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# NEWSLETTER 2017



Dear Colleagues and friends,

I have been asked by the CNRS to be in charge of the French part of the Indian-French Laboratory of Solid State Chemistry. IFLaSC in English or LaFICS in French is an Associated International Laboratory created in 2003 between the Centre National de la Recherche Scientifique (CNRS), a French public scientific and technological institution, the Université de Caen Basse Normandie (UCBN), the Université de Strasbourg, Alsace public scientific and professional institutions and The Indian Institute of Science, Bangalore (IISc), an autonomous public institution funded by the government of India. Several laboratories and institutions linked to the CNRS, the UCBN and the IISc are involved in this LaFICS that are:

- the Institut de Chimie de la Matière Condensée de Bordeaux (ICMCB)
- the Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS)
- the Laboratoire de Cristallographie et Science des Matériaux de Caen (CRISMAT)
- the Ecole Nationale Supérieure d'Ingénieurs de Caen
- the Université de Strasbourg
- The Solid State and Structural Chemistry Unit, (SSCU), IISc, in Bangalore
- Materials Research Center (MRC), IISc, in Bangalore
- The Indian Institute of Technology, Bombay, India (IIT/B), through its Department of Metallurgical Engineering & Materials Science (MEMS)
- The Indian Institute of Technology, Madras, India (IIT/M), through its Department of Chemistry



With this News Letter and in collaboration with my new homologue in India, Prof. Satish Patil, I wish to bring some more dynamism to this LIA and encourage Indians and French Researchers to promote excellent and fruitful collaborative projects.

In this News Letter you will then find some insights concerning the activities performed in the framework of this LIA.

Enjoy your reading!

Marie Helene DELVILLE, PhD

## Research highlights

Satyanarayana, M.; Pralong, V.; Varadaraju, U. V., Synthesis and Electrochemical Study of New P3 Type Layered  $\text{Na}_{0.6}\text{Ni}_{0.25}\text{Mn}_{0.5}\text{Co}_{0.25}\text{O}_2$  for Sodium-Ion Batteries. *ChemistrySelect* 2017, 2, 5660-5666  
 Synthesis and Electrochemical Study of New P3 Type Layered  $\text{Na}_{0.6}\text{Ni}_{0.25}\text{Mn}_{0.5}\text{Co}_{0.25}\text{O}_2$  for Sodium-Ion Batteries. *ChemistrySelect* 2017, 2, 5660-5666. <http://dx.doi.org/10.1002/slct.201700376>  
 CRISMAT, France/IIT Madras, India

In this paper, the room temperature stable P3 type  $\text{Na}_{0.6}\text{Ni}_{0.25}\text{Mn}_{0.5}\text{Co}_{0.25}\text{O}_2$  phase was studied as an interaction material for Na ion batteries. The phase was synthesized by mixed hydroxide co-precipitation method followed by heating at 750 °C in air. Its purity was analyzed by Rietveld refinement using GSAS software. X-ray photoelectron spectroscopy (XPS) analysis showed that Co, and Mn were in oxidation states of 3+ and 4+, respectively, and Ni is in 2+ and 3+ oxidation states. The electrochemical properties of this layered material as a cathode delivered the reversible discharge capacity of 105 and 130 mAh/g at C/10 rate in the voltage window of 1.5-3.6 and 1.5-4.0 V vs.  $\text{Na}^+/\text{Na}$ , respectively. The good capacity retention and nearly 99 % of coulombic efficiency was observed. The Na insertion and de-insertion occurred by reversible phase transitions as evidenced by ex-situ powder X-ray diffraction. With increasing cutoff voltage to 4.4 V, the ex-situ powder X-ray diffraction pattern indicated that the existence of P3 phase at high Na de-insertion.

