

**School on Nanomaterials for
magnetism and spintronics**

Ecole Franco - Coréenne

IPCMS Université Louis Pasteur - Strasbourg

LPM Université Henri Poincaré - Nancy

Ewha University - Séoul

18-23 FÉVRIER 2008



PROGRAMM



MONDAY FEBRUARY 18, 2008

- 9h15-9h30 - Welcome B. Doudin (Strasbourg)
9h30-10h15 - Introduction W. Weber (Strasbourg)
10h15-11h00 - Thin films and nanostructures, fabrication and properties (1) P. Panissod (Strasbourg)
11h30-12h15 - Thin films and nanostructures, fabrication and properties (2) P. Panissod (Strasbourg)
12h-13h00 - Materials for Spintronics T.H. Kim (Seoul)
- 15h00-15h45 - Transport through magnetic domain walls D. Weinmann (Strasbourg)
15h45-16h30 - Nanoparticles (1) G. Pourroy (Strasbourg)
17h00-17h45 - Nanoparticles (2) G. Pourroy (Strasbourg)

TUESDAY FEBRUARY 19, 2008

- 9h30-10h15 - Magnetic oxides A. Maignan (Caen)
10h15-11h00 - Ferroelectric materials A. Maignan (Caen)
11h30-12h15 - Multiferroics A. Maignan (Caen)
12h15-13h00 - New switching molecular systems (1) J.F. Letard (Bordeaux)
- 15h00-15h45 - New switching molecular systems (2) J.F. Letard (Bordeaux)
15h45-16h30 - Carbon-based spintronics (1) J. Trbovic (Basel)
17h00-17h45 - Carbon-based spintronics (2) J. Trbovic (Basel)

WEDNESDAY FEBRUARY 20, 2008

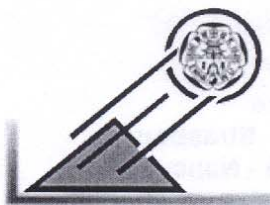
- 9h30-11h00 - Spin electronics devices and design (1+2) M. Hehn (Nancy)
11h30-12h15 - Current-induced switching : spin transfert torque S. Mangin (Nancy)
12h15-13h00 - Magnetoelectric interfaces and ferroelectric tunnel junctions (1) E. Tsymbal (U. of Nebraska)
- 15h00-15h45 - Magnetoelectric interfaces and ferroelectric tunnel junctions (2) E. Tsymbal (U. of Nebraska)
16h15-17h00 - Exchange coupling Y. Henry (Strasbourg)
17h00-18h30 - Laboratory visits (1) nanofabrication rooms or (2) physical measurements

THURSDAY FEBRUARY 21, 2008

- 9h30-11h00 - Scanning probe microscopies and magnetism (1+2) J.P. Bucher (Strasbourg)
11h30-12h15 - Low-dimensionality magnetism M. Drillon (Strasbourg)
12h15-13h00 - Talks of participants (1)
- 15h00 -16h00 - Talks of participants (2)
16h30-18h30 - Poster session

FRIDAY FEBRUARY 22, 2008

- 9h30-10h15 - Correlation effects in transport D. Weinmann (Strasbourg)
10h15-11h00 - New quantum transport phenomena in magnetic nanojunctions E. Tsymbal (U. of Nebraska)
11h30-13h00 - Laboratory visits (2) physical measurements or (1) nanofabrication rooms
- 15h00-16h30 - Microwave magnetism (1+2) M. Bailleul (Strasbourg)
17h00-17h45 - Femtosecond spin dynamics in semiconductors P. Gilliot (Strasbourg)
17h45-18h30 - Femtosecond magnetization dynamics of nanoparticles V. Halté (Strasbourg)



THE STUDY OF RELAXATION BEHAVIOR ON CO-DOPED IN LIFEPO₄ BY MOESSBAUER SPECTROSCOPY

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Since the magnetoelectric (ME) effect was observed in Lithium-orthophosphates LiMPO₄ (M=Fe⁺², Mn⁺², Co⁺², Ni⁺²), have been extensively investigated for information storage and electronic, magnetic and optical switches [1]. Especially, LiFePO₄ compound is very charming for application rechargeable Li batteries because of high theoretical energy density, low cost, remarkable thermal stability and environmental friendliness. And, recently, the observation of ferrotoroidic (FTO) domains in LiCoPO₄ was reported by Bas. Van Aken et al [2]. From these complex magnetic structures, LiMPO₄ show the various anomaly effects. Therefore, it is essential to determine the unusual magnetic properties of LiMPO₄ in low temperatures for properly understand the mechanism. We present crystallographic and magnetic properties of LiFe_{1-x}Co_xPO₄ using the Mössbauer spectroscopy and the x-ray diffraction (XRD).

The polycrystalline sample of LiFe_{1-x}Co_xPO₄ was made by using a direct reaction. Lithium carbonate (Li₂CO₃), iron(II) oxalate dehydrate (FeC₂O₄ · 2H₂O), ammonium dihydrogen phosphate ((NH₄)H₂PO₄), and cobalt oxide (CoO), were mixed in stoichiometric ratios and sealed in evacuated quartz tubes. The X-ray (Cu-K α radiation) diffraction patterns exhibited a orthorhombic phase for LiFePO₄. The crystal structure was determined to be a orthorhombic with space group *Pnma* by using a Rietveld refinement. The lattice constant $a_0 = 10.329$ and 10.241 , $b_0 = 6.006$ and 5.924 , and $c_0 = 4.698$ and 4.698 at $x = 0, 1$, respectively. The Mössbauer spectrum shows a large asymmetric and distorted line broadening at 4.2 K. We have analyzed the Mössbauer spectra by using the full Hamiltonian for the ⁵⁷Fe nucleus and by considering both the magnetic dipole and the electric quadrupole interactions. The magnetic hyperfine field (H_{hf}) and the quadrupole splitting (ΔE_Q) at 4.2 K were fitted and yielded the following results: $H_{hf} = 135$ and 127 kOe, $\theta = 22.5$ and 16° , $\varphi = 12.5$ and 0° , $\eta = 1.0$ and 0.95 , $\Delta E_Q = (1/2)e^2qQ[1+(1/3)\eta^2]^{1/2} = 2.85$ and 0.36 mm/s, and $R = 2.7$ and 3.0 at $x = 0$ and 1 , respectively.

References

- [1] I. Kornev, physical Revi. B, **62**, 12247 (2000).
- [2] B. B. V. Aken, Nature, **449**, 702 (2007).