



Ircelyon

INSTITUT DE RECHERCHES
SUR LA CATALYSE
ET L'ENVIRONNEMENT

PhD Topic 2022

Couches minces de MOF pour l'énergie et l'environnement MOF Thin-films for Energy and Environment

Team « Engineering, from material to reactor (ING) » /IRCELYON Institute of Catalysis and Environment (CNRS National laboratoires and University Claude Bernard Lyon1)

Field : *Chemistry and nanoscience - materials - environment - catalysis*

Keywords : Porous polymers - Metal-Organic Frameworks – CO₂ - CVD ALD - organometallic chemistry

Background : Metal-Organic Frameworks (MOFs) are periodic three-dimensional organic/inorganic hybrid assemblies of metal centres linked by organic ligands. Some of these materials can exhibit nanoscale microporosity coupled with very high thermal and chemical stability. The field of applications of these materials is very vast (sensors, catalysts, dielectrics, solid electrolytes for batteries, optoelectronics and non-linear optics, etc.) which make them prime candidates for use in the separation, detection and catalytic conversion of gases.

Challenge : These materials are generally synthesized in solution. The growth of efficient thin films is therefore difficult or incompatible with microprocessing techniques. Recently, the first CVD -ALD (Chemical Vapor Deposition - Atomic Layer Deposition) growths of MOF thin films have been reported in the literature, which finally opens the way to their implementation for applications compatible with micro-nanotechnology.

PhD topic : The work proposed here aims to develop a technique for growing MOFs by CVD - MLD (Molecular Layer Deposition) for use as a sensitive layer for CO₂ detection and catalytic conversion. In a first step, the growth of MOFs in the gas phase will be studied. Once the MOF growth technique has been developed on a reference system, we will focus on the development of sensitive microporous thin films in order to allow the detection of CO₂ and, via post-synthesis modification, converted into integrated detector-catalysts.

Project : This PhD internship will start in October 2022 in the Engineering, Material to Reactor (ING) group of the Institut de Recherches sur la Catalyse et l'Environnement de Lyon (IRCELYON). It will be linked to the Laboratoire Dépôt du Département des Plateformes Technologiques (LETI) of the CEA.

Desired skills : The project will require skills in chemistry for synthesis (organic and organometallic). Knowledge in structural characterization of porous materials (gas physisorption, X-ray diffraction, electron microscopy), chemical composition (by XPS, FTIR) and porosity (by ellipso-porosimetry) is a plus. The project will require a taste of the exchanges between chemists, material physicists and physical characterisation.

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