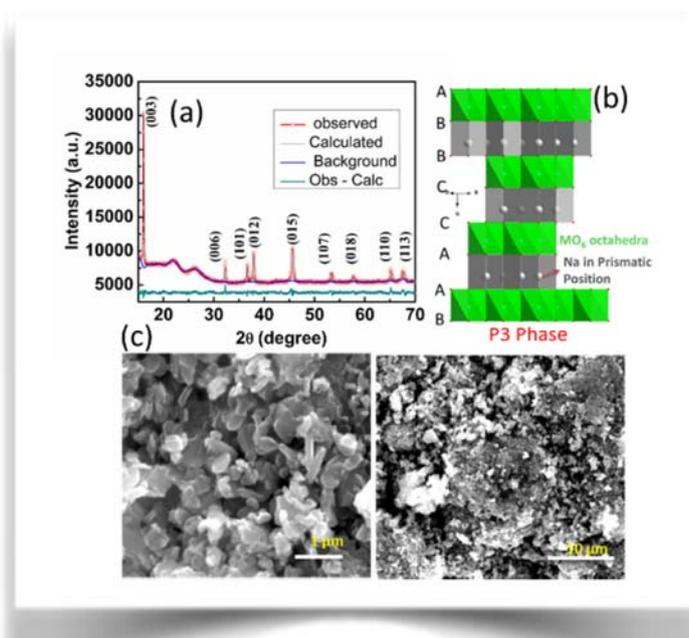


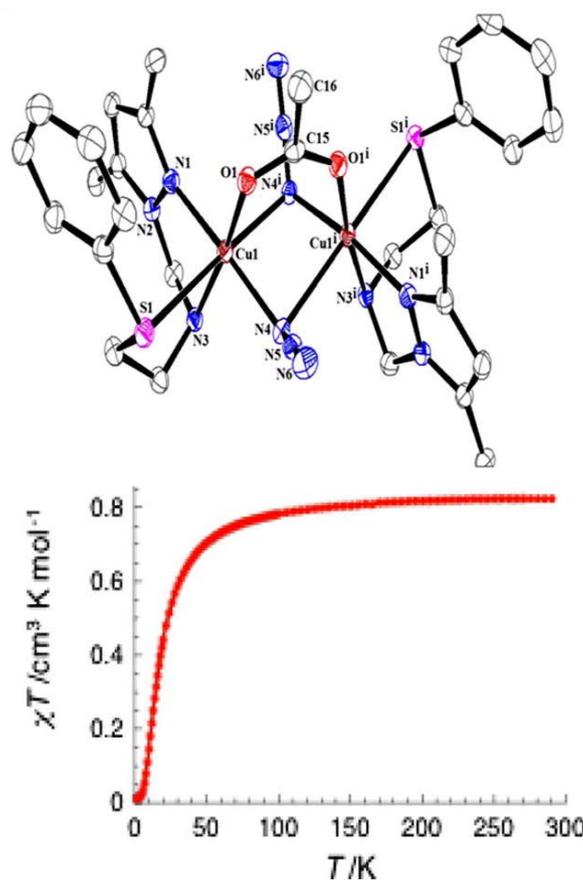
Figure (a) Bright field low resolution TEM images and corresponding ED rings, (b) EDX elemental mapping and (c) bright field HRTEM image of Co-Ni nanoparticles

Sadhu, M. H.; Mathoniere, C.; Patil, Y. P.; Kumar, S. B., Binuclear copper(II) complexes with N3S-coordinate tripodal ligand and mixed azide-carboxylate bridges: Synthesis, crystal structures and magnetic properties. *Polyhedron* 2017, 122, 210-218 [http://ac.els-cdn.com/S0277538716306271/1-s2.0-S0277538716306271-main.pdf?\\_tid=50fdaafc-31a4-11e7-8f5b-00000aab0f27&acdnat=1493996926\\_060dd0474d48449e45c52ba6d7c2da59](http://ac.els-cdn.com/S0277538716306271/1-s2.0-S0277538716306271-main.pdf?_tid=50fdaafc-31a4-11e7-8f5b-00000aab0f27&acdnat=1493996926_060dd0474d48449e45c52ba6d7c2da59)  
 ICMCB, France/IISc Bangalore, India

The authors synthesized and characterized a new N3S-coordinate tetradentate ligand N,N-bis((3,5-dimethyl-1H-pyrazol-1-yl)methyl)-2-(phenylthio)ethan-1-amine (bdmpe). Two double end -on azide bridged copper(II) complexes  $[\text{Cu}(\text{bdmpe})(\mu(1,1)\text{-N}_3)]_2(\text{X})_2$  [ $\text{X} = \text{ClO}_4^-$ ,  $\text{PF}_6^-$ ] & two triple bridged copper (II) complexes  $[\text{Cu}_2(\text{bdmpe})_2(\mu(1,1)\text{-N}_3)_2(\text{Y})]\text{PF}_6$  [where  $\text{bdmpe} = \text{N}-((3,5\text{-dimethyl-1H-pyrazol-1-yl)methyl})_2\text{-}(2\text{-phenylthio)ethan-1-amine}$ ,  $\text{Y} = \text{CH}_3\text{COO}^-$  or

HCOO-] have been synthesized and characterized. Ligand (dmpe) was formed from ligand bdmpe during in situ complexation reaction. Crystal structures of the three complexes [Cu(bdmpe)(N-3)](2)(ClO4)(2) (1), [Cu-2(dmpe)(2)( $\mu$ (1.1)-N-3)(2)(CH3COO)]PF6 (3) & [Cu-2(dmpe)(2)( $\mu$ (1.1)-N-3)(2)(HCOO)]PF6 (4) were solved by single crystal X-ray diffraction studies & the structural data revealed that the complex [Cu-2(bdmpe)(2)(N-3)(2)](ClO4)(2) is binuclear and two copper (II) centers are bridged by a pair of ( $\mu$ (1.1)) N-3(-) ion whereas the structures of complexes 3 and 4 are binuclear with triple bridged and two adjacent copper(II) centers are bridged by pair of N-3(-) ions with end-on ( $\mu$ (1.1)) coordination mode and one acetate/formate group with syn-syn coordination mode, respectively. Variable temperature (4-273 K) magnetic measurement shows that complex 1 has no magnetic interaction whereas complexes 3 and 4 have weak antiferromagnetic interactions with  $\chi$  values  $-15.3(1) \text{ cm}(-1)$  for complex 3 and  $-17.8(1) \text{ cm}(-1)$  for complex 4.

