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nano emca

Porous Materials for cleaner water, safer food and smarter sensing

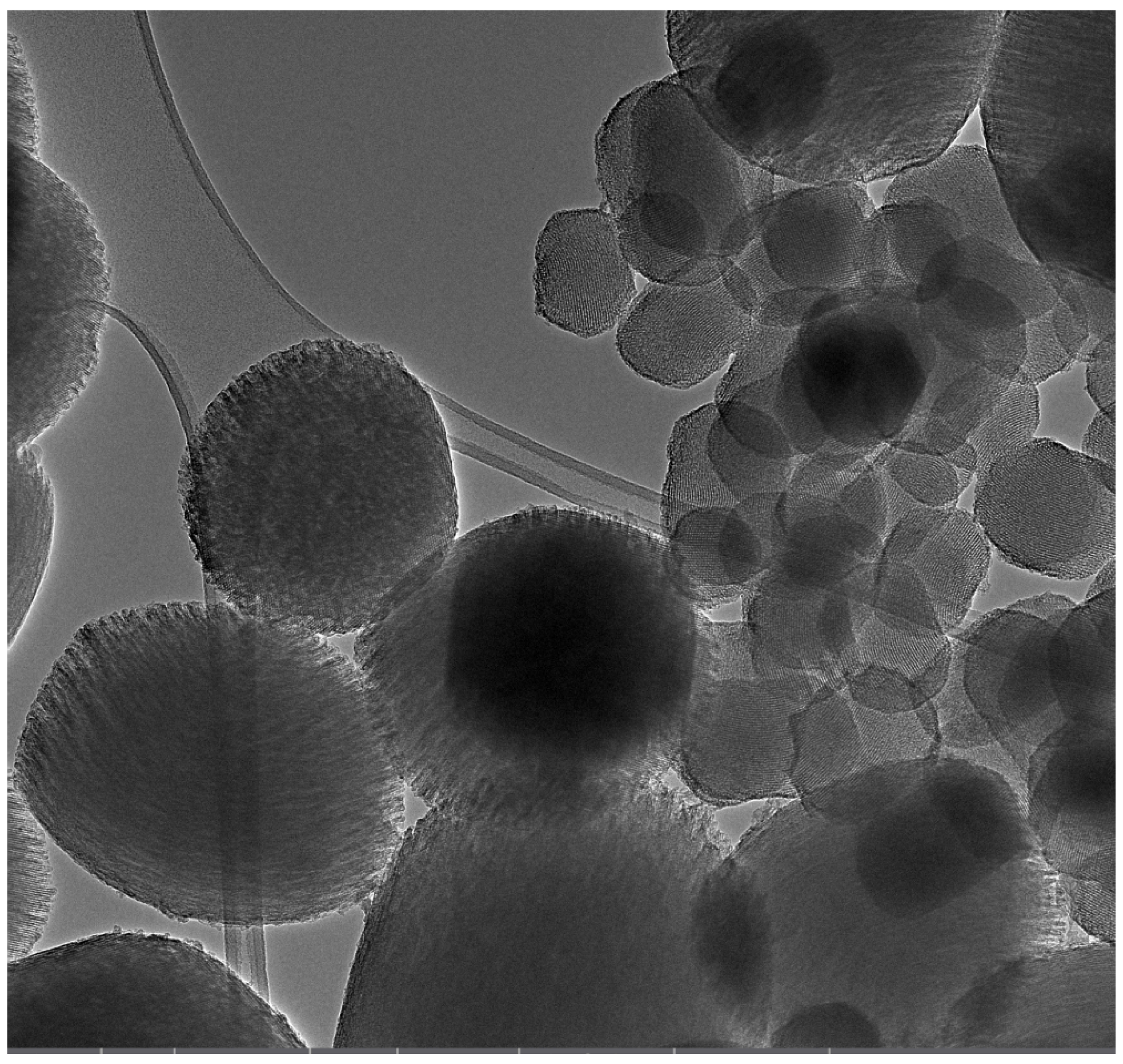
PMOs are porous materials. Their structure can be tuned so they can absorb, release, catalyse or detect different substances. In NANOEMCA, they are engineered as confined nanoreactors with different morphologies, large pores and high surface area.

How NANOEMCA makes PMOs

NANOEMCA develops PMOs through new synthetic routes, including template synthesis, post-grafting, photo-induced methods and green nanoparticle formation. The materials are then investigated with advanced characterisation tools to confirm structure, composition and performance.

Free and transition metal-loaded mesoporous organosilica confined nanoreactors will be obtained by synthesis approaches involving the design of ligands, preparation of metal complexes as metalloligands, and their subsequent incorporation into mesoporous framework or grafting onto mesopores internal surface.

The PMOs confined NRs prepared will be tested as encapsulation and delivery systems for volatile bioactive fragrances, antimicrobial compounds, and enzymes for food preservation. The PMOs will be used as efficient and highly selective adsorbents/ion exchangers for remediation of wastewater containing heavy metal ions.



Main applications of PMOs

Water treatment

PMOs can act as adsorbents and photocatalysts to help remove heavy metal ions, dyes, pharmaceuticals and other pollutants from water.

Food & packaging

PMO NRs will be used to develop active food packaging containing volatile compounds, and that materials can be safely, used by scientists and manufacturers working in the fields of health, food, environment and materials.

