OF EXCELLENCE IN INTERNATIONAL MEETINGS
20 YEARS
alliedacademies.com

2nd International Conference on

MAGNETISM AND MAGNETIC MATERIALS

September 24-26, 2018 | Budapest, Hungary

DAY 1

Scientific Tracks & Abstracts

Day 1

SESSIONS

September 24, 2018

Magnetism and Magnetic Materials | Magneto-Optics | Nanomaterials and Nanotechnology
Hard and Soft Magnetic Materials

Session Introduction

Session Chair

Sandeep Kumar Srivastava
Central Institute of Technology, India

Session Co-chair

Rafael A Prato M
VITO-Flemish Institute for Technological Research, Belgium

Title: **Structural and magnetic properties in iron oxide epitaxial thin films**
Masato Watanabe, Research Institute for Electromagnetic Materials, Japan

Title: **Nanomagnetite magnetization on demand via a novel electrosynthesis route**
Rafael A Prato M, VITO-Flemish Institute for Technological Research, Belgium

Title: **Room temperature single phase multiferroic Aurivillius compound**
Chenglong Jia, Lanzhou University, China

Title: **On the magnetic properties of Fe-doped hydroxyapatite nanoaprticles**
Alessio Adamiano, Institute of Science and Technology for Ceramics (ISTEC-CNR), Italy

Title: **Improving the stability and magnetic hardening of $Fe_{16}N_2$ by alloying: A first-principles study**
Satadeep Bhattacharjee, Indo-Korea Science and Technology Center, India

Masato Watanabe, Mater Sci Nanotechnol 2018, Volume 2

STRUCTURAL AND MAGNETIC PROPERTIES IN IRON OXIDE EPITAXIAL THIN FILMS

Masato Watanabe
Research Institute for Electromagnetic Materials, Japan

Magnetite Fe_3O_4 has been known to be a fundamental spinel ferrite ubiquitously found in nature as a component of iron sand. It also has a magnetization of 6kG which is high among ferrites, a high Curie temperature of 858K and the intriguing electronic physical properties of half-metallicity and large anomalous and planar Hall effect, leading to the possibilities of various spintronic memory and sensor devices. Sputtered Fe_3O_4 thin films epitaxially grown on heated MgO(100) and other cubic single-crystalline substrates were evaluated by high-resolution XRD, magnetization measurements using VSM and SQUID, temperature dependence of resistivity by PPMS, and hyperfine structures by conversion electron Mössbauer spectroscopy, CEMS. In-plane and out-of-plane structural characterization revealed that the samples were composed of a single phase of spinel structure, the cube-on-cube epitaxial relationship between the Fe_3O_4 layer and substrate crystals and low FWHM of rocking curves in a range of several tens to several hundred arcsec. The magnetization was found to reach 6kG of the reported bulk value. The Verwey transition around 120K, of which observation is usually difficult in thin film form, was clearly confirmed from resistivity measurements. The CEMS showed that the vacancy parameters delta depends on gas pressure during sputter deposition and strongly influence the structural and magnetic properties. Epitaxial growth of another attractive ferromagnetic iron oxide of metastable epsilon-Fe_2O_3 will be briefly presented.

BIOGRAPHY

Masato Watanabe has earned his PhD from Tohoku University in Japan. He is currently Chief Research Scientist of Research Institute for Electromagnetic Materials, a public utility foundation in Sendai Japan. He has been involved in research subjects mainly on magnetic functionalities including hard magnetism, magnetooptical properties and anomalous hall effect in inorganic sputtered thin films and laser-generated nanoparticle colloids belonging to the foundation, universities and private companies.

m_watanabe@denjiken.ne.jp

Note:

Rafael A Prato M et al., Mater Sci Nanotechnol 2018, Volume 2

NANOMAGNETITE MAGNETIZATION ON DEMAND VIA A NOVEL ELECTROSYNTHESIS ROUTE

Rafael A Prato M[1,4], V Van Vught[1], P Marin[2,3], S Eggermont[4] J Fransaer[4] and X Dominguez-Benetton[1]
[1]Flemish Institute for Technological Research, Belgium
[2]Instituto de Magnetismo Aplicado, Spain
[3]UCM, Spain
[4]KU Leuven, Belgium

A fast, environmentally friendly, room-temperature electrosynthesis route for magnetite nanocrystals is presented here. We use a gas diffusion electrode (GDE) to generate oxidants and hydroxide in-situ from air, enabling an oxidative electrosynthesis of particles from a single iron salt ($FeCl_2$). Upon applying a potential of -350 mV vs. Ag/AgCl at the GDE, oxygen is reduced to reactive oxygen species (ROS) which triggers a controlled oxidation of Fe^{2+} to Fe^{3+}, FeOOH and finally $Fe_{3-x}O_4$ are formed. The composition of non-stoichiometric magnetite can be finely controlled with the charge applied, which in turn determines the magnetic properties of the samples. In turn, the size of the nanocrystals can be tuned from 5 to 20 nm by changing the precursor concentration. The nanocrystals possess up to 85% of the bulk saturation magnetization of pure magnetite and minimal coercivity. Using air, NaCl and only $FeCl_2$, a remarkable level of control over the size and composition of nanomagnetite is achieved at room-temperature and in a fast, environmentally friendly, and reproducible manner.

Note:

BIOGRAPHY

Rafael A Prato M has completed his BSc in Chemical Engineering at the University of California Santa Barbara, USA, and his MSc in Chemistry at the University of Oslo, Norway. He is currently pursuing a PhD in Materials Engineering jointly at the KU Leuven and the Flemish Institute for Technological Research (VITO), Belgium.