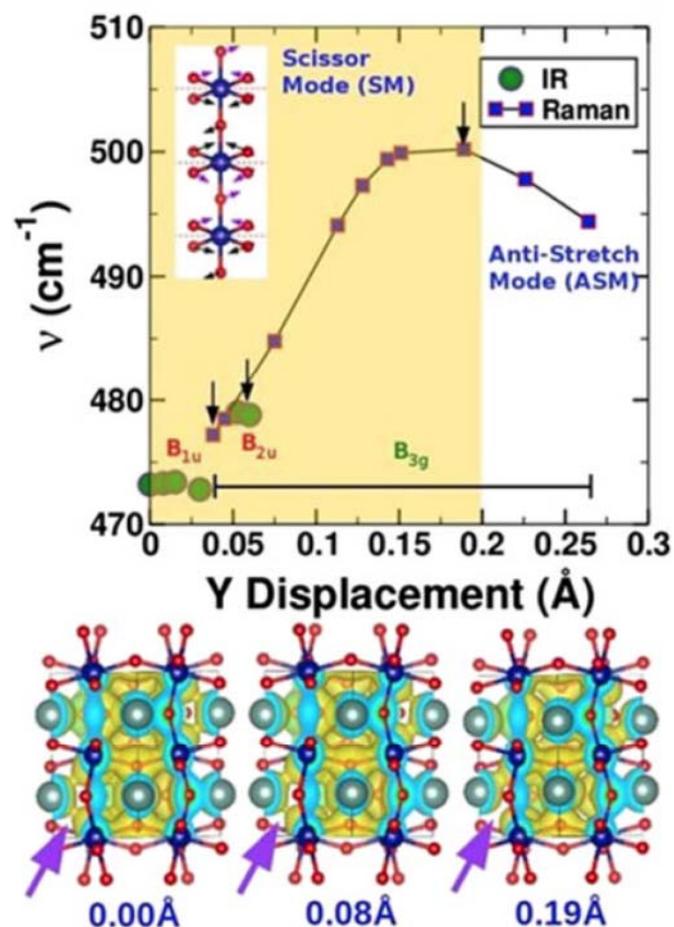
Figure: Magnetic structure of CaBaCo4O7 showing the Co2p (red circle) zig-zag ferromagnetic chains (Brick red stripe). The Co1 (green circle) and Co4 (violet oval) are surrounded by the parallel zig-zag chains and coupled antiferromagnetically to the Co2p chains.



Mannepalli, V. R.; Raghunathan, R.; Ramadurai, R.; David, A.; Prellier, W., Local structural distortion and interrelated phonon mode studies in yttrium chromite. *J. Mater. Res.* 2017, 32, 1541-1547. <https://www.cambridge.org/core/journals/journal-of-materials-research/article/local-structural-distortion-and-interrelated-phonon-mode-studies-in-yttrium-chromite/4585EE6CD596A5B3E9C83A7C76AAA590>  
IISc Bangalore, India /CRISMAT, France

YCrO3 (YCO) perovskite has been originally reported to be a biferroic with antiferromagnetic and ferroelectric (FE) properties, in which the origin of FE in YCO remains ambiguous. However, further studies reveal the presence of a global orthorhombic Pnma structure with a local structural heterogeneity. In this study, we discuss the high temperature phonon modes and their inter-relation to local structural distortions in YCO perovskite through Raman spectroscopy experiments and density functional theory (DFT) calculations. We observe that the Raman active B3g(3) out of phase scissor mode (SM) disappears above the dielectric transition temperature ( $T_c$ ) commensurate with the local structural distortions. DFT calculations show that the transformation of a room temperature Y-cation distorted orthorhombic structure to a perfect orthorhombic structure above the dielectric transition temperature in which the Y cation is undisplaced could lead to the conversion of SM with symmetry B3g to Raman inactive B1u mode

Figure. Behavior of the B<sub>3g</sub> SM with yttrium displacement in YCO as computed from DFT calculations. Y-cation displacements of 0.0 and 0.3 Å correspond to higher and lower limits on the temperature scale, respectively. Raman and IR active modes are shown, respectively, as blue squares and green circles. Also shown in the plot is the symmetry of the mode. The SM represents the B<sub>1u</sub> symmetry in a completely ordered structure and hence is not Raman active at high temperatures. At the extremum of disorder (very low temperatures), the mode converts into anti stretch mode (ASM). The cross-over points between the SM with other phonon modes are marked as black arrows where the SM transforms into a BM. The inset shows the SM that is being characterized. The red dashed line represents a crystallographic plane to show oxygen atoms above/below the plane and arrows represent the direction of forces. The atoms with arrows marked in magenta are above the plane and those in black below the plane, leading to 180° phase shift. The lower panel shows the charge density isosurfaces for 0.0, 0.08, and 0.19 Å displacements. The magenta arrows show the change in charge delocalization between Y and one of the planar oxygen atoms as the Y cation is displaced.