Biosensors

PMOs can support highly sensitive gas sensors and electrochemical biosensors, including platforms for medical detection such as HER-2.

Biocatalysis

Enzymes can be immobilised inside PMOs so they remain stable and reusable, making them useful for industrial processes and pollutant degradation.

What makes PMOs special?

The project combines organic and inorganic chemistry inside the same material, giving PMOs stability, flexibility and multiple functions. By loading metals or biomolecules into the pores, the materials can be adapted for catalysis, adsorption, sensing or delivery.

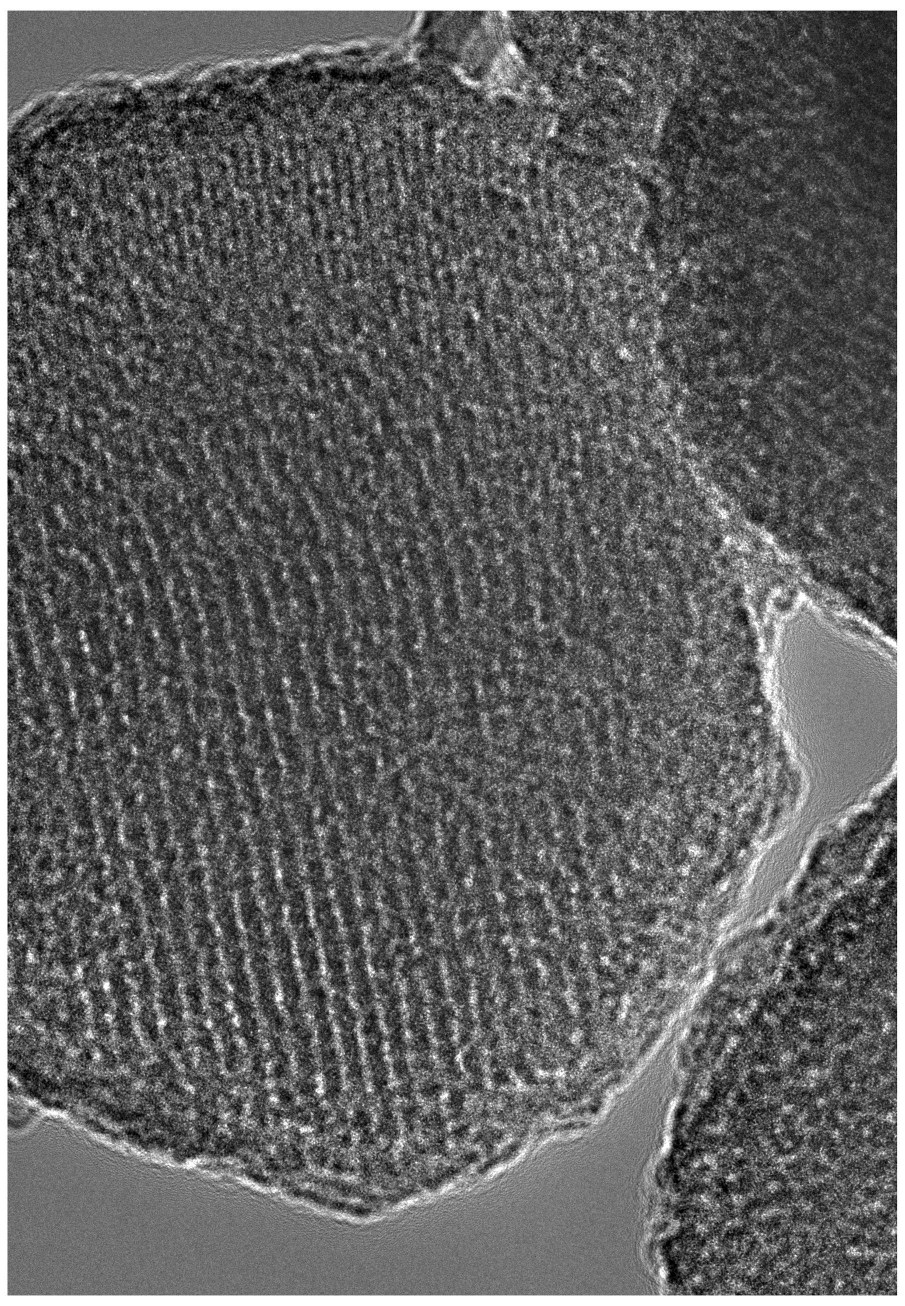
The channel walls (smart channels) of the PMOs contain both inorganic and organic groups. The PMOs' inorganic groups offer structural, mechanical, and thermal stability, and the organic groups can be customized for specific or multiple applications.

From lab to demonstrator

The project does not stop at synthesis. It also tests materials in realistic settings, evaluates their reusability and compares different synthesis routes using Life Cycle Assessment and Life Cycle Costing to support sustainability and scale-up.

The project will create and test an electronic nose for gas sample analysis and biosensors with applications in biological detection. PMOs food packaging demonstrators with the PMOs embedded in conventional plastic and bio-based polymers for food packaging materials wil be proposed as technological solution to address sustainability and food safety.

The know-how and technological progresses in PMOs for food packaging, environmental pollution control, environmental remediation, biomedical purposes and biomolecule immobilization will contribute to the development of innovative materials that compete with highly porous solids (mesoporous silica, non-siliceous mesoporous and metal–organic materials).



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