Rafael.prato@vito.com

Chenglong Jia, Mater Sci Nanotechnol 2018, Volume 2

ROOM TEMPERATURE SINGLE PHASE MULTIFERROIC AURIVILLIUS COMPOUND

Chenglong Jia
Lanzhou University, China

Multiferroics (MFs) have attracted great research interest due to the coexistence of ferroelectric and magnetic ordering, as well as magnetoelectric (ME) coupling. At present, there is a very limited number of single-phase MFs known and these are still far from practical applications. In single-phase MFs, the simultaneous presence of electric and magnetic dipoles does not guarantee strong (ME) coupling, as the microscopic mechanisms of ferroelectricity and magnetism are quite different and do not intrinsically interact with each other. Here we show that in the Aurivillius system Bi3.25La0.75Ti3-2xNbxFex/2Cox/2O12, the x=0.25 composition is ferroelectrically and ferromagnetically active at room temperature. A single-phase structure was supported by XRD, SEM/EDX and neutron diffraction data. Clear ME couplings were observed in this single-phase material at room temperature, where the magnetic iron and cobalt ions contribute to ferroelectric polarization and magnetic moment simultaneously. The results of structural, electrical and magnetic measurements are supported by first principle calculations. This discovery of room temperature multiferroic activity in this system will help to guide the design of room temperature single-phase MFs with strong ME coupling for sensors and solid-state memory applications.

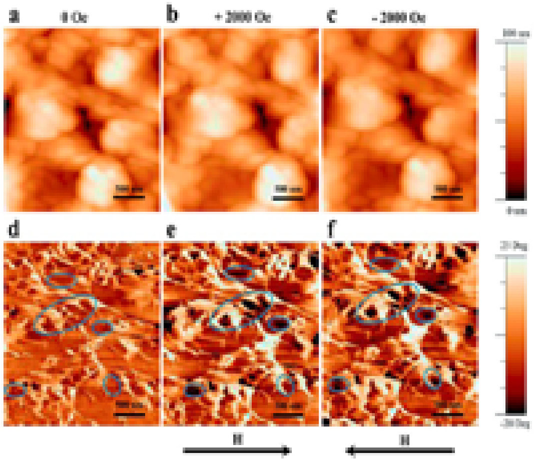


Figure.1: Ferroelectric domain switching under magnetic field in BFCT25. (a) topography and (d) vertical PFM phase at zero magnetic field; (b) topography and (e) vertical PFM phase at +2000 Oe; (c) topography and (f) vertical PFM phase at -2000 Oe via FMR.

Recent Publications

1. Li Zheng et al., (2016). Room temperature magnetoelectric coupling in intrinsic multiferoic Aurivillius phase textured ceramics. In Dalton Trans. 45: 14049.
2. Jia C L et al., (2014). Mechanism of interfacial magnetoelectric coupling in composite multiferroics. Phys. Rev. B 90: 054423.
3. Jia C L et al., (2007). Microscopic theory of spin-polarization coupling in multiferroic transition-metal oxides. Phys. Rev. B 76: 144424.
4. Jia C L et al., (2006). Bond electronic polarization induced by spin. Phys. Rev. B 74: 224444.

BIOGRAPHY

Chenglong Jia is currently working as a Professor at Lanzhou University, China. He was the distinguished visiting fellow of the Royal Academy of Engineering, UK (2015). He is the Deputy-Director of Key Laboratory for Magnetism and Magnetic Materials of the Ministry of Education, Lanzhou University, China. He has published more than 50 papers in reputed journals and has been serving as an Editorial Board Member of repute.

cljia@lzu.edu.cn

Alessio Adamiano, Mater Sci Nanotechnol 2018, Volume 2

ON THE MAGNETIC PROPERTIES OF FE-DOPED HYDROXYAPATITE NANOAPRTICLES

Alessio Adamiano
Institute of Science and Technology for Ceramics (ISTEC-CNR), Italy

Magnetic nanoparticles (MNPs) have strongly emerged in nanomedicine since their successful application in magnetic drug delivery, hyperthermia and contrast agent for diagnostic imaging. MNPs are required to be targeted to a tissue/organ to maximally accomplish their function, leading to high concentrations in a localized area and thus to the possible arising of toxic implications. To circumvent these issues, numerous studies were focused on doping well-known biocompatible materials with magnetic ions to obtain intrinsically safe and biocompatible magnetic biomaterials. At this regard, the control over the doping mechanism is a key factor for an accurate synthesis of the targeted biomaterial with high biological and magnetic properties. In this work, we investigate the relation between the synthesis temperature and the structural and magnetic properties of hydroxyapatite nanophases synthesized by wet neutralization method in the presence of Fe^{2+}/Fe^{3+} ions. We demonstrate how the control of the synthesis parameters uniquely yields the formation of hydroxyapatite nanophase exhibiting partial with both iron ions - and the simultaneous formation of iron oxide- based secondary phase - thus obtaining a nanocomposite (FeHA) whose structural and magnetic properties are strictly related to the doping temperature determining the final iron setting.

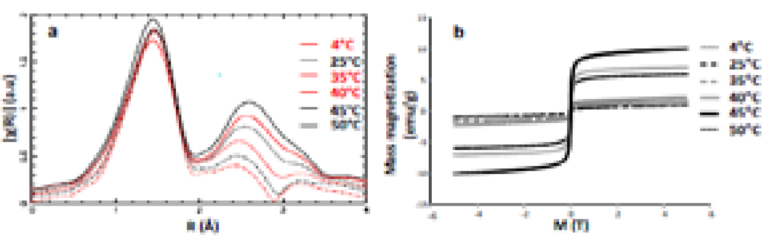


Fig. 1 Modulus of the Fourier Transforms of the EXAFS signals (a) and Magnetization versus magnetic field isotherms collected at 300 K (b).

Recent Publications

1. Adamiano A et al., (2017). Biomineralization of a titanium-modified hydroxyapatite semiconductor on conductive wool fibers. Journal of Materials Chemistry B. 5 (36): 7608-7621.
2. Adamiano A et al., (2017). Fe-Doping-induced magnetism in nano-hydroxyapatites. Inorganic Chemistry. 56(8): 4446-4458.
3. Piccirillo C, et al. (2017). Luminescent calcium phosphate bioceramics doped with europium derived from fish industry byproducts. Journal of the American Ceramic Society. 100 (8): 3402-3414.
4. Sprio S et al.(2017). Tissue engineering and biomimetics with bioceramics. Advances in Ceramic Biomaterials. 407-432.

