INNOVATIVE CATALYTIC PROCESSES AND ADVANCED MATERIALS

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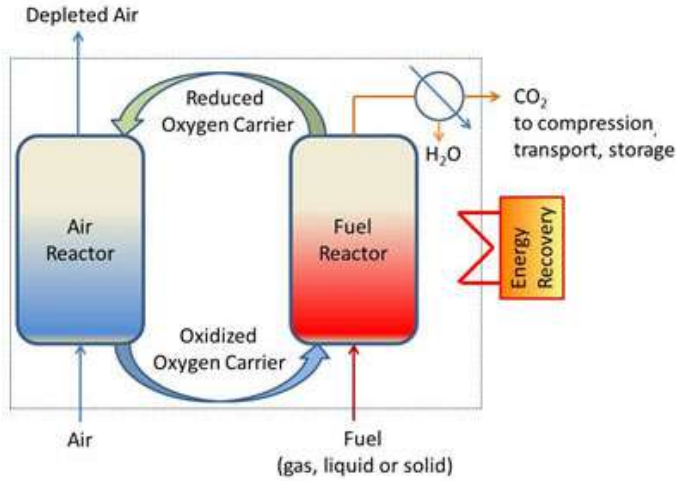

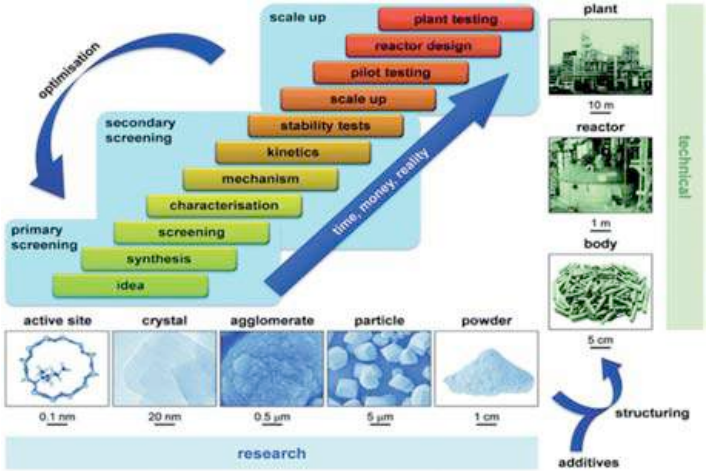

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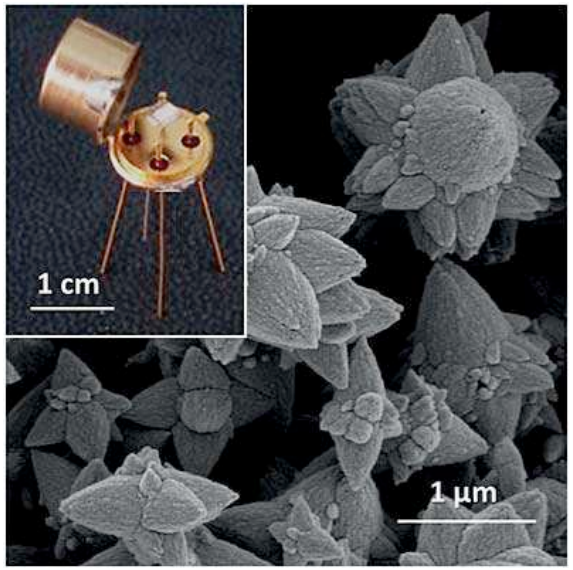
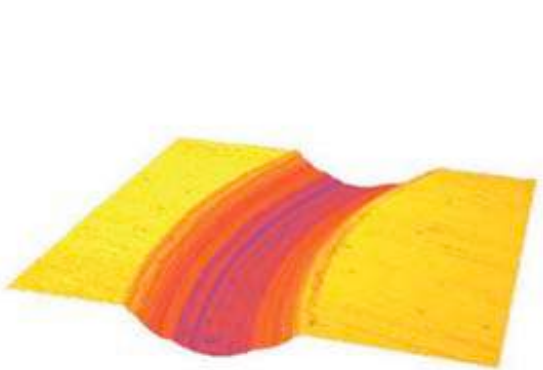
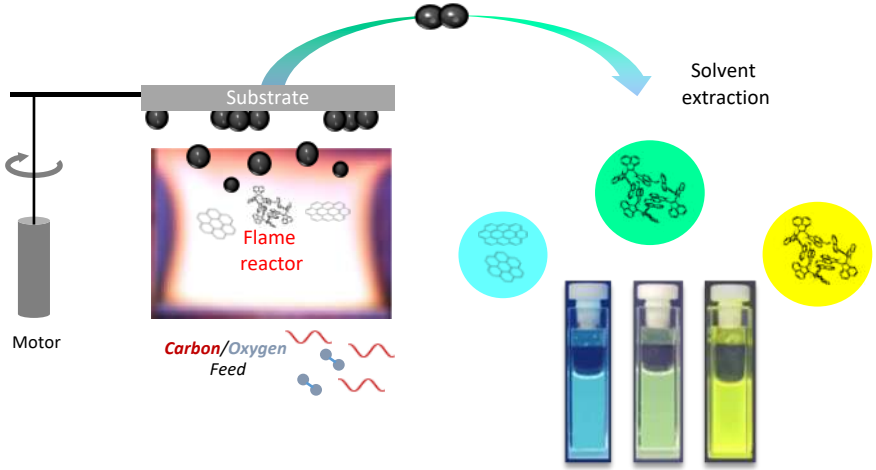






