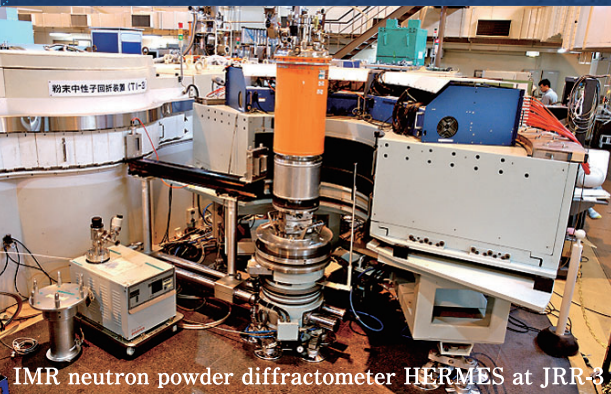




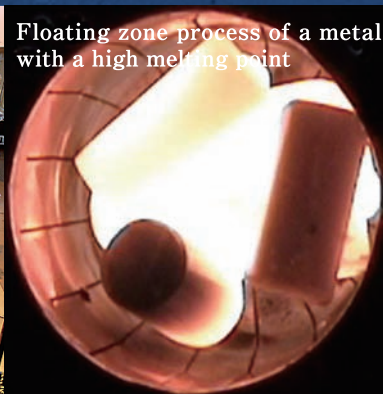
ICC-IMR news No.1

International Collaboration Center

Institute for Materials Research, Tohoku University



Floating zone process of a metal with a high melting point



Poster session at the 118th IMR Symposium

Welcome to ICC-IMR

ICC-IMR was founded after the International Frontier Center for Advanced Materials (IFCAM) in April 2008. Although ICC-IMR's original mission was to serve as an international think-tank of materials science, it has evolved into the international research collaboration center of the Institute for Materials Research (IMR). As such, ICC-IMR's programs have been expanded to include collaborative research projects by international teams.

As one of the centers of excellence in materials science, IMR holds 24 research groups and five research centers. ICC-IMR works as a gateway of diverse collaborations between international researchers and IMR members. Currently, ICC-IMR coordinates five different programs:

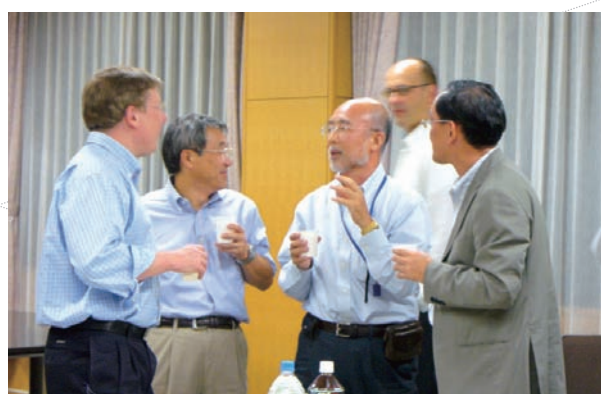
- 1) International Integrated Project Research
- 2) Visiting Professorships
- 3) Short Single Research Visits
- 4) International Workshops
- 5) Coordination of International Research Collaboration.

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

Highlights of an ICC-IMR International Workshop

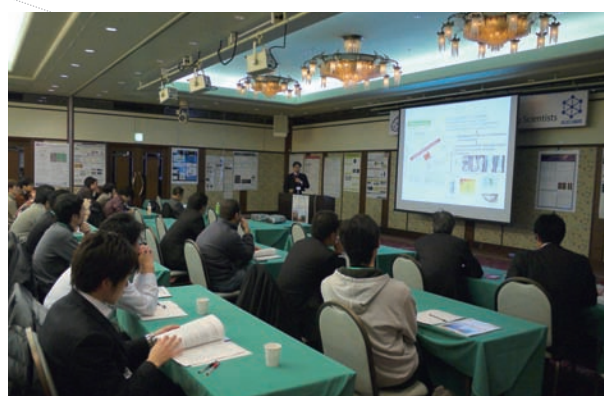
Inelastic Neutron and X-Ray Scattering in Strongly Correlated Electron Systems, Oct. 1–3, 2008, Chairperson S. Maekawa (IMR)

This workshop focused on unifying the data observed in various spectroscopic methods as well as clarifying the underlying electronic states of superconductors and other systems. Participants included 69 scientists and students, including ten from abroad. In the workshop, inelastic neutron, x-