BIOGRAPHY

Alessio Adamiano is a Researcher for the Italian National Research Council (CNR) at the Institute of Science and Technology for Ceramic Materials. He obtained his PhD in Environmental Science with a project on the analysis of protein driving biomineralization processes in Mediterranean corals. Over the last five years, he has been investigating the applications of magnetic calcium phosphate materials to regenerative and nano-medicine. Recently, he was awarded together with Drs C Piccirillo and M Iafisco by the Italian Ministry of Agricultural, Food and Forestry Policies for the project "RECOVER" on the transformation of fishery by-products into valuable biomedical products. He has published more than 25 papers in international journals and six book chapters.

alessio.adamiano@sitec.cnr.it

Satadeep Bhattacharjee et al., Mater Sci Nanotechnol 2018, Volume 2

IMPROVING THE STABILITY AND MAGNETIC HARDENING OF FE16N2 BY ALLOYING: A FIRST-PRINCIPLES STUDY

Satadeep Bhattacharjee[3], **Krishnamohan Thekkepat**[1,2] **Mahesh Chandran**[3], **Pil-Ryung Cha**[4], **Jung Hae Choi**[1] and **Seung-Cheol Lee**[1,2,3,4]
[1]Korea Institute of Science and Technology, Republic of Korea
[2]KIST School, Korea University of Science and Technology, Republic of Korea
[3]Indo-Korea Science and Technology Center, India
[4]Kookmin University, Republic of Korea

$Fe_{16}N_2$, a promising alternative to rare-earth based permanent magnets, has a very limited applicability due to its poor thermal stability. In this work, using density functional theory method, we investigate the e ect of alloying Fe16N2 with 3d and 4d transition group elements on its formation energy and magnetic properties. Using a systematic screening procedure, we propose Vanadium (V) as an excellent alloying element that improves both the stability and magneto-crystalline anisotropy energy (MAE) of Fe16N2. Our work demonstrates that alloying Fe16N2 with V improves its MAE by 20% in addition to making it suitable for high temperature applications. Synergistic improvement in both these performance parameters has not been reported so far. Our work provides useful inputs for experimental e orts to stabilize Fe16N2.

BIOGRAPHY

Satadeep Bhattacharjee holds a PhD degree in physics and has expertise in the broad area of materials theory. Prior to joining the IKST, he worked in different places such as University of Bonn (Germany), University of Liege (Belgium), Uppsala University (Sweden), RIKEN (Japan) and University of Arkansas in USA. He has authored 20+ research papers in reputed journals. Satadeep has worked in different areas such as electronic structure of low dimensional correlated systems, multiferroics, magnetic multilayers, magnetic molecules, magnetic memory materials etc. His current research interest involves heterogeneous catalysis.

satadeep.bhattacharjee@ikst.res.in

Note:

20 YEARS OF EXCELLENCE IN INTERNATIONAL MEETINGS
alliedacademies.com

2nd International Conference on

MAGNETISM AND MAGNETIC MATERIALS

September 24-26, 2018 | Budapest, Hungary

DAY 2

Scientific Tracks & Abstracts

Day 2
SESSIONS
September 25, 2018

Electromagnetism | Functional Magnetic Materials

Session Introduction

Session Chair
Jonas Fransson
Uppsala University, Sweden

Session Co-chair
Shailender Gaur
P.W.D. B&R, Br. Hisar, Government of Haryana
India

Title: **Magnetic non-equilibrium control of heat and charge transport in paramagnetic molecular dimer**
Jonas Fransson, Uppsala University, Sweden

Title: **Electrochemically synthesis and magnetic properties of spin transition compounds**
Guillermo Pozo, VITO-Flemish Institute for Technological Research, Belgium

Title: **NMR-in-magnetics as useful tool for investigation of local structure of magnetic nanomaterials**
Vladimir V Matveev, Saint Petersburg State University, Russia

Title: **Peculiarities of magnetic ordering in novel chiral 2D magnet $MnSnTeO_6$**
Elena Zvereva, Moscow State University, Russia

Title: **Characterization of coal combustion material for its application in geo-environmental engineering**
Abhijit Deka, Central Institute of Technology, India

Title: **Magnetism in novel family of triangular layered antimonates MSb_2O_6 (M=Mn,Co,Ni,Cu)**
Grigory Raganyan, Moscow State University, Russia

Title: **Investigation of magnetic molecules containing 3d and 4f metals**
Ján Titiš, University of Ss. Cyril and Methodius, Slovakia

Jonas Fransson, Mater Sci Nanotechnol 2018, Volume 2

MAGNETIC NON-EQUILIBRIUM CONTROL OF HEAT AND CHARGE TRANSPORT IN PARAMAGNETIC MOLECULAR DIMER

Jonas Fransson
Uppsala University, Sweden

Utilizing the possibility to electrically and thermally control the magnetic exchange, interactions between localized magnetic moments, we here present results regarding the charge and heat transport properties in dimer comparing, for example, paramagnetic molecules. We consider both charge and heat, transport under non-equilibrium conditions imposed using voltage bias and temperature difference across the junction. Generic properties for both transport quantities are reduced currents in the magnetically active regime compared to the inactive, or, paramagnetic, and efficient current blockade in the anti-ferromagnetic regime. In contrast, while the charge current is about an order of magnitude larger in the ferromagnetic regime, compared to the anti-ferromagnetic, the heat current is efficiently blockaded there as well. This disparate behavior of the heat current is attributed to current resonances in the ferromagnetic regime which counteract the normal heat flow. It can also be noted that the temperature difference has a strongly reducing effect of the exchange interaction, which tends to destroy the magnetic control of the transport proper-ties. The upside of the weakened exchange interaction is a possibility to tune the system into thermal rectification, for both the charge and heat currents.

