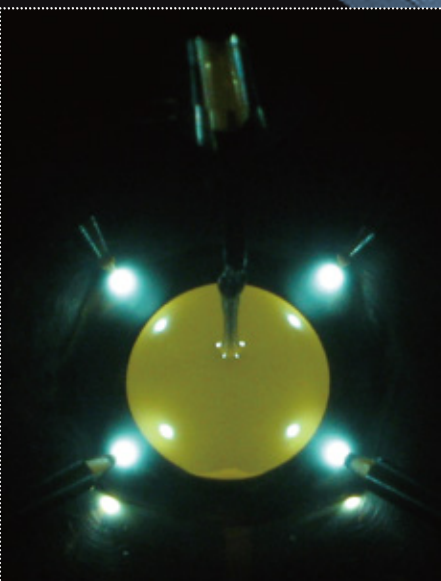




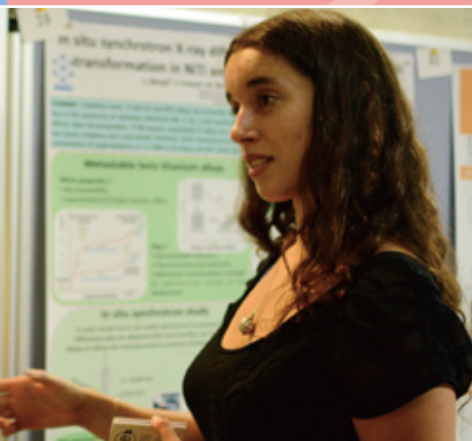
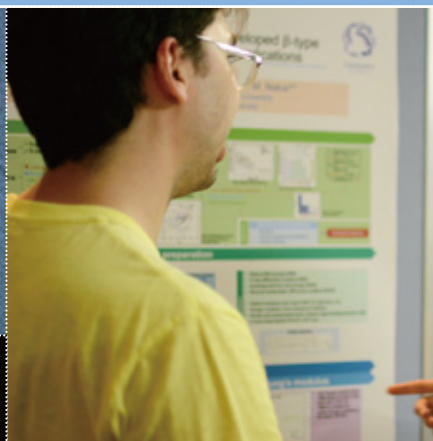
ICC-IMR news No.6

International Collaboration Center

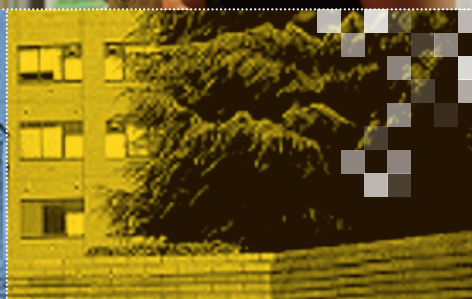
Institute for Materials Research, Tohoku University



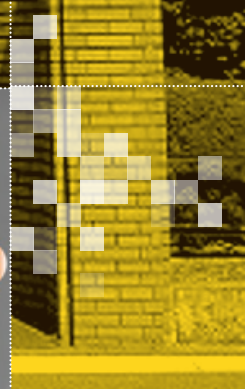
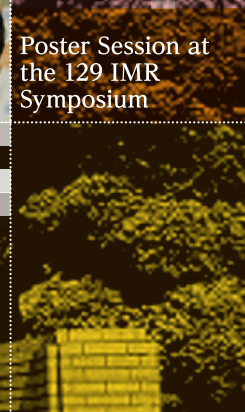
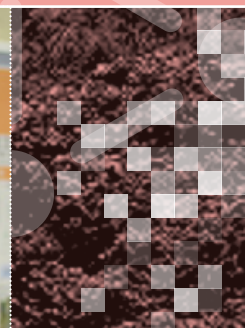
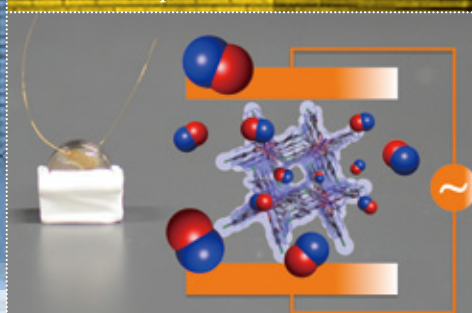
Single Crystal Growth by
Czochralski Method