The development of materials and catalysts is part of a context of sustainability both in the processes in which they must be used and in the production of the material itself. The sectors of interest in fact are of interest with other lines of activity: mobility, propulsion, decarbonisation, circular economy. T

he activities are important for the design, development and testing of materials. They are the basis for an advancement of most of industrial processes and allows, through the introduction of targeted functions, to improve performance and production of selected materials.

The catalysts and materials developed are therefore aimed at obtaining an overall increase in the sustainability of the process both through the development of material production techniques that use less expensive (by-products, waste, etc.) or less toxic products and through the introduction of properties which lead to a significant reduction in the energy involved in the process (generally catalytic).

MATERIALS / CATALYSTS FOR A PROCESS

Increase in the sustainability of processes and/or development of new eco-sustainable processes alternative to traditional ones.

- ✓ Lower costs and the environmental impact of the process
  - Replacement of noble metals with other elements or reduction of their concentration
  - Reduction of the energy involved in the process in which the catalyst/material is used (process temperatures, number of process stages, reactor volume)
- ✓ Development of resistance properties (chemical, thermal and mechanical) under severe operative conditions

PROCESS OF SYNTHESIS OF MATERIALS / CATALYSTS

Development of eco-sustainable processes for the production of materials.

- ✓ Replacement/reduction of materials used in the synthesis with others with a lower environmental impact
  - Use of waste materials for synthesis
  - Use of tools for subtractive machining with greater durability

Know-how

Design, development and testing of:

- ✓ heterogeneous catalysts and sorbents (from the chemical formulation to the structured system).
- ✓ carbon-based materials, also of MOF type, inorganic (inorganic oxides, TiO2, MgO, ZnO etc), hybrids and composites (ferromagnetites, graphene-like hybrids, MOF / GRM, etc) matewreials.
- ✓ ceramic materials, light alloys (eg titanium, aluminum) and polymeric matrix composites (from solution, from melt).
- ✓ biocompatible materials

Chemical / physical / mechanical characterizations of complex matrices (composite, ceramic, porous, etc)

Physico-chemical characterization, main instruments

- Elemental analysis (ICP-MS, CHNS, XRF)
- Morphological/structural characterization (optical microscope, XRD, SEM/EDX, AFM, chemisorption, laser for in-situ nanosec remote diagnostics, chamber for in-situ optical, spectroscopic and electrical analysis)
- Spectroscopies (RAMAN / FTIR / UV-Vis, In-situ FTIR / DRIFT)
- Thermal characterization (TPD / TPR / TPO, DSC, DTA, TG-MS)
- Granulometers
- Porosimeters
- Chromatographs (GC-MS, HPLC, IC-GC)

Mechanical and tribological characterization

- Tribometer
- Scratch test
- Profilometers
- Erosimeter
- Durometers

Functional characterization (catalytic processes)

- Laboratory scale catalytic test facilities for a wide range of processes
- Kinetic modeling of catalytic reactions

INNOVATIVE CATALYTIC PROCESSES AND ADVANCED MATERIALS

- ✓ Development/intensification of chemical accumulation processes starting from renewable sources, (thermochemical cycles: catalysts, carriers, etc.)
- ✓ Development of catalysts for upgrade of products
- ✓ Development of new composite or functionalized organic/inorganic sorbents for CO2 capture
- ✓ Development of new sorbents for the purification of natural gas and biogas and study of regenerability
- ✓ Development of eco-sustainable subtractive manufacturing processes and study of materials obtained through additive processes
- ✓ Innovative materials that have longer life and lower environmental impact during operation
- ✓ Development of alternative materials for batteries (components)
- ✓ Valorization of process by-products, waste (including urban solids) and processing waste
- ✓ Development and upgrade of materials and catalysts for the abatement of emissions from mobile or stationary sources that also use unconventional fuels
- ✓ Development of materials for sensors aimed at mitigating chemical risk (detection of VOC, O2, CO2 ...)
- ✓ Bottom-up synthesis from combustion and pyrolysis systems of fluorescent carbon dots
- ✓ Development of biocompatible materials