BIOGRAPHY

Jonas Fransson has completed his PhD in Physics in 2002, at Uppsala University, Uppsala, Sweden, and postdoctoral studies from The Royal Institute of Technology, Stockholm, Sweden, and Los Alamos Natl. Lab., Los Alamos, NM, USA. He is Professor in Physics at Uppsala University since 2015. He has published more than 80 papers in reputed journals and written the text book "Non-Equilibrium Nano-Physics".

Jonas.Fransson@physics.uu.se

Note:

Guillermo Pozo et al., Mater Sci Nanotechnol 2018, Volume 2

ELECTROCHEMICALLY SYNTHESIS AND MAGNETIC PROPERTIES OF SPIN TRANSITION COMPOUNDS

Guillermo Pozo[1], P de la Presa[2,3], R Prato[1], P Marin[2,3], J Fransaer[4] and X Dominguez-Benetton[1]
[1]VITO-Flemish Institute for Technological Research, Belgium
[2]Instituto de Magnetismo Aplicado, Spain
[3]KU Leuven, Belgium

Recently, a third fundamental state for magnetism (besides ferromagnetism and antiferromagnetism) was experimentally realized in a novel class of matter: the spin-liquid state, which was only possible after finding a way to synthesize herbertsmithite ($ZnCu_3(OH)_6Cl_2$). Here we introduce an electrochemically-driven method for synthesizing monodisperse nano-particles of $ZnxCu_{4-x}(OH)6Cl_2$ (in which x=1 for herbertsmithite, x=0 for clinoatacamite and 0.33<x<1 for paratacamite) at room temperature (18°C). The synthesis was carried out using a mixture of Cu^{2+} and Zn^{2+} ions as the metal precursors and O_2 (in air) as the oxidant gas through a gas-diffusion cathode. Zero-field-cooled (ZFC) and field-cooled (FC) mass magnetization (M) in a field of 7.98 kA/m, over the temperature range of 2 to 300 K, showed a small ferromagnetic ordering below Tc ~ 6 K that is accompanied by bifurcation of FC data that are assigned to an impurity phase. There was less difference between zero-field and field cooled susceptibility, when the stoichiometric coefficient on the interlayer site was 1, which support a less spin-glass behavior. We believe that the extracted ferromagnetic hysteresis at T=2 K was caused by an impurity phase. As the purity of the herbertsmithite nanoparticles is increased, a clear distinction of the quantum spin liquid state is expected.

Note:

BIOGRAPHY

Guillermo Pozo has completed his PhD in Chemical Engineering at the University of Queensland, Australia. He is currently a Marie Curie Research fellow working at the VITO-Flemish Institute for Technological Research, Belgium.

guillermo.pozo@vito.be

Vladimir V Matveev, Mater Sci Nanotechnol 2018, Volume 2

NMR-IN-MAGNETICS AS USEFUL TOOL FOR INVESTIGATION OF LOCAL STRUCTURE OF MAGNETIC NANOMATERIALS

Vladimir V Matveev
Saint Petersburg State University, Russia

The lecture is devoted to nuclear magnetic resonance (NMR) in the magnetically ordered state also known as NMR in magnetics or spin echo, or FNR. This technique possesses a potential for effective investigation and testing of various magnetic materials, especially in the nanocrystalline and/or in nanocomposite state. In the first part of the lecture an introduction is done to basic physics of pulse NMR in magnetics together with a brief description of the method development since its appearance, about 60 years ago. The method was successfully applied to a lot of magnetics such as metallic cobalt and cobalt-containing materials, including films, multilayers and nanoparticles; various ferro- and ferrimagnetic compounds, Heusler alloys, intrinsically inhomogeneous perovskite-like CMR manganites etc. Several works of different years demonstrate that NMR technique is the useful addition to well-known diagnostic methods of magnetic materials and allows one to get unique information. In the second part of the lecture we review applications of the technique to some novel magnetic structures/materials during the last few decades. We describe a determination of the core-shell structure of bimetallic FeCo nanoparticles, an observation of ferromagnetic clusters in spin-glass manganites far above Curie temperature, molecular magnets i.e., array of molecular complexes with several 3d-metal ions, Mn-doped magnetic semiconductors, and a detection of zero-field 13C NMR signal in so-called magnetic carbon i.e., in carbon-based magnetic materials free from metallic elements.

BIOGRAPHY

Vladimir V Matveev has completed his PhD from Semenov Institute of Chemical Physics of USSR Academy of Sciences. He is a Senior Researcher of Department of Nuclear-Physics Investigation Techniques of Saint Petersburg State University, Russia. He has published more than 25 papers in reputed journals and made a lot of reports/lectures at international conferences.

v.matveev@spbu.ru

Note:

Elena Zvereva et al., Mater Sci Nanotechnol 2018, Volume 2

PECULIARITIES OF MAGNETIC ORDERING IN NOVEL CHIRAL 2D MAGNET MNSNTeO$_6$

Elena Zvereva[1], **Bukhteev K**[1], **Nalbandyan V**[2], **Evstigneeva M**[2], **Komleva E**[3], **Streltsov S**[3], **Kurbakov A**[4], **Kuchugura M**[4] and **Vasiliev A**[1]
[1]Moscow State University, Russia
[2] Southern Federal University, Russia
[3]Institute of Metal Physics, Russia
[4]Petersburg Nuclear Physics Institute – NRC Kurchatov Institute, Russia

New triangular lattice layered compound $MnSnTeO_6$ with unique chiral crystal structure was prepared and its static and dynamic magnetic properties were studied both experimentally (through magnetization, specific heat, neutron diffraction and ESR) and theoretically (through *ab initio* DFT calculations). Magnetic susceptibility and specific heat evidence an onset of antiferromagnetic order at TN~10 K. However, there observes an additional first order transition at T*~5 K, which can't be related to structural one as confirmed from the neutron data. The ground state was found to be stabilized by seven exchange parameters determined via ab initio DFT calculations. All of them are significant, but there is a remarkable difference triggered by chiral structure: the left-handed interactions are weaker than the right-handed ones. The spin dynamics was (ESR data) discussed in the terms of critical broadening and BKT scenario.