Poster Session at
the 129 IMR
Symposium



Signals from
Gated Adsorption Behavior



Welcome to ICC-IMR

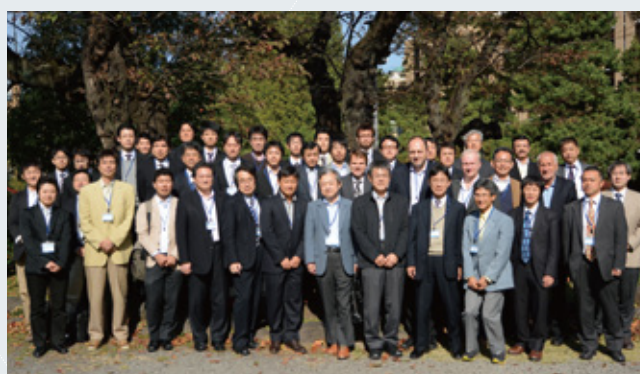
ICC-IMR was founded in April 2008 as the center for the international collaboration of the Institute for Materials Research (IMR). As one of the centers of excellence in material science, IMR holds 27 research groups and seven research centers. ICC-IMR works as a gateway of diverse collaborations between international researchers and IMR members. ICC-IMR has invited 47 invited visiting professors and conducted 20 international research projects since the start-up. The applications are open for foreign researchers and the projects are evaluated by peer-review process by international reviewers. Currently, ICC-IMR coordinates six different programs:

- | | |
|--|--|
| 1) International Integrated Project Research | 4) International Workshops |
| 2) Visiting Professorship | 5) Fellowship for young researcher and PhD student |
| 3) Short Single Research Visits | 6) Material Transfer Program |

We welcome applicants from around the globe to participate in these international programs.

2nd Intensive Discussions on Growth of Nitride Semiconductors, Oct. 29-31, 2014, Chairperson T. Matsuoka (IMR)

The international workshop “2nd Intensive Discussion on Growth of Nitride Semiconductors (IDGN-2)” was held on October 29-31, 2014 just after blue LEDs consisted of nitride semiconductors was awarded as “the 2014 Nobel Prize in Physics”. The previous workshop held in 2012 provided us the opportunity to share the most recent achievements and to discuss the technical issues on crystal growth and device applications of nitrides. In the present workshop, the technical sessions to cover electronic devices, optical devices and their related crystal growth techniques were arranged. The nitride semiconductors have been strongly expected to be applied for optical and electronic devices from the physical properties superior to conventional semiconductors. The workshop had an important aspect; i.e., the growers of bulk GaN and epitaxial films presented up-to-date technologies to device fabricators. The mutual communication between crystal growers and device fabricators will bring a new era beyond the current technical limitation.



Participants near the venue in Katahira campus

KINKEN WAKATE: 11th Materials Science School for Young Scientists, Sep. 29, 2014, Sendai, Japan, Organizer M. Fujita (IMR)

The exploration of high-transition-temperature superconductor and the understanding of its mechanism are exciting and challenging issues in the modern materials science. Hence, we held KINKEN-WAKATE school, which is oriented for superconductivity, with inviting four world-famous professors. The lectures were provided from both theoretical and experimental points of view, with introducing the recent results obtained by quantum beams such as neutron, muon and X-ray. Over 40 students and young researchers attended the school. They learned many aspects of research of



superconductivity. In the Short Talk Session, several participants gave contributed presentations on their researches. Senior scientists kindly made constructive suggestions and comments on their talks. Participants very much enjoyed discussions and exchanged information on their own researches. The school received a favorable impression.

Siu-Tat Chui, University of Delaware, Sep. 11–Dec. 10, 2014

Research Proposal: Spin Plasmonics



My wife and I have enjoyed our stay, the warm hospitality of our host (Bauer), the efficient help of the lab secretary (Mika-san) and the friendly atmosphere provided by members of the Bauer group. Except for the very convenient and comfortable “new” building where I stayed, the immediate area around IMR has not changed much since I last come here more than ten years ago. Café Mozart, our old hangout, still remained, including a new one next to the river, along which I enjoyed walking. Kokubuncho Dori now has a different atmosphere.

I have profited scientifically from interacting with the different IMR groups (Bauer, Nojiri, Saitoh, Takanashi). Through their introduction and through old contacts, I also learned from and interact with other scientist in the area (Miyazaki and his former collaborators, Ishihara). I enjoyed the many seminars which created an exciting atmosphere. The scientific outcome of my visit has been published in two papers ["Enhancing ferromagnetic resonance absorption for very thin insulating magnetic films with spin plasmonics", JAP 117, 183902 (2015); "Electron interaction effect on the spin diffusion and transport in half metallic magnets", JMMM 393, 457, (2015)]. These work opened new routes to new ideas.