INNOVATIVE CATALYTIC PROCESSES AND ADVANCED MATERIALS

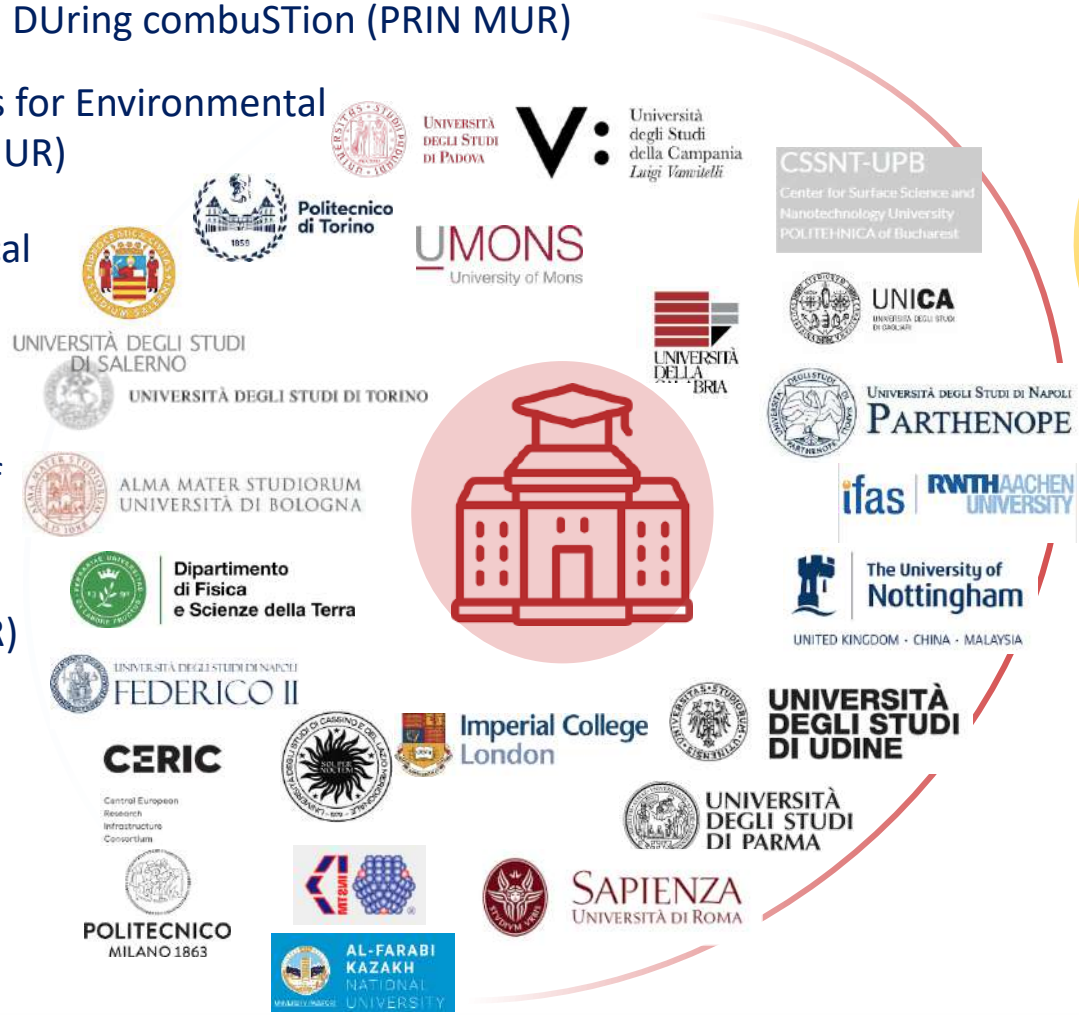
MAGIC DUST. Modeling and Analysis of carbon nanoparticles for innovative applications Generated dIrectly and Collected DUring combuSTion (PRIN MUR)

Nanostructured Porous Ceramics for Environmental and Energy Applications (PRIN MUR)

TRIM. Industrial and technological research for marine mobility (PON MUR, EU)

BIOFEEDSTOCK. Development of integrated technological platforms for the enhancement of residual biomasses (PON MUR)

WIREADD. Production of complex geometries through additive manufacturing by metal wire deposition (PRISM-E Piemonte region)



MAIN SOURCES OF FINANCING / COLLABORATIONS