BIOGRAPHY

Elena Zvereva has completed her PhD in 2000 and habilitation in 2017 from Lomonosov Moscow State University, Russia. She is Professor Associate of Physics Faculty of Lomonosov Moscow State University, Russia. She has over 100 publications that have been cited over 300 times. Scientific interests include wide class of quantum cooperative phenomena in Condensed Matter Physics, with emphasis on strongly correlated electron system, low dimensional magnetism, novel functional materials for Li-ion batteries fabrication and spintronics. Research activities are related to the fundamental characterization of static, dynamic and resonant physical properties of the new complex oxides and chalcogenides of transition, alkali and rare-earth metals.

zvereva@mig.phys.msu.ru

Note:

Abhijit Deka et al., Mater Sci Nanotechnol 2018, Volume 2

CHARACTERIZATION OF COAL COMBUSTION MATERIAL FOR ITS APPLICATION IN GEO-ENVIRONMENTAL ENGINEERING

Abhijit Deka[1] and **Sreedeep S**[2]
[1]Central Institute of Technology Kokrajhar, India
[2]Indian Institute of Technology Guwahati, India

Coal combustion residue has gained immense importance in the field of material science and engineering due to its wide application. Fly ash which gets generated from the burning of coal in the thermal power plant during the production of electricity has immense characteristics for its use in engineering. In this study, four different fly ashes were collected from the thermal power plant in India and they were tested to find out its morphological property using field emission scanning electron microscope (FESEM), chemical composition using x-ray fluorescence (XRF), geotechnical properties, contaminant retention capacities using batch equilibrium test etc. The classification of fly ashes was made based on the oxide composition (SiO_2+ Al_2O_3+ Fe_2O_3) as recommended by ASTM C618-05 code of practice. It was observed that for class F fly ash, majority of the particles are spherical in shape. This spherical shaped particle indicates the presence of high amount cenosphere which acts as storage house for contaminants. The image of high calcium class C fly ash showed the presence of sharp platy structure. This was due to presence of glassy particles which are most likely to be found in C class fly ash. The study evaluated and demonstrated the properties of class F and C Indian fly ash and its application in geotechnical engineering field.

BIOGRAPHY

Abhijit Deka has completed his PhD from Indian Institute of Technology Guwahati, India. He is the Assistant Professor of Central Institute of Technology Kokrajhar, India. He has over 10 publications and has been serving as a reviewer of reputed journal.

a.deka@cit.ac.in

Note:

Grigory Raganyan et al., Mater Sci Nanotechnol 2018, Volume 2

MAGNETISM IN NOVEL FAMILY OF TRIANGULAR LAYERED ANTIMONATES MSB_2O_6 (M=MN, CO, NI, CU)

Grigory Raganyan[1], **Elena Zvereva**[1], **Nikulin A**[2], **Nalbandyan V**[2], **Kurbakov A**[3], **Kuchugura M**[4] and **Vasiliev A**[1]
[1]Moscow State University, Russia
[2]Southern Federal University, Russia
[3]Petersburg Nuclear Physics Institute – NRC Kurchatov Institute, Russia

Magnetic and thermodynamic properties of four new metastable trigonal layered MSb_2O_6 phases (M =Mn, Co, Ni, Cu) were investigated. All compounds have been prepared by the low-temperature ion-exchange reactions. Except $CuSb_2O_6$, all compounds under study demonstrate a long-range antiferromagnetic order at low temperatures with Neel temperatures ~8 K (Mn), ~11 K (Co) and ~15 K (Ni) respectively. In addition, the magnetization isotherms indicate a magnetic field induced spin-reorientation (spin-flop type) transition below TN at BSF ~ 0.8 T for $MnSb_2O_6$ and BSF ~ 8 T for $CoSb_2O_6$ respectively, implying two different spin-configurations in the ordered phases. It is interesting to note that the magnetic properties observed here for these novel compounds possessing the trigonal layered rosiaite-type structure are essentially different from those reported for their stable polymorphs MSb_2O_6 (M=Ni, Co, Cu) with tetragonal trirutile-type structure. Magnetic behavior of all trirutile-type compounds MSb_2O_6 (M=Ni, Co, Cu) is quite similar. A characteristic feature is the presence of a wide temperature range where all MSb_2O_6 with trirutile structure exhibit short-range antiferromagnetic order and the temperature dependence of the magnetic susceptibility x(T) demonstrates clear low-dimensional broad maximum at T_{max} followed by long-range antiferromagnetic order. Despite the nearly perfect 2D square M^{2+} sublattice the data were well described within the formalism of antiferromagnetic 1D spin chain. In contrast, new metastable MSb_2O_6 phases (M=Mn, Co, Ni, Cu) did not show any sign of low-dimensional behavior and the magnetic susceptibility nicely follows the Curie-Weiss law over the wide temperature range higher T_N. The negative values of Curie-Weiss temperature indicate predominance of the antiferromagnetic interactions and moderate frustration for the 2D triangular M^{2+} magnetic sublattice.

Note:

BIOGRAPHY

Grigory Raganyan has completed his Bachelor and Magister degree from Moscow State University, Russia. Currently, he is pursuing PhD student of Moscow State University. He is co-author of three articles from journals with impact factor more than three. His scientific interests include strongly correlated electron systems, low dimensional magnetism. His Research activities are related to the fundamental characterization of static, dynamic and resonant physical properties of the new complex oxides.