Integrated Project

International integrated projects between IMR and foreign institutions/groups provide world-class collaborative research for a period of up to two years. Diverse research teams with members from multiple countries are encouraged. International referees evaluate each project.

Visiting Professorships

Individuals staying more than a month can apply for a visiting professorship. Successful applicants are employed as formal visiting professors of IMR, and travel costs are supported.

Single Research Visits

Applicants accepted for a short research visit are allowed access to IMR, including its research centers and divisions, and travel expenses are partially supported. Collaborating with several IMR groups is encouraged during a single research visit.

International Workshops

ICC-IMR supports international workshops held at IMR. These can be independent workshops or ones cosponsored with other organizations.

Fellowship for young researcher and PhD student

Applicants are supported partially up to two months of research under the IMR supervisor.

Material Transfer Program

The products of IMR can be transferred to foreign research institution based on the international exchange agreement and are used for the international collaborative research in abroad.

New Approaches for Single-chain Magnets and Related Magnetically Correlated Materials

Principle investigators: R. Clérac, *Centre de Recherche Paul Pascal, CNRS, France*, C. Mathoniere, *Institut de Chimie de la Matière Condensée de Bordeaux, CNRS, France*, & H. Miyasaka, *Institute for Materials Research, Japan*

Collaborator: Wataru Kosaka, *Institute for Materials Research, Japan*

Here we introduce an on-going project, which measures the permittivity of compounds in order to monitor the structural changes induced by an inter-metal electron transfer involving a spin-crossover.

The French team, which consists of Dr. R. Clérac (CRPP, CNRS, France) and Prof. C. Mathoniere (Université Bordeaux 1/ICMCB, France) and their colleagues, prepared a family of cyano-bridged $\text{Co}^{\text{II}}\text{--Fe}^{\text{III}}$ dinuclear compounds with different counter anions. Figure 1 shows an example with a PF_6^- counter anion. This family of paramagnetic compounds exhibits temperature-dependent inter-metal electron transfer, which leads to a diamagnetic $\text{Co}^{\text{III}}\text{--Fe}^{\text{II}}$ low spin system.

Interestingly, this transition in the orthorhombic system involves a structural modification where its space group is changed from $Pnma$ for the high temperature region (paramagnetic) to $P2_12_12_1$ for the low temperature region (diamagnetic). The temperature dependence of the magnetic properties occurs as a spin transition from the paramagnetic state with $S = 3/2$ to the diamagnetic state at the transition temperature. This behavior was confirmed by measuring the structures at temperatures above and below the transition temperature. Permittivity measurements of compounds in a pellet sample captured the transition in detail. These data demonstrate that the electron transfer and a simultaneous high-spin/low-spin transition occur with a reversible structural transition. Thus, permittivity measurements are useful to understand electron transfer even in discrete species.

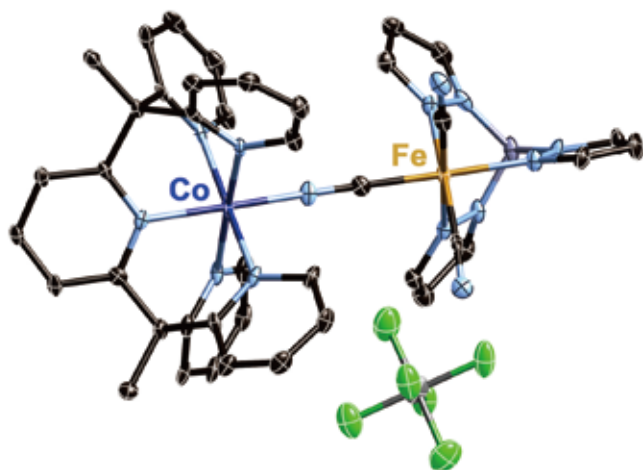


Fig. 1 Structure of the cyano-bridged $\text{Fe}^{\text{III}}\text{--Co}^{\text{II}}$ dimer, $[(\text{Tp})\text{Fe}^{\text{III}}(\text{CN})_3\text{Co}^{\text{II}}(\text{PY5Me}_2)]\text{PF}_6\cdot 2\text{DMF}$, where the counter anion PF_6^- can be replaced by AsF_6^- .

