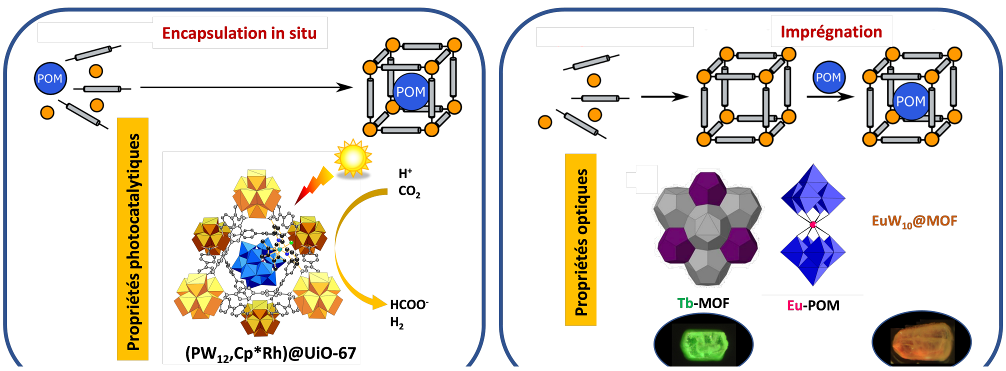
MATERIALS@MIM

The activity of the " **Materials**" axis is dominated by the design of composite materials. These materials combine a wide range of inorganic components, from molecular complexes (POMs) to inorganic clusters or nanoparticles (gold, metal oxides) or porous hybrid materials such as MOFs. A major focus is on the design of nanocomposites coupling MOF nanoparticles (nanoMOFs) to various inorganic (POMs, oxides) or (bio) organic (biopolymers, carbon materials, enzymes, cells) components. The materials obtained are being studied for various energy, environmental and biomedical applications.

POM@MOFs

These composite materials result from the immobilization of POMs in the cavities of MOF-type materials. These POM@MOFs are being



studied for their photocatalytic properties (CO_2 reduction, water oxidation), with the POM acting as a catalyst or electron reservoir, but also for their optical properties. For example, the immobilization of a luminescent POM in a luminescent MOF has led to the first luminescent ratiometric thermometer of the POM@MOF type.

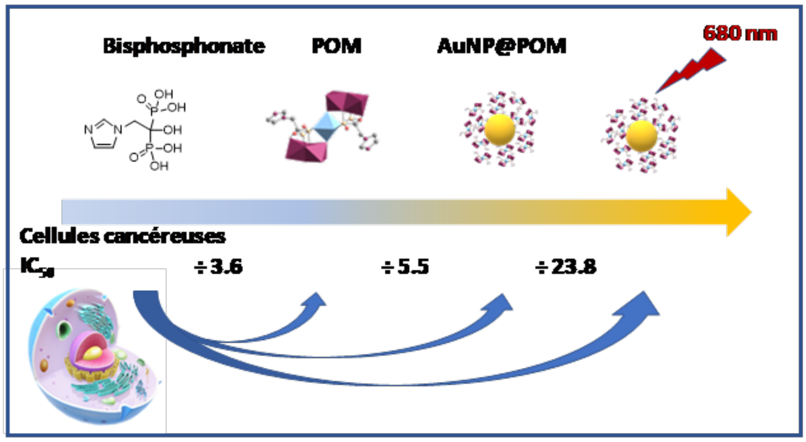
RECENT PUBLICATIONS

ACS Catal. **2022**

J. Mat. Chem. C **2024**

Applied Catal. B: Env. **2025**

Composites based on POMs for biological applications



The AuNP@POM composites studied by the MIM team combine gold nanoparticles and molybdenum-hybrid POMs containing biologically active bisphosphonate ligands. Their anticancer activity is drastically enhanced under irradiation at 680 nm thanks to the AuNP core. We are also investigating the antibiofilm activity of AuNP@POM nanocomposites.
Another family of composites combines POMs and photosensitizing molecules used for radical polymerization reactions. The resulting polymers generate singlet oxygen upon irradiation with visible light and exhibit antibacterial activity.