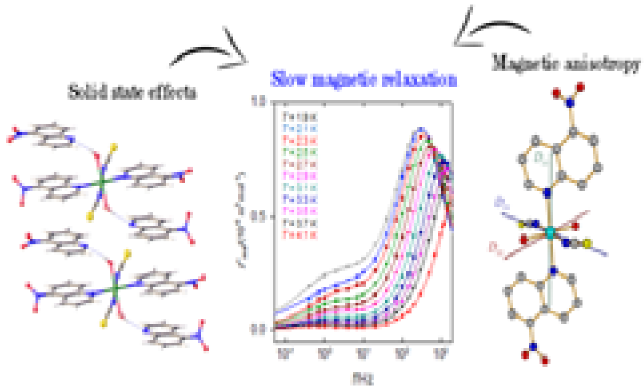
grigorik275@gmail.com

Ján Titiš, Mater Sci Nanotechnol 2018, Volume 2

INVESTIGATION OF MAGNETIC MOLECULES CONTAINING 3D AND 4F METALS

Ján Titiš
University of Ss. Cyril and Methodius, Slovakia

Rationally designed magnetic molecules, such as single-molecule magnets (SMMs), are regarded as potential candidates for various applications in future molecular electronics. SMMs are above all transition metal and/or lanthanide complexes that, beside other interesting quantum phenomena, exhibit slow relaxation of the magnetization at the level of one molecule. We have studied a series of metal complexes containing Co(II), Ni(II) and Dy(III) ions showing multiple field-supported slow magnetic relaxation processes detected by AC susceptibility measurements. A set of AC magnetic parameters (isothermal susceptibilities, distribution parameters, relaxation times) have been fitted to the experimental data by employing the multiple (two, three)-set Debye model. Static (DC) magnetic properties of these compounds were also studied experimentally and theoretically. By employing the standard spin Hamiltonian, we have extracted the DC magnetic parameters (g-factor components, zero-field splitting parameters). By combining the structural and magnetic experimental data and quantum chemistry calculations (DFT, ab initio) we have defined the magnetostructural correlations which provide simple rules for tuning the SMM properties in this family of compounds.



Recent Publications

1. Lomjanský D, Moncol J, Rajnák C, Titiš J, Boča R (2017). Field effects to slow magnetic relaxation in a mononuclear Ni(II) complex. Chemical Communications. 53:6930-6932.
2. Boča R, Stolárová M, Falvello LR, Tomás M, Titiš J, Černák J (2017). Slow magnetic relaxations in a ladder-type Dy(III) complex and its dinuclear analogue. Dalton Transactions. 46:5344-5351.
3. Hazra S, Titiš J, Valigura D, Boča R, Mohanta S (2016). Bis-phenoxido and bis-acetato bridged heteronuclear {CoIIIDyIII} single molecule magnets with two slow relaxation branches. Dalton Transactions. 45:7510-7520.
4. Smolko L, Černák J, Dušek M, Titiš J, Boča R (2016). Tetracoordinate Co(II) complexes containing bathocuproine and single molecule magnetism. New Journal of Chemistry. 40:6593-6598.
5. Banik R, Roy S, Dlháň Ľ, Titiš J, Boča R, Kirillov AM, Martin AD, Bauza A, Frontera A, Rodríguez-Diéguez A, Salas JM, Das S (2016). Self-assembly synthesis, structure, topology, and magnetic properties of a mononuclear Fe(iii)-violurate derivative: A combined experimental and theoretical study. Dalton Transactions. 45:16166-16172.

BIOGRAPHY

Ján Titiš has completed his PhD in 2008 from Slovak University of Technology. He is the Associate Professor of Inorganic Chemistry at University of Ss. Cyril and Methodius in Trnava and Executive Coeditor of Nova Biotechnologica et Chimica. He has published 55 papers in reputed journals. His h-index is 12.

jan.titis@ucm.sk

OF EXCELLENCE IN INTERNATIONAL MEETINGS
20 YEARS
alliedacademies.com

2nd International Conference on

MAGNETISM AND MAGNETIC MATERIALS

September 24-26, 2018 | Budapest, Hungary

DAY 3

Scientific Tracks & Abstracts

Day 3

SESSIONS

September 26, 2018

Magnetization Dynamics | Materials Science and Engineering

Session Introduction

Session Chair
Georgios K. Kertsopoulos
Independent Private Inventor, Greece

Title: **Field supported slow magnetic relaxation in hexacoordinate Co(II) complexes with easy plane anisotropy**
Cyril Rajnák, University of Ss. Cyril and Methodius, Slovakia

Title: **Domain dynamics in multiferroics**
Masakazu Matsubara, Tohoku University, Japan

Title: **High temperature all organic ferromagnetic materials**
Young-Wan Kwon, Korea University, Korea

Title: **The triangular type mixed spin-1/2 and spin-1 ising nanowire with core-shell structures**
Ali Oubelkacem, Moulay Ismail University, Morocco

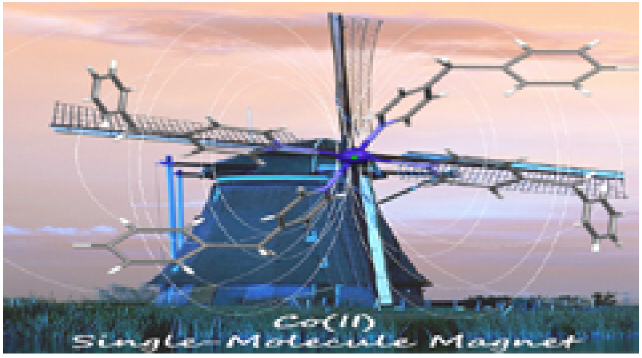
Title: **Different magnetic properties of Ni(II) complexes with (pseudo)halide ligands depending on their geometry**
Lomjanský D, University of SS Cyril and Methodius, Slovakia