ICC-IMR activities in FY 2014

Research Projects

New Approaches for Single-Chain Magnets and Related Magnetically-Correlated Materials (FY2013–2014)

PI: R. Clérac (Centre de Recherche Paul Pascal, CNRS, France) and H. Miyasaka (Solid-State Metal-Complex Chemistry, IMR)

Spin, Lattice, and Ac-Feld Coupling in Magnetic Materials and Devices (FY2013–2014)

PI: S. Gönnenwein (Walther-Meissner-Institute, Bavarian Academy of Science, Germany) and G. E-W. Bauer (Theory of Solid State Physics, IMR)

New Guideline for Designing Hydrogen Storage Complex Hydrides (FY2013–2014)

PI: B. Hauback (Institute for Energy Technology, Norway) and S. Orimo (Hydrogen Functional Materials, IMR)

High Pressure Studies of Strongly Correlated Electron Systems (FY2013–2015)

PI: G. Knebel (CEA Grenoble, France) and D. Aoki (Actinide Materials Science, IMR)

New Technology for Materials Science: Developing a Terahertz-Frequency EPR Spectrometer (FY2013–2014)

PI: D. Graham (The University of Manchester, USA) and H. Nojiri (Magnetism, IMR)

Visiting Professors

B.J. Gunawarman, Andalas University, Indonesia, July 1–August 31, 2014

“Corrosion Behavior of New Beta Type Titanium Alloys in modified Artificial Saliva”

C. Wetzel, Rensselaer Polytechnic Institute, USA, September 8–November 30, 2014

“Development of GaInN Heterostructures of High InN Fraction”

S. Chui, University of Delaware, USA, September 11–December 10, 2014

“Spin Plasmonics”

Dr. S. Bedanta, National Institute of Science Education and Research, India, FY2014

“Magnetization Reversal Processes in Perpendicularly Magnetized FePt Dots and Antidot Arrays”

Prof. V. Kataev, Leibniz Institute for Solid State and Materials Research IFW Dresden, Germany, October 7–November 11, 2014

“Exploring the Phase Diagram of the Frustrated Quantum Spin Magnet LiCuSbO₄”

M. Matsuda, Oak Ridge National Laboratory, USA, FY2014

Neutron Scattering Study in Strongly Correlated Electron Systems

Workshops

Spin Mechanics 2, June 21–24, 2014

9th International Workshop on Biomaterials in Interface Science–Innovative Research for Biosis-Abiosis Intelligent Interface Summer Seminar, Aug. 26–27, 2014

2nd Asian Nuclear Fuel Conference: ANFC, Sep. 18–19, 2014

11th Materials Science School for Young Scientists:
KINKEN–WAKATE 2014, Sep. 29, 2014

Research Frontier of Transition-Metal Compounds Opened
by Advanced Spectroscopies, Sep. 30–Oct. 2, 2014

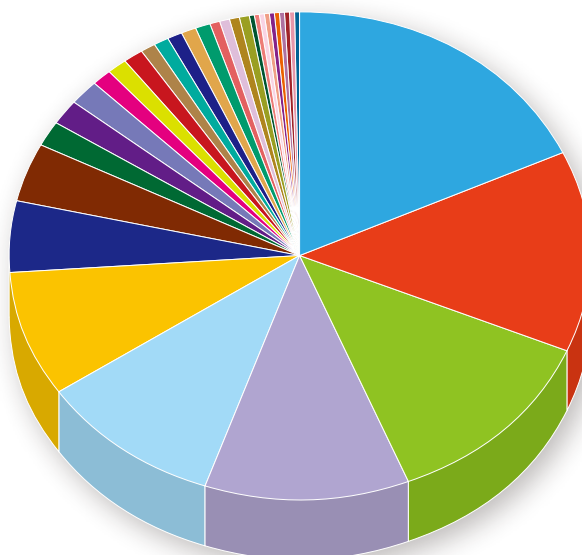
2nd Intensive Discussion on Crystal Growth of Nitride Semiconductors, Oct. 30–31, 2014

Visitors supported by ICC-Programs Graph on the world map



Visitors 2009-2014

USA	67	Canada	4	Ukraine	2
China	48	Norway	4	Argentina	1
Germany	46	Taiwan	4	Austria	1
Korea	42	Italy	3	Belgium	1
France	37	Mexico	3	Czech Republic	1
UK	31	Poland	3	Denmark	1
Netherlands	17	Singapore	3	Indonesia	1
Russia	14	Spain	3	Slovakia	1
India	7	Australia	2	Thailand	1
Iran	6	Hong-Kong	2	Turkey	1
Switzerland	6	Slovenia	2	Vietnam	1



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