ECOCHEM
Eco-friendly and intensified chemical reactions

GENERAL CONTEXT

The chemical industry nowadays contributes to 5 % of the global anthropogenic CO_2 emissions. On average, 1 to 2.5 Kg of CO_2 are emitted per Kg of manufactured product. Because the market of chemistry is growing at an annual rate of 3%, the CO_2 emissions from the chemical industry will automatically increase if nothing is done. In addition, the increase in taxes on CO_2 emissions (Paris agreement on climate change) is an economic driver forcing the chemical industry to reduce its CO_2 emissions. In this context, the development of eco-efficient (low carbon) processes has become a priority.

OBJECTIVES

ECOCHEM aims at investigating innovative catalytic technologies for the synthesis of fine chemicals from cheap and industrially relevant chemicals, such as N_2, NH_3, light alkenes, light alcohols…, through eco-efficient processes. By eco-efficient processes, we mean here processes or reactions that are less emitting of CO_2 *(i.e.* better use of energy, simplified downstream processes, cascade reactions, intensified processes/reactions, less waste, catalysis, etc.).

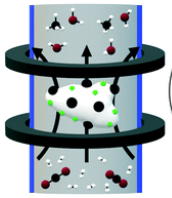
METHODOLOGY

- The design of more efficient catalytic systems (homogeneous and heterogeneous),
- The development of catalytic reactions at lower temperatures through the coupling of catalysis with alternative heating/activation systems.
- Process intensification to further reduce CO_2 emissions
- Electrification of chemical reactions, including better control of energy transfer (to chemicals and/or catalysts)
- Elucidation of reaction mechanisms at play

EXPECTED RESULTS, IMPACTS

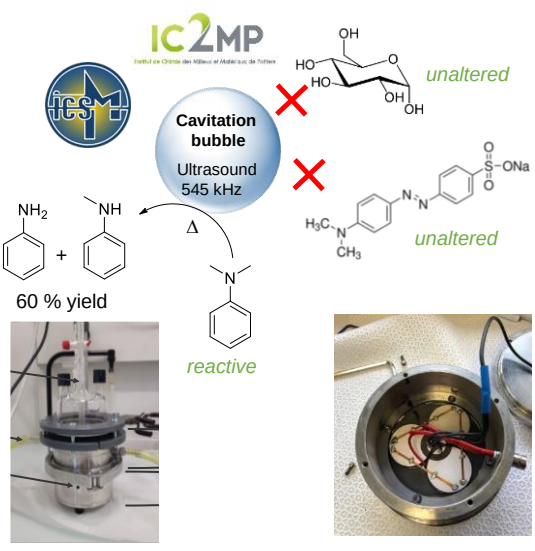
- Reduction in CO_2 emissions is expected in (1) detergency, paints and cosmetics, (2) polymers (packaging, construction, automotive, electronics) and (3) solvents,
- Structuration of a multi-disciplinary national community on catalyst design and assisted-catalysis, catalyst integration to catalytic process and multi-scaled approach,
- Formation of students better armed to tackle the future challenges faced by the chemical industry,
- Provision of scientific expertise to chemical companies which are currently strongly requesting novel and eco-friendly technologies.

Some highlights



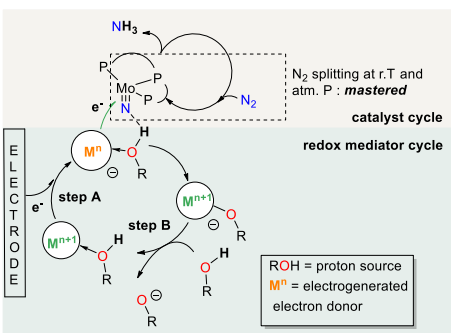
Magnetically Induced Heterogeneous Catalysis

Selective transfer of energy to catalyst



Specific hydrothermal reactions induced by cavitation in water

Selective transfer of energy to hydrophobic chemicals



Dual catalytic cycle

Synergistic effect between catalysis and electricity