RECENT PUBLICATIONS

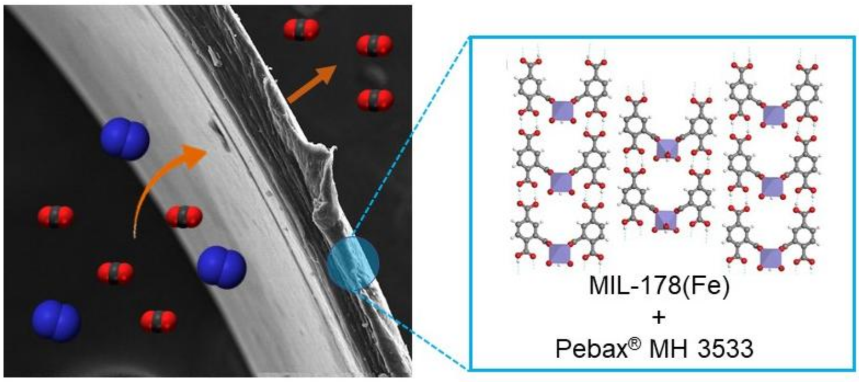
ACS Appl. Nano Mat **2021**

ACS Appl. Nano Mat **2024**

Eur. J. Polymer **2025**

Coord. Chem. Rev. **2026**

MOF-based nanocomposites for gas separation or photocatalysis



The MIM team is developing research on the design of nanocomposites combining MOFs with various components (polymers, carbon materials, metallic nanoparticles). These composites are being studied for the separation or conversion of small gas molecules (CO2, H2, etc.). We are also working on the synthesis of MOF nanostructures using certain carbon materials as structuring agents.

RECENT PUBLICATIONS

Chem. Sci. 2023

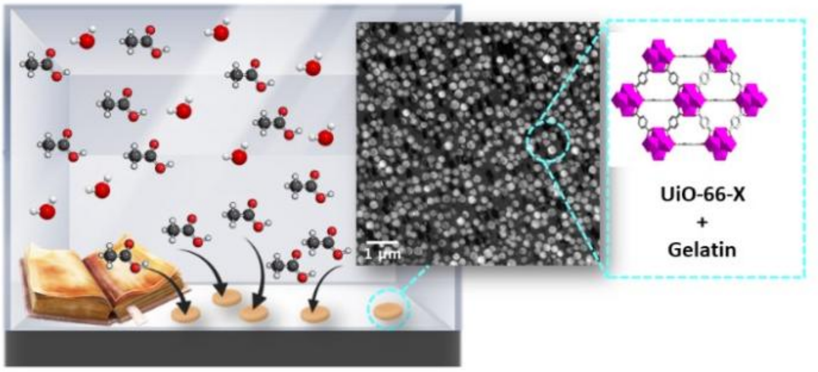
ACS Appl. Mater. Interfaces 2025

Adv. Mater. 2026

J. Photochem. Photobiol., A. **2026**

Nanocomposites based on MOFs and polymers for the capture of volatile organic compounds

The MIM team is involved in an interdisciplinary theme at the interface of heritage sciences and materials sciences. The aim is to design new MOF-based adsorbents for the capture of VOCs emitted in the ambient environment of museums. Our main focus is on the capture of acetic acid, a VOC highly emitted in museums due to the degradation of all cellulose-based materials (photographic films, books, furniture, etc.).