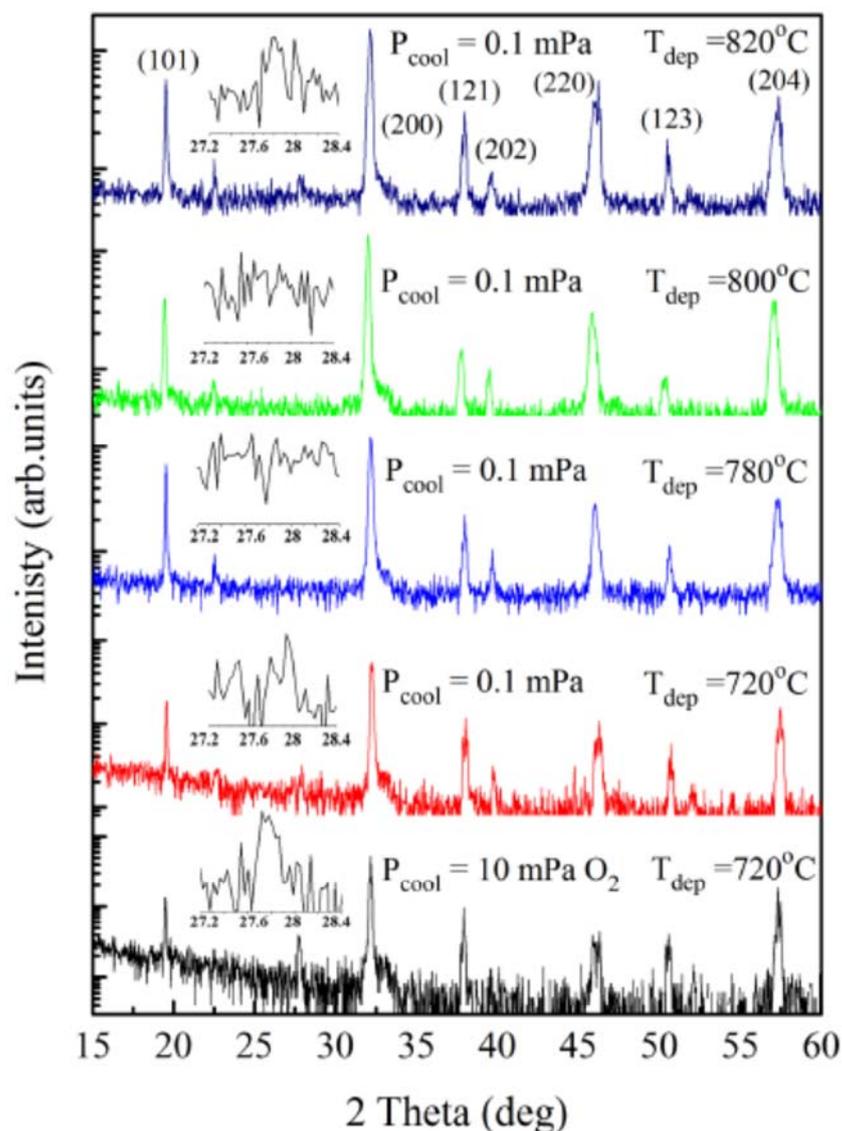
Santosh, M.; Lacotte, M.; David, A.; Ph, B.; Grygiel, C.; Pravarthana, D.; Rohrer, G. S.; Salvador, P. A.; Padhan, P.; Lüders, U.; Junling, W.; Prellier, W., Pulsed laser deposition of Sr<sub>2</sub>FeMoO<sub>6</sub> thin films grown on spark plasma sintered Sr<sub>2</sub>MgWO<sub>6</sub> substrates. *Journal of Physics D: Applied Physics* 2017, 50, 235301. <http://stacks.iop.org/0022-3727/50/i=23/a=235301>.

IIT Madras India/CRISMAT, France

Sr<sub>2</sub>FeMoO<sub>6</sub> (SFMO) films were deposited on polycryst. spark plasma synthesized Sr<sub>2</sub>MgWO<sub>6</sub> (SMWO) substrates. Films were grown using pulsed laser deposition at temps. (T<sub>dep</sub>) between 720 °C and 820 °C in a vacuum environment of pressure P<sub>dep</sub> = 10<sup>-6</sup> mbar (0.1 mPa); after deposition they were cooled either in a pressure P<sub>cool</sub> = P<sub>dep</sub> or P<sub>cool</sub> = 10<sup>-4</sup> mbar (10 mPa) O<sub>2</sub>. Despite the use of an isostructural substrate, the growth and cooling conditions play the primary role in determining. details of the films' structures and properties, similarly to single-crystals. Grazing x-ray and electron back-scatter diffraction indicate that vacuum-cooled films were pure perovskite-structured SFMO exhibiting grain-over-grain growth that aligned the perovskite sub-cells. SrMoO<sub>4</sub> impurities were observed. in the x-ray patterns for the oxygen-cooled films similarly to single-crystal substrates.

Magnetic, electronic and magnetoresistive properties were all a function of growth and cooling environments. The Curie temp. and magnetization of the films increased with  $T_{\text{dep}}$  up to 800 °C. The vacuum-cooled films had low-resistivities with essentially metallic cond. (small resistivity increases occurred at low-T), while the cond. of oxygen-cooled films were consistent with variable range hopping. The oxygen-cooled films had higher low-field magnetoresistance effects at 5 K than the vacuum-cooled films, which seems consistent with SrMoO<sub>4</sub> forming at grain boundaries. This work opens the route to tailor the electronic properties by engineering the grain boundaries in thin films.

Figure Grazing x-ray diffraction patterns of 200 nm SFMO thin films deposited on polycrystalline SMWO, and grown at various temperatures ( $T_{\text{dep}}$ ) and different cooling conditions. The grazing angle is 0.3°. Insert shows a zoom in the 27–28° region

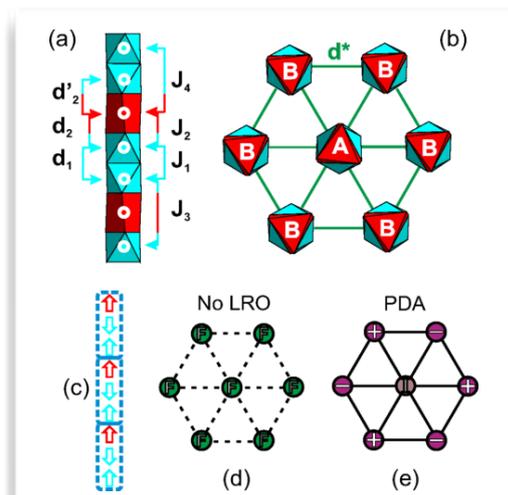


Seikh, M. M.; Caignaert, V.; Perez, O.; Raveau, B.; Hardy, V., **Single-ion and single-chain magnetism in triangular spin-chain oxides**. *Physical Review B* 2017, 95, 174417..  
Department of Chemistry, West Bengal, India/CRISMAT, France

Sr<sub>4-x</sub>Ca<sub>x</sub>Mn<sub>2</sub>CoO<sub>9</sub> oxides ( $x=0$  and  $x=2$ ) are found to exhibit magnetic responses typical of single-chain magnets (SCMs) and single-ion magnets (SIMs), two features generally investigated in coordination polymers or complexes. The compound  $x=0$  appears to be a genuine SCM, in that blocking effects associated with slow spin dynamics yield remanence and coercivity in the absence of long-range ordering (LRO). In addition, SIM signatures of nearly identical nature are detected in both compounds, coexisting with SCM in  $x=0$  and with LRO in  $x=2$ . It is also observed that a SCM response can be recovered in  $x=2$  after application of magnetic field.

