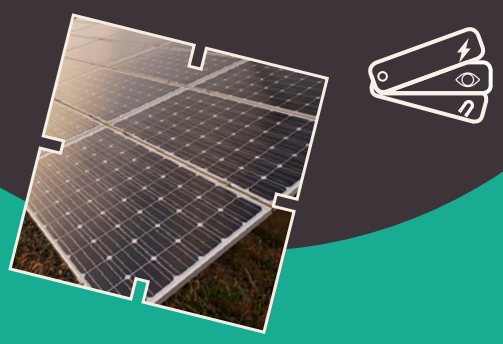
Synthesis in a polyol medium or in a rapid micromixing reactor



These nanoparticles are then ordered together to produce a macroscopic material : magnets will give the shape of needles all oriented in the same way. They can also be deposited in the form of thin layers.



The processes developed allow the manufacture of materials with hybrid and multifunctional properties useful for ecological transition for example.



Dip coating under controlled atmosphere

Sintering (sometimes assisted by a magnetic field)

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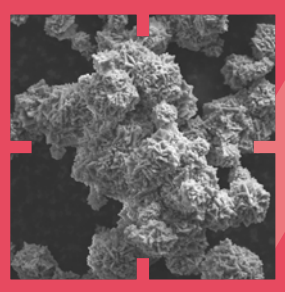
MECAMETA

Mechanics and metallurgy of materials

Within the MECAMETA axis, researchers work mainly on metals. They use high pressure and temperature processes to obtain materials with the desired mechanical properties (hardness, elasticity, density...).

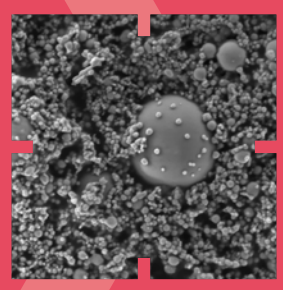
The precursor materials are most often alloy powders. Their selection is an important step in the research process because the size and shape of the selected grains will have an influence on the final material.



H 2 µm

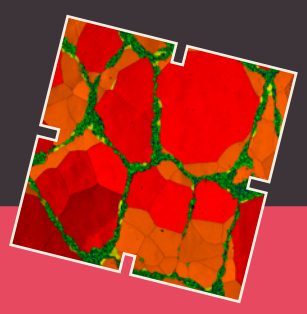
Impact or fragmentation of powders using a mill

The powders are then impacted, comminuted or sintered. These actions allow to intervene at different scales : from the crystalline structure to the microstructures.



H 20 nm

The processes developed find applications in the aerospace and medical fields where the materials need specific properties.



Sintering at high pressures andtemperatures that modify the structures of materials

By varying the pressure and temperature during these steps, materials with different properties are obtained. To identify their characteristics, they are tested in the form of test specimens.

Design : Nathalie Lidgi-Guigui / graphic design : Laura Bertrand et Camille Lindeperg / Images ©LSPM

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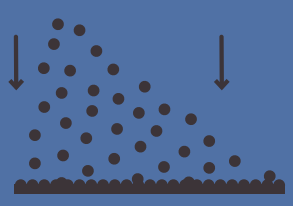
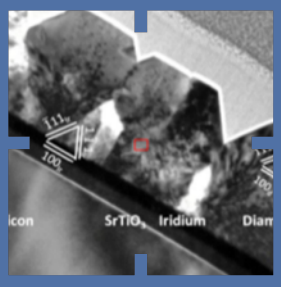
PPANAM

Plasma processes, nanostructures and thin films

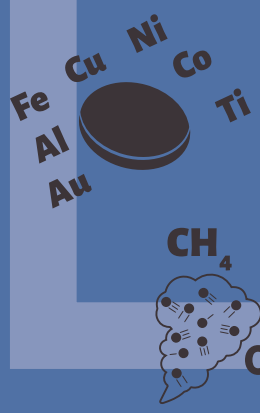
The PPANAM research axis uses atom deposition growth : atoms are arranged on a substrate to form a new material. Working directly at the atomic scale allows researchers to create very thin layers of material.



At the LSPM laboratory, to arrange atoms on a surface, a pure material can be vaporized or sputtered. Another technique is to control chemical reactions in gas phase to deposit carbon atoms that will become diamonds.



⊢ 2 µm

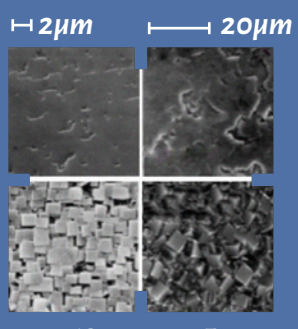


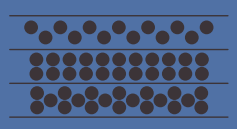
Precursors are used in the form of solid metal or reactive gas.

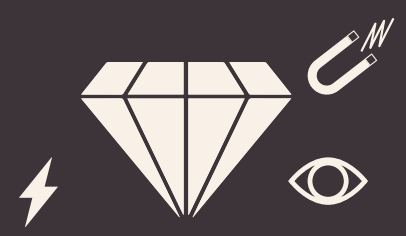
These processes involve physical phenomena and chemical reactions that will influence the organization of atoms and control the properties of the material obtained.

The formation of a plasma, for example, occurs in the sputtering process.

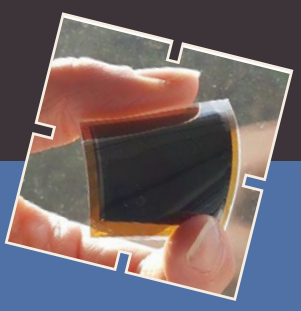
The substrate used also influences the growth of the material : this phenomenon is studied within PPANAM as well.







The processes developed make it possible to manufacture materials with innovative properties in fields such as electronics, magnetism, optics... and which can even improve the aesthetics of certain devices!



Design : Nathalie Lidgi-Guigui / graphic design : Laura Bertrand et Camille Lindeperg / Images ©LSPM

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LSPM

Laboratory of Process and Material Sciences

Nearly 140 people work in this experimental science research laboratory. They investigate different subjects linked by the same theme: the physico-chemical process of materials manufacturing and their characterization.

MECAMETA

PPANAM

MINOS

The laboratory is organized in 3 work axes which are in relation with each other : PPANAM, MINOS and MECAMETA

Processes make it possible to transform materials by giving them new properties : strength, density, structure, etc. that can be used in many applications.

The process is the method by which a precursor is transformed to a final form. This protocol can involve several physical or chemical phenomena as well as different techniques.

The researchers enrich the scientific community with new knowledge, but their discoveries are also of interest to the private sector. Nearly half of the researchers work with companies.

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