Cyril Rajnák, Mater Sci Nanotechnol 2018, Volume 2

FIELD SUPPORTED SLOW MAGNETIC RELAXATION IN HEXACOORDINATE CO(II) COMPLEXES WITH EASY PLANE ANISOTROPY

Cyril Rajnák
University of Ss. Cyril and Methodius, Macedonia

Single molecule magnets known up to date cover several classes of transition metal complexes: there are polynuclear and mononuclear, 3d and 4f, heteronuclear 3d-4f, field induced, and field suppressed, with single mode and multimode relaxation channel systems. Over the past years an increased interest is paid to mononuclear 3d complexes mainly for their easy synthesis, stability, and low price. They involve high-spin Cr (III), Mn (III), Fe (III), Fe (II), Fe (I), Co (II), Ni (I), and Ni (II) complexes. Also, the key factor – the magnetic anisotropy is much easily tuned by a rational synthesis for mononuclear complexes. Considerable attention has been paid to the class of mononuclear Co (II) complexes, mostly tetracoordinate, pentacoordinate, and hexacoordinate. These complexes possess a large magnetic anisotropy expressed by the axial zero-field-splitting (ZFS) parameter D. However, the language in terms of the D- and E-parameters implies that the spin Hamiltonian formalism is legitimate to apply which holds true only for the non-degenerate ground electronic terms of the A- or B-symmetry (point-group irreducible representation); this is the case of quasitetrahedral Co (II) complexes. For pentacoordinate and hexacoordinate complexes one should be careful since here also the degenerate ground electronic terms occur: 4E for the geometry of tetragonal pyramid (the coordination number cn=4+1) and 4Eg for the elongated tetragonal bipyramid (cn=4+2). Application of the spin Hamiltonian (SH) formalism to magnetic data fitting and/or ab initio calculations for systems with degenerate ground term is conceptually mistaken since SH approach utilizes the non-degenerate perturbation theory.



Recent Publications

1. Schäfer B, Rajnák C, Šalitroš I, Fuhr O, Klar D, Schmitz-Antoniak C, Weschke E, Wende H, Ruben M (2013). Room temperature switching of a neutral molecular iron(ii) complex. Chemical Communications. 49:10986-10988.
2. Rajnák C, Titiš J, Fuhr O, Ruben M, Boča R (2014) Single-molecule magnetism in a pentacoordinate cobalt(II) complex supported by an antenna ligand. Inorganic Chemistry. 53:8200-8202.
3. Lomjanský D, Moncol' J, Rajnák C, Titiš J, Boča R (2017) Field effects to slow magnetic relaxation in a mononuclear Ni(II) complex. Chemical Communications. 53: 6930-6932.
4. Boca R, Rajnák C, Titis J, Valigura D, (2017) Field supported slow magnetic relaxation in a mononuclear Cu(II) complex. Inorganic Chemistry. 56:1478–1482.
5. Rajnák C, Varga F, Titiš J, Moncol' J, Boča R (2017) Field-Supported Single-Molecule Magnets of Type [Co(bzimpy) X2]. European Journal of Inorganic Chemistry 2017:1915–1922.

BIOGRAPHY

Cyril Rajnák has obtained an MSc and then a RNDr from the University of Ss. Cyril and Methodius in 2009 and 2010, respectively. He received his PhD from the University of Strasbourg in 2014 under the guidance of Prof. Mario Ruben. He received second PhD from the University of Ss. Cyril and Methodius under the supervision of Prof. Roman Boča. In 2015, he joined the Alma Mater as an Assistant Professor. His research is focused on organic and inorganic synthesis and development of single-molecule (Ion) magnets. He has published more than 20 reputed journals.

cyril.rajnak@ucm.sk

Masakazu Matsubara, Mater Sci Nanotechnol 2018, Volume 2

DOMAIN DYNAMICS IN MULTIFERROICS

Masakazu Matsubara
Tohoku University, Japan

Spin-spiral multiferroics exhibit a strong coupling between the electric and magnetic subsystems which is of potential interest for technological applications. Although these systems have been investigated for more than a decade, the magnetoelectric domain evolution under external fields is still largely unknown. Using optical second harmonic generation (SHG) microscopy we resolve how electric, magnetic, and optical fields affect the multiferroic domains in the archetypal spin-spiral multiferroic $TbMnO_3$. In consecutive electric switching cycles, varying multi-domain patterns emerge before a single-domain state is obtained. This observation reflects that the domain walls can easily move without being pinned by, e.g., structural defects. In striking contrast to the electric-field response, multi-domain patterns persist when the polarization direction is flopped by applied magnetic fields. Here, a uniform polarization rotation is observed within all domains, which incorporates a transformation of neutral into nominally charged domain walls. Landau-Lifshitz-Gilbert simulations reveal that this behavior is intrinsic and provide first evidence for the scalability of macroscopic magnetoelectric properties onto the level of domains. Furthermore, in a proof-of-principle experiment we demonstrate that reversible optical switching of multiferroic order parameter is possible by using light pulses of two different colors, which leads to sequential laser-controlled writing and erasure of multiferroic (antiferromagnetic spin-spiral) domains. Opto-magnetism is thus complemented by an important degree of freedom, namely local control of antiferromagnetism by means of light.

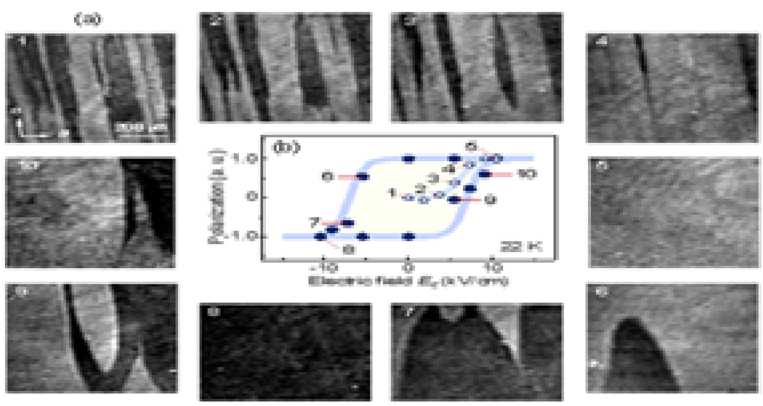


Fig.1: Electric-field control of multiferroic domains in $TbMnO_3$. (a) Progression of multiferroic domain structure in a cycled electric field Ec along the c axis. Bright and dark regions correspond to +Pc and –Pc domains, respectively. (b) Ferroelectric hysteresis loop derived from the areal ratio of +Pc to –Pc domains in SHG images.