RECENT PUBLICATIONS

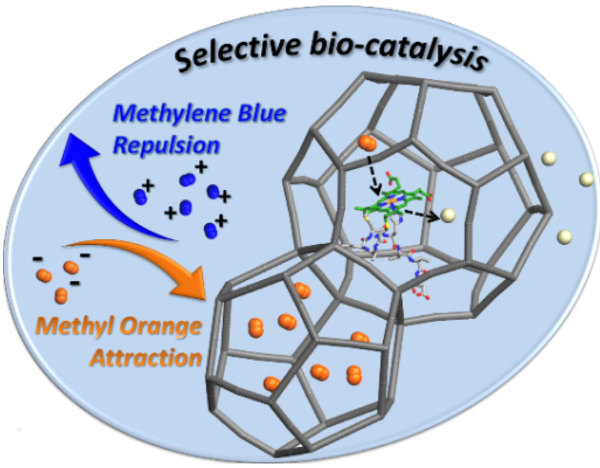
Chem. Mater. **2022**

ACS Appl. Mater Interfaces **2023**

ICOM CC **2023**

Porous biohybrid composites

The MIM team is developing a new family of porous biohybrid materials coupling MOFs and a wide range of biological components, from proteins such as enzymes and antigens to bacteria. The aim is to build new complex materials at the interface between the porous architecture of MOFs and the world of living organisms, opening up prospects in a wide range of applications (catalysis, health, environment) with major societal implications.

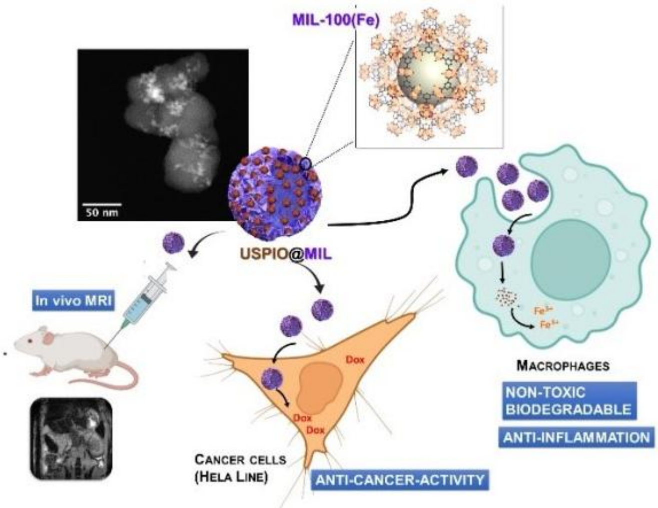


RECENT PUBLICATIONS

ACS Mater. Lett **2023**

Nano-objects coupling MOFs and inorganic nanoparticles

The MIM team is working on the design of new therapeutic vectors with dual functionality (therapy and imaging) by combining iron-based MOF nanoparticles (MIL-100(Fe)) with various inorganic nanoparticles (Au, Fe2O3...). This approach has the advantage of coupling the controlled drug release properties of nanoMOFs with the optical properties of gold or the magnetic properties of gFe2O3, which are very useful in medical imaging (optical contrast agent or MRI).



RECENT PUBLICATIONS

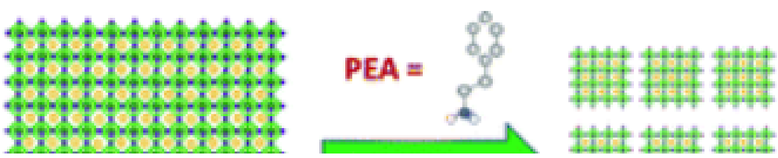
J. Mater. Chem. B. **2023**

Nanoscale **2024**

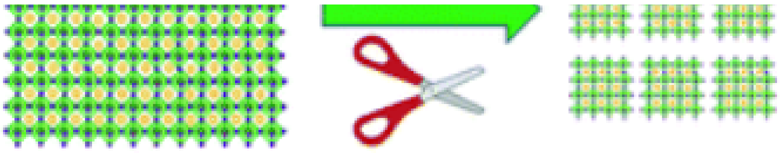
Adv. Healthc. Mater. **2025**

Soft chemistry perovskite nanocrystals

In collaboration with the LuMIn team (ENS-Paris Saclay), we are developing



soft chemistry methods for the large-scale production of monodisperse perovskite $CsPbBr_3$ nanocrystals. This approach is promising for the large-scale synthesis of this type of photoactive material for optoelectronic devices such as LEDs or photodetectors.



RECENT PUBLICATIONS

Chem. Commun. **2022**