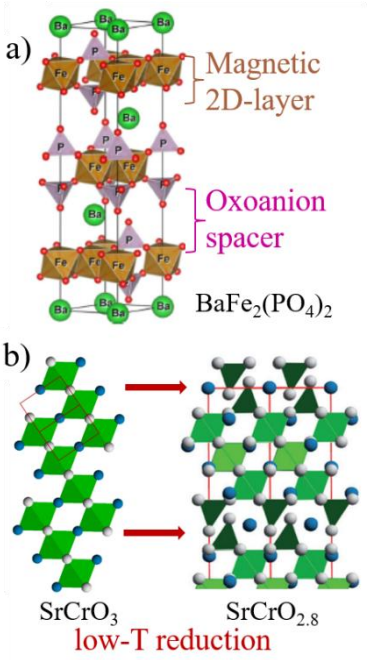
Date : October 2017

Subject Proposal for Exchange Students in Chemistry (Master Level)

Low-D Multi : Synthesis, Crystal Chemistry and Characterization of new inorganic multiferroic materials with low dimensional structures

Magnetic and electronic materials are used in our everyday life. Combination and control of both properties at the same time is realized in the so called “multiferroics”. Numerous applications can be envisaged for these materials, for example, to write magnetic data using electric fields.[1]

The UCCS has developed the concept of low dimensional oxides as potential room temperature multiferroics, using oxo-anions as spacers (phosphates, sulfates, vanadates) between magnetic cations.[2] We also use topochemical routes to control dimensionality, these modify the anion content but preserve the “skeleton”.[3] Numerous preparation and characterization methods are available in our laboratory: solid state, hydrothermal and newly high pressure techniques, along with powder and single crystal X-ray diffraction, state-of-the-art electron microscopy, electrical and (soon) magnetic measurements.[4] We also use large scale facilities (e.g. ILL/ESRF in Grenoble) and electronic calculations for a deeper understanding of the materials.[5] All this equipment will be “*at the heart*” of the proposed stage.



The project aims to synthesize materials based on transition metal and oxo-anions of the type A-M-(XO_4) (A = Ba, K, Na, M = Fe, Co, Ni and X = P, S, V) to control the dimensionality and magnetic properties. The synthesis and the physico-chemical properties of the materials will be characterized with the different techniques available in our group.

About me (Angel): I recently join the UCCS team as Marie Curie Individual Fellow. I performed my Postdoctoral stage at the University of Edinburgh. Before that, my PhD in Materials Chemistry at Universidad Complutense de Madrid, Spain and my bachelors in Physics in Mexico. About Olivier: He is Directeur de Recherche CNRS and responsible of the group MISSP « Inorganic Materials, Structure, Systems and Properties » at the UCCS.

a) *$BaFe_2(PO_4)_2$ phosphate, showing the iron octahedra two-dimensional magnetic layer separated by the oxoanion (PO_4) double layer.* [2]

b) *Low-temperature topochemical reaction by CaH_2 as reductant providing unique access to control dimensionality in $SrCrO_{3-d}$.* [3]

Key Words: Multiferroic materials, crystallography, magnetism

Level : Master

Applicant profile: Master student in materials science, colloids science and/or formulation chemistry, motivated by experimental work and with ease to communicate.

Contacts: Angel M. Arévalo López angel.arevalo-lopez@univ-lille1.fr

Olivier Mentré olivier.mentre@ensc-lille.fr

Date : October 2017

[1] *Physics* 2 (2009) 20. **[2]** *Angew. Chem. Int. Ed.* 51 (2012) 11745. **[3]** *Angew. Chem. Int. Ed.* 51 (2012) 10791.
[4] http://uccs.univ-lille1.fr/ **[5]** https://www.ill.eu/, http://www.esrf.eu/