These results suggest that purely inorganic systems could play a valuable role in the topical issue of the interplay among SIM, SCM, and LRO phenomena in low-dimensional magnetism.

Figure. (a) Schematic picture of the CoMn<sub>2</sub>O<sub>9</sub> chains, showing the alternation between two Mn<sup>4+</sup> in octahedra (cyan) and one Co<sup>2+</sup> in trigonal prisms (red), as well as the characteristic distances and interactions discussed in the text. (b) Perpendicular view showing the distribution of the A ( $d_2 = d_2$ ) and B ( $d_2 < d_2$ ) chains on a triangular lattice. (c) The  $\uparrow\downarrow\uparrow$  configuration shown to be the most favorable for  $(J_2 - J_3) < J_4 < (J_2 + J_3)$ . Depending on  $d^*$ , this spin system can either escape LRO (d) and be composed of F chains or enter a PDA state (e) made of up and down ferrimagnetic-like chains as shown in (c), coexisting with I chains having a zero net magnetization.



Dolai, M.; Ali Molla, H.; Rogez, G.; Ali, M., Two [Mn<sub>3</sub>( $\mu$ -3-O)]<sup>7+</sup> based Single Chain Magnets with different solvent ligation. *Polyhedron* 2017, 127, 248-256.

<http://www.sciencedirect.com/science/article/pii/S0277538717300803>

Department of Chemistry, Jadavpur University, Kolkata, India/IPCMS, France

[MnIII<sub>3</sub>( $\mu$ -3-O)]<sup>7+</sup> based EE-azido-bridged 1D chains  $[\{Mn_3O(5-Br-salox)_3(N_3)(H_2O)_4\} \cdot 3H_2O]_n$  (1) and  $[\{Mn_3O(5-Br-salox)_3(N_3)(H_2O)_3(DMF)\} \cdot 2H_2ODMF]_n$  (2) (5-Br-saloxH<sub>2</sub> = 2-hydroxy-5-bromo-benzaldehyde oxime) have been synthesized and characterized by single crystal X-ray diffraction analysis. The complex 1 was synthesized by the reaction between ligand and metal precursor in the presence of azide ion in MeOH, while complex 2 can be obtained in two ways: in the first method, the same reaction as in 1, with only difference in solvent composition – a mixture of solvents DMF/MeOH (2:3/v/v) was used. In another method, 2 was isolated simply by the recrystallization of 1 from DMF. Magnetic studies on these complexes reveal that both 1 ( $\Delta E = 45.9$  K;  $\tau_0 = 6.6 \times 10^{-10}$ ) and 2 ( $\Delta E = 54$  and  $49.7$  K;  $\tau_0 = 1.4 \times 10^{-12}$  s and  $7.6 \times 10^{-12}$  s) exhibit SCM behavior with a slight difference in magnetic properties due to the only difference in coordinated/non-coordinated solvents.

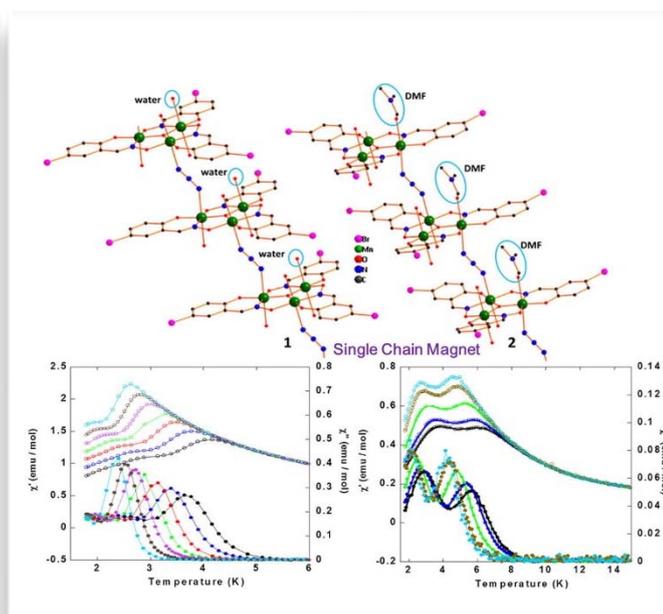


Figure. a) Azido bridged 1D coordination polymeric chain in the complex 1 and 2. All non-coordinated solvent molecules and H-atoms are omitted for clarity.

b) Temperature and frequency dependence of the in-phase susceptibility ( $\chi''$ ) (open circles) and out-of-phase susceptibility ( $\chi''''$ ) (full circles) (full lines are just guides for the eye) of 1 at 990 Hz (black), 316 Hz (dark blue), 99 Hz (red), 31 Hz (green), 9.9 Hz (purple), 3.2 Hz (brown) and 1 Hz (light blue).

c) Temperature and frequency dependence of the in-phase susceptibility ( $\chi''$ ) (open circles) and of the out-of-phase susceptibility ( $\chi''''$ ) (full circles) (full lines are just guides for the eye) of 2 at 990 Hz (black), 316 Hz (dark blue), 99 Hz (green), 31 Hz (grey), 3.2 Hz (light blue)

Kundu, A. K.; Caignaert, V.; Hardy, V.; Raveau, B., Superexchange interactions between Fe-3d and Ln-4f states: long range antiferromagnetism in perovskite derivatives Ba<sub>3</sub>LnFe<sub>2</sub>O<sub>7.5</sub>. *Journal of Materials Chemistry C* 2017, 5, 7236-7242..