BIOGRAPHY

Masakazu Matsubara has completed his PhD from University of Tokyo, Japan. He is the Associate Professor of Tohoku University, Japan.

m-matsubara@m.tohoku.ac.jp

Young-Wan Kwon, Mater Sci Nanotechnol 2018, Volume 2

HIGH TEMPERATURE ALL ORGANIC FERROMAGNETIC MATERIALS

Young-Wan Kwon
Korea University, Korea

High-temperature organic and polymeric ferromagnetic materials have been attempted by many researchers for several decades. In the earlier studies, the intrinsic magnetism of the natural DNAs in dry state was reported and the discotic liquid crystals with a porphyrin core and iron (III) phthalocyanine intercalators showed a high-temperature ferromagnetism. In this presentation, the room temperature ferromagnetic properties of all organic composites with an ordered structure will be discussed by electron paramagnetic resonance (EPR) spectroscopy and superconducting quantum interference device (SQUID) measurement. This new finding for the magnetism of all organic compounds enables to trailblaze new high-temperature organic and polymeric ferromagnetic materials and devices.

BIOGRAPHY

Young-Wan Kwon has received his BS and MS degrees in Chemistry from Korea University, Seoul, Korea, in 1993 and 1996, respectively, and the PhD degree in Polymer Chemistry from Korea University, Seoul, Korea, in 2006. He is currently a Research Professor, KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, Korea.

ywkwon@korea.ac.kr

Note:

Ali Oubelkacem et al., Mater Sci Nanotechnol 2018, Volume 2

THE TRIANGULAR TYPE MIXED SPIN-1/2 AND SPIN-1 ISING NANOWIRE WITH CORE-SHELL STRUCTURE

Ali Oubelkacem[1],Y Benhouria[1], I Essaoudi[1]
A Ainane[1,2,3] and R Ahuja[3]
[1]Moulay Ismail University, Morocco
[2]Max-Planck-Institut für Physik Complexer Systeme, Germany
[3]Uppsala University, Sweden

The triangular mixed spin ising nanowire model consisting of a spin-(1/2) core which is surrounded by a spin-1 ferrimagnetic surface shell is studied in the presence of the crystal field using the Monte Carlo MC simulation based on the heat bath algorithm and the effective field theory based on the probability distribution. We have examined the effects of the core-surface and crystal field on the critical and compensation temperatures. Several properties, such us the magnetization, hysteresis behaviors, correctives field and remnant magnetizations are studied. For the appropriate values of the system parameters, the compensation point and multi-loops are found.

BIOGRAPHY

Ali Oubelkacem has completed his PhD from Mouly Ismail University, Faculty of Sciences, Physics Department, Meknes, Morocco. He is a Professor at the Faculty of Sciences of Meknes. He has over 20 publications in the magnetism field and nanostructures, that have been published in different international journals (*JMMM, Physica A, B, Physica Scripta, Thin Films, Chines Journal of Physics, JOSC*...), permanent member of the magnetism group at the same department.

al_aboulkacem@yahoo.fr

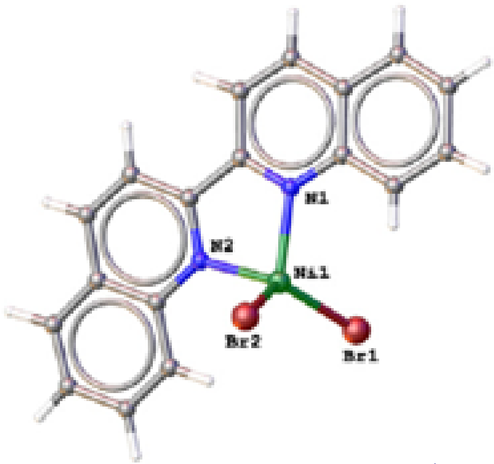
Note:

Lomjanský D et al., Mater Sci Nanotechnol 2018, Volume 2

DIFFERENT MAGNETIC PROPERTIES OF NI(II) COMPLEXES WITH (PSEUDO)HALIDE LIGANDS DEPENDING ON THEIR GEOMETRY

Lomjanský D, Rajnák C, Titiš J, Moncoľ J, Smolko L and **Boča R**
University of SS Cyril and Methodius, Slovakia

Four tetracoordinate Ni(II) complexes have been prepared, structurally characterized, and subjected to magnetometric studies. The complexes [Ni(*PPh*$_3$)$_2$(NCS)$_2$], [Ni(*dppp*)(NCS)$_2$], and [Ni(*dppm*)Br$_2$] are planar and thus diamagnetic. The complex [Ni(*biqu*)Br$_2$] is quasi-tetrahedral, with the geometry close to C_{2v} symmetry, and paramagnetic. While on one side it resembles a prolate bisphenoid (the angle N-Ni-N=83 deg), on the second side it mimics an oblate bisphenoid (Br-Ni-Br=126 deg). It exhibits a zero-field splitting of the ground term $^3A_2$ into three crystal-field multiplets that can be described by D and E parameters within the spin Hamiltonian formalism. The ab initio calculations confirm this interpretation; however, the evaluation of the spin-Hamiltonian parameters meets difficulties owing to the quasi-degeneracy of the electronic terms.



lomjanskyd@gmail.com

Note: