

CHEMISTRY MASTER - M2**INTERNSHIP 2019-2020 (end of January – end of June)**

Options of Master (please tick the box(es) of the training that fits the field of the internship) :

MA (Advanced Materials) - COSV (Organic Chemistry and Life Sciences) MMF (Functional Molecules nad Macromolecules) PCCP (Physical Chemistry and Chemical Physics)

TITLE	Investigation of infinite-layer nickelates : structural features and electronic properties
SUBJECT	<p>The recent discovery of unconventional superconductivity in $\text{Nd}_{0.8}\text{Sr}_{0.2}\text{NiO}_2$ infinite layer nickelates has motivated the investigation of new compounds with similar frameworks and electronic structure. In a first step, we will focus on $\text{RENiO}_{2+\delta}$ (RE = Nd, Sm) compounds and single crystals elaborated by flux methods in order to analyze carefully the composition, the structural features and the electronic properties. In a second step, we will move to <i>innovative</i> 2D networks such as Ruddelsden-Popper (RP) phases ($\text{Ni}^+/\text{Ni}^{2+}$ mixed valences) such as $\text{RE}_{1.6}\text{Sr}_{0.4}\text{NiO}_{3.5}$ (RP1, already prepared in the group with RE = La), $\text{RE}_3\text{Ni}_2\text{O}_6$-$\text{RE}_{2.4}\text{Sr}_{0.6}\text{Ni}_2\text{O}_6$, (RP2) $\text{RE}_4\text{Ni}_3\text{O}_8$-$\text{Re}_{3.2}\text{Sr}_{0.8}\text{Ni}_3\text{O}_8$-(RP3) or $4\text{SrTiO}_3+\text{NdNiO}_{2+x}$ (RP4). These compounds will be prepared by topochemical reduction of the corresponding $\text{Ni}^{2+}/\text{Ni}^{3+}$ pristine perovskite or RP phases using hydrides (NaH, CaH_2, TiH_2) at various temperatures. In a third step, the electrochemical reduction of dense pellet as well as single crystals of $\text{Ni}^{2+}/\text{Ni}^{3+}$ pristine phases will be performed by applying a (negative) potential close to the hydrogen evolution. Finally, reduction using hydrides at low temperatures of homologous oxy-fluorides pristine materials (Ni^{2+}) obtained by reaction between oxides and fluorinated polymers (PTFE, PVDF) will be attempted in order to increase the Ni^+ content and to prepare the formal '$\text{Nd}_2\text{NiO}_3\text{F}$' composition. This 'hot topic' exploratory solid state chemistry work will give rise to a better understanding of the chemistry of nickelates as well as the related physical properties.</p>
TECHNIQUES USED	Solid State synthesis of nickelates (powder and single crystals obtained by flux method), XRD analysis, Magnetic and resistivity measurements on powders and single crystals
HOST LABORATORY	ICMCB-CNRS-University of Bordeaux
TEAM	Groupe III and Groupe I and Groupe VI
SCIENTIFIC DIRECTOR	Name : Alain Demourgues (Groupe III) and Baptiste Vignolle (Groupe VI) and Jean-Marc Bassat (Groupe I) Tel : 05-40-00-26-55 Mail : alain.demourgues@icmcb.cnrs.fr

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Possibility to pursue the internship until the end of August: YES <input type="checkbox"/> / NO x<input checked="" type="checkbox"/>	
Possibility to offer the internship to a M1 if not attributed to a M2: YES x<input checked="" type="checkbox"/> / NO <input type="checkbox"/>	