Indian Institute of Information Technology, Design & Manufacturing Jabalpur,, India/CRISMAT, France

Perovskite derivatives Ba<sub>3</sub>LnFe<sub>2</sub>O<sub>7.5</sub>, with Ln = Sm, Eu, Gd, Dy, Ho, Er have been synthesized. These oxides isotypic to the already known yttrium phase crystallize in the P21/c space group. Their structure can be described as an assemblage of double "FeLn" chains built up of isolated FeO<sub>4</sub> tetrahedra and YO<sub>6</sub> octahedra, interconnected through dimeric tetrahedral Fe<sub>2</sub>O<sub>7</sub> groups. Magnetization and specific heat measurements show that all the members of this series, including the Y-phase, exhibit long range antiferromagnetic ordering, with TN ranging from 6.2 K for Y to 12.5 K for Dy.

The evolution of TN with respect to the rare earth size is complex and similar to that observed for the structurally related Ba<sub>2</sub>LnFeO<sub>5</sub> perovskites, but shows significantly higher values. The antiferromagnetism of the Y-phases is ascribed to SSE Fe–O–O–Fe interactions along the chains in both oxides "Ba<sub>3</sub>Y" and "Ba<sub>2</sub>Y", whereas in addition transversal SSE/SE Fe–O–O–Fe–O–Fe–O–O–Fe interactions between the chains are proposed for the "Ba<sub>3</sub>Y" phase. For magnetic lanthanides, the antiferromagnetic behavior of both series implies strong 3d(Fe)–4f(Ln) interactions, i.e. SE Ln–O–Fe interactions along the chains in both series but in addition transversal SE Ln–O–Fe–O–Fe–O–Ln interactions between the chains in the "Ba<sub>3</sub>Y" series. The particular role of the magnetic moment and magnetic anisotropy of the lanthanide is also considered.

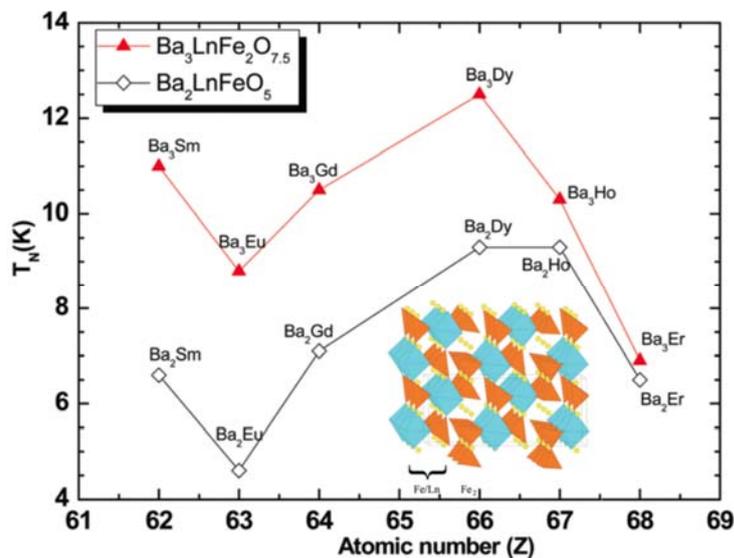


Figure. (a) Magnetic transition temperature versus atomic number Z of the lanthanide for the two series Ba<sub>3</sub>LnFe<sub>2</sub>O<sub>7.5</sub> and Ba<sub>2</sub>LnFeO<sub>5</sub>. (b) Structure) Ba<sub>3</sub>LnFe<sub>2</sub>O<sub>7.5</sub> both built up of similar double rows of corner-sharing FeO<sub>4</sub> tetrahedra and LnO<sub>6</sub> octahedra labelled "FeLn"

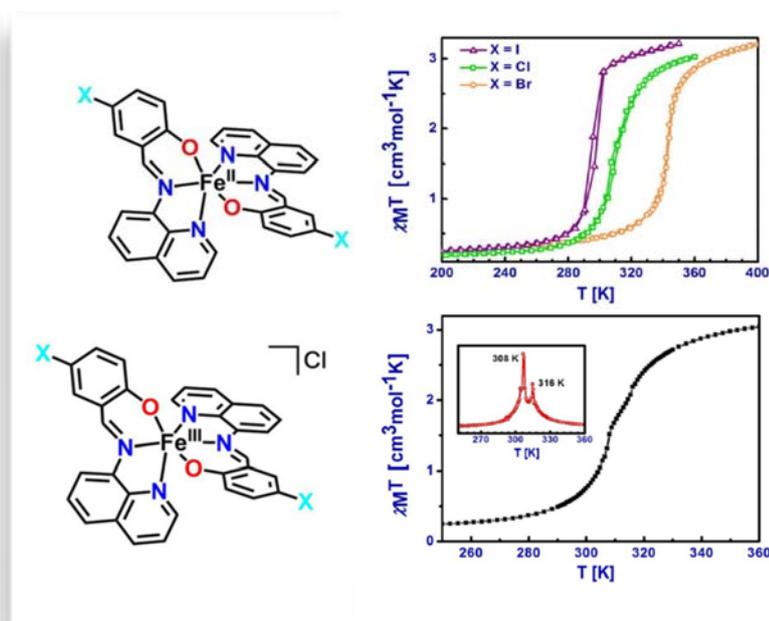
Phonsri, W.; Macedo, D. S.; Vignesh, K. R.; Rajaraman, G.; Davies, C. G.; Jameson, G. N. L.; Moubarki, B.; Ward, J. S.; Kruger, P. E.; Chastanet, G.; Murray, K. S., Halogen Substitution Effects on N<sub>2</sub>O Schiff Base Ligands in Unprecedented Abrupt FeII Spin Crossover Complexes. *Chemistry – A European Journal* 2017, 23, 7052-706. <http://onlinelibrary.wiley.com/doi/10.1002/chem.201700232/abstract> IIT Bombai, India/ICMCB, France

