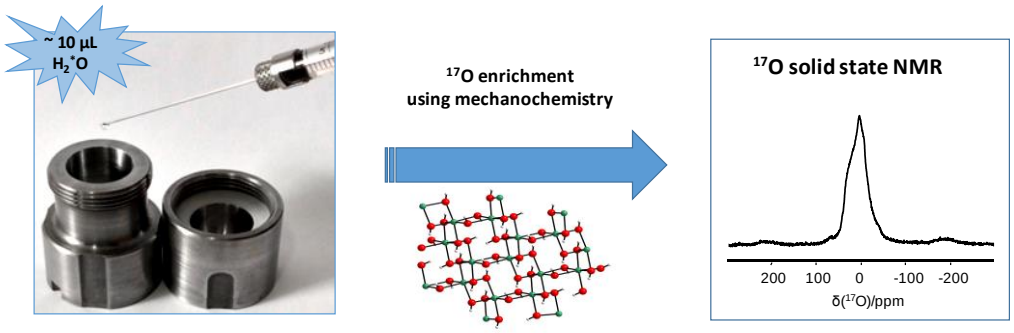
- Post-doctoral position -

"Isotopic labeling of inorganic compounds in oxygen-17 using mechanochemistry: from novel synthetic methods to high resolution NMR"

Project :

Oxygen is present in the vast majority of molecules and materials around us, whether they are natural or synthetic. Developing tools capable of analyzing precisely the local environment of this nucleus is thus essential to be able to understand the structure and reactivity of a large number of systems. In this context, Nuclear Magnetic Resonance (NMR) is a particularly powerful technique, which can provide detailed information about the local structure around oxygen. However, it is poorly sensitive and only occasionally used, mainly because the isotope which can be studied by NMR, oxygen-17, has a very poor natural abundance (0.04 %).

To counter the very **poor sensitivity of oxygen-17 NMR spectroscopy**, a CNRS research group in Montpellier (France), recently looked into new techniques for ^{17}O-isotopic labeling using mechanochemistry (https://doi.org/10.1002/anie.201702251). The advantage of this approach is that it gives access to a much broader range of molecules and materials enriched in ^{17}O, thereby opening the way to structural investigations on a larger diversity of compounds, and to new developments in NMR spectroscopy.



In this context, a post-doctoral research position is currently available at the Institut Charles Gerhardt in Montpellier, on a 12 month contract (renewable) funded by a European ERC-CoG grant. The main objective of this project will be to explore the potential of mechanochemistry as a new synthetic route for **labeling a variety of inorganic precursors**, which are commonly used in materials synthesis (e.g. metal (hydr)oxides, carbonates or phosphates). Particular attention will be paid to the characterization of the labeled compounds, using in particular high resolution ^{17}O **solid state NMR** techniques, in order to determine the **mechanisms of isotopic enrichment**. Finally, the possibility to use some of the enrichment protocols to label in oxygen-17 functional materials (e.g. mixed metal oxides, heterogenous catalysts and biomaterials) will also be looked into.

The research work will consist in:

- isotopic enrichment of inorganic compounds using mechanochemistry
- full characterization of the labeled phases using standard materials chemistry techniques (powder XRD, IR & Raman spectroscopies, electron microscopy, N_2 adsorption …)
- multinuclear solid state NMR analyses, including high resolution ^{17}O solid state NMR.

Requirements:

The candidate is expected to have a PhD in materials chemistry, with expertise in inorganic materials synthesis and a sound background in the use of a wide range of characterization techniques. The knowledge of solid state NMR techniques will be a definite asset.

More generally, the candidate needs to be highly motivated and capable of performing research in an autonomous and rigorous way. Given the multidisciplinarity and international-context of the project, the candidate is expected to have excellent team working skills and a very good level in English. He (she) will also be involved in the dissemination of the research, through publications and presentations at national and international conferences. Moreover, the selected candidate will participate to the supervision and NMR training of the undergraduate and graduate students involved in the project.

Host Institution / group:

The research will be performed at the Institut Charles Gerhardt (ICGM, UMR 5253) of the University of Montpellier (https://www.icgm.fr/). The ICGM is internationally recognised for its expertise in materials science, with an excellent research environment for the synthesis and characterization of materials. In particular, the recruited candidate will have direct access to 4 different ball-milling machines for the isotopic labeling, and to the different analytical platforms of the ICGM and the University of Montpellier for materials characterization (X-ray diffraction, electron microscopy…), including by solid state NMR (300, 400 and 600 MHz spectrometers, all « wide bore », equipped with a very large range of MAS NMR probes, including one probe specifically for ^{17}O NMR experiments).

The selected candidate will not only interact on a day-to-day basis with the team of researchers and students involved in the project (and notably with Drs Danielle Laurencin, Bruno Alonso and Thomas-Xavier Métro), but also with scientists with whom the team has established collaborations, both nationally and internationally. Moreover, to gain in sensitivity and resolution, measurements at higher fields or using Dynamic Nuclear Polarization (DNP) will be programmed, notably on the instruments of the French high-field NMR network (IR-RMN - http://www.ir-rmn.fr/).

Application procedure:

The project is supported by the European Research Council (ERC consolidator program; MISOTOP project; PI: Danielle Laurencin). Funding for this post-doc position is available for 2 years, but the initial contract will be of 1 year (potentially renewable). The net monthly salary is between 2100 and 2900 euros, depending on experience.

For informal queries about the position and/or the project, please send an email to Danielle Laurencin (ICGM, danielle.laurencin@umontpellier.fr), Bruno Alonso (ICGM, bruno.alonso@enscm.fr) and Thomas-Xavier Métro (IBMM, thomas-xavier.metro@umontpellier.fr).

To formally apply for the position, please use the CNRS portal (http://bit.ly/2Jzag1D); a CV, motivation letter, and the names of 2 references are requested.

Preferred starting date: September 16th, 2019