A family of halogen-substituted Schiff base iron(II) complexes, [FeII(qsal-X)<sub>2</sub>], (qsal-X=5-X-N-(8-quinolyl)salicylaldimines) in which X=F (1), Cl (2), Br (3) or I (4) has been investigated in detail. Compound 1 shows a temperature invariant high spin state, whereas the others all show abrupt spin transitions, at or above room temperature, namely, 295 K (X=I) up to 342 K (X=Br), these being some of the highest T<sub>1/2</sub> values obtained, to date, for FeII N/O species. We have recently reported subtle symmetry breaking in [FeII(qsal-Cl)<sub>2</sub>] 2 with two spin transition steps occurring at 308 and 316 K. A photomagnetic study reveals almost full HS conversion of [FeII(qsal-I)<sub>2</sub>] 4 at low temperature

( $T(\text{LIESST})=54 \text{ }^\circ\text{K}$ ). The halogen substitution effects on the magnetic properties, as well as the crystal packing of the  $[\text{Fe}^{\text{II}}(\text{qsal-X})_2]$  compounds and theoretical calculations, are discussed in depth, giving important knowledge for the design of new spin crossover materials.

In comparison to the well known iron(III) analogues,  $[\text{Fe}^{\text{III}}(\text{qsal-X})_2]^+$ , the two extra  $\pi$ - $\pi$  and P4AE interactions found in  $[\text{Fe}^{\text{II}}(\text{qsal-X})_2]$  compounds, are believed to be accountable for the spin transitions occurring at ambient temperatures.

Figure. (a) Schematic picture of the  $\text{CoMn}_2\text{O}_9$  chains, showing the alternation between two  $\text{Mn}^{4+}$  in octahedra (cyan) and one  $\text{Co}^{2+}$  in trigonal prisms (red), as well as the characteristic distances and interactions discussed in the text. (b) Variable-temperature magnetic susceptibility (cMT) measurements for 2, 3 and 4, c) 2 with more steps, an inset shows the first order differentiation of the magnetic plot.



Preethi Meher, K. R. S.; Caignaert, V.; Motin Seikh, M.; Raveau, B.; Maignan, A., *Magnetoelectric coupling in ceramic of the Zn-doped  $\text{CaBaCo}_4\text{O}_7$  pyroelectric ferrimagnet*. *Ceramics International* 2017, 43, 208-211. <http://www.sciencedirect.com/science/article/pii/S0272884216316662>  
Visva-Bharati University, Santiniketan, India/CRISMAT, France

Electric and magnetic properties of the  $\text{CaBaCo}_{3.97}\text{Zn}_{0.03}\text{O}_7$  ferrimagnet ceramic have been studied. For this magnetoelectric compound, thermally assisted transitions in the pyroelectric current, at different temperatures characteristic of the magnetic transitions, are evidenced even in the absence of electrical poling. This result, interpreted by taking into account the magnetostrictive nature of this cobaltite, is supported by  $P(H)$  magnetoelectric coupling measurements performed in the 48–70 K interval. The change of polarization sign induced by changing the polarity of the poling electrical field, not observed in crystals but in 114 ferrimagnetic ceramics, is explained by symmetry arguments related to the tetrahedral coordination of the cobalt cations. Thus, this new type of pyroelectric ferrimagnetic ceramics might offer novel ways to exploit the magnetoelectric coupling of these oxides.

Satyanarayana, M.; Rao, R. S.; Pralong, V.; Varadaraju, U. V., Reversible Li Insertion Studies on  $V_4O_3(PO_4)_3$  as High Energy Storage Material for Li-Ion Battery Applications. *Journal of the Electrochemical Society* 2017, 164, A6201-A6205. <http://jes.ecsdl.org/content/164/1/A6201>  
IIT Madras, India/CRISMAT, France

Li-insertion studies were performed on  $V_4O_3(PO_4)_3$  that belongs to the libscumbite/lazulite family. Availability of multiple oxidation states and vacancies in crystal structure allows for the insertion of more than 7 lithium ions per formula unit. We will show that in the voltage window of 1-4 V vs. Li<sup>+</sup>/Li, 6.0 Li-ions could be inserted leading to a reversible capacity of 195 mAh/g at a C/5 rate. A structural transformation is observed from ex-situ XRD patterns after the insertion of 2 lithium at 2.4 V vs. Li<sup>+</sup>/Li, consistent with the available crystallographic sites in the structure. Interestingly we show that from this phase  $Li_2V_4O_3(PO_4)_3$ , further lithium insertion lead to an amorphous material but the structure is completely recovered on charge.

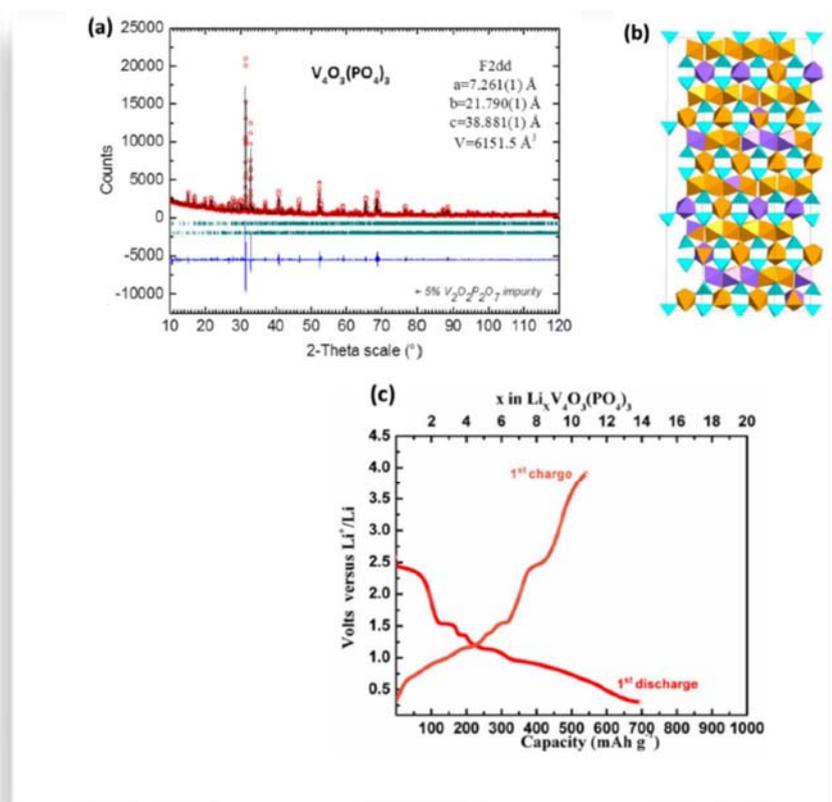


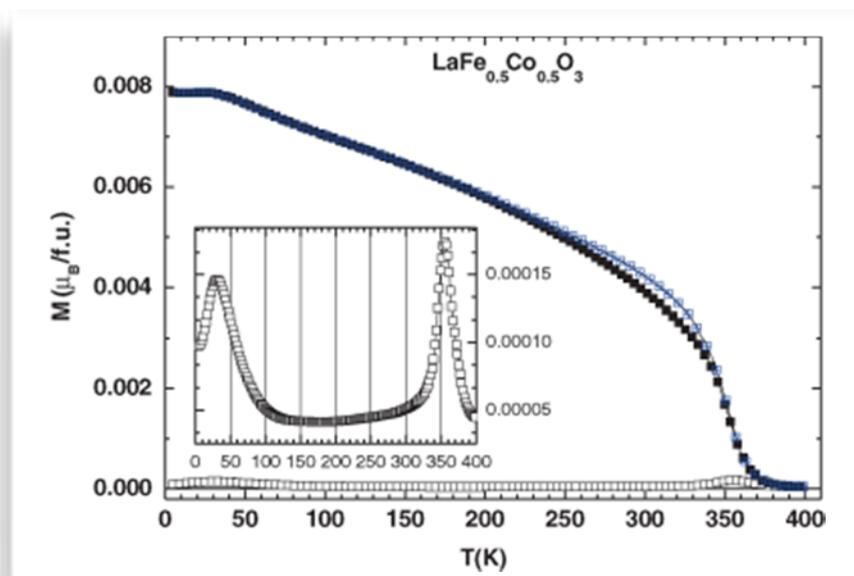
Figure. (a) Rietveld refined X-ray Powder diffraction pattern (Co K $\alpha$  radiation) of orthorhombic  $V_4O_3(PO_4)_3$  (black pattern represents observed data, red pattern represents refined pattern and blue represents difference between observed & refined pattern); (b) Structural view of  $V_4O_3(PO_4)_3$  along the a axis (c) First discharge-charge curves of  $V_4O_3(PO_4)_3$  at current rate of C/5 in the voltage window of 0.3–4 V versus Li<sup>+</sup>/Li.

Solanki, V.; Das, S.; Kumar, S.; Seikh, M. M.; Raveau, B.; Kundu, A. K., Crucial role of sol-gel synthesis in the structural and magnetic properties of  $LaFe_{0.5}(Co/Ni)_{0.5}O_3$  perovskites. *Journal of Sol-Gel Science and Technology* 2017, 82, 536-540. <https://link.springer.com/article/10.1007%2Fs10971-017-4319-x>

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In this paper the authors synthesized Iron-based perovskites  $LaFe_{0.5}M_{0.5}O_3$ , with the orthorhombic (S.G. Pbnm) and rhombohedral (S.G. R-3c) structure for M=Co and Ni, respectively using the sol-gel method, in contrast to the literature results. Magnetic investigations reveal that  $LaFe_{0.5}Co_{0.5}O_3$  is a canted antiferromagnet and reaches a magnetic transition of 370 K, i.e., much above the 300 K value observed by previous authors, whereas  $LaFe_{0.5}Ni_{0.5}O_3$  is antiferromagnetic at low temperature.

Figure. Temperature dependent ZFC (open symbol) and FC (solid symbol) magnetization,  $M$ , for  $\text{LaFe}_{0.5}\text{Co}_{0.5}\text{O}_3$  under the applied fields of a  $H = 50$  Oe



## EVENTS AND MEETINGS TO BE ANNOUNCED

A Workshop will take place in Bangalore during the first semester of 2018. Dates still need to be fixed.

A call will be launched by the end of January for short term scientific mission exchanges for Students and young Researchers preferably. The rules are the following: The host lab pays for the accommodation and stay the visiting lab pays for the travel each helped by its funding institution (LAFICS and DTS).

## OTHER NEWS

Six Indian Colleagues were hosted in the French laboratories among whom 2 PhD students. While two visits by French Researchers were identified by the LIA.

A CEFIPRA Project did not receive funding in 2017, another one has been applied for 2018.

The French part of the LIA and the CNRS would really appreciate that from now Researchers working in the framework of this LIA, acknowledge its support.

This is an example: We acknowledge financial support from the National Center for Scientific Research (CNRS) in the frame of the Indian-French Laboratory of Solid State Chemistry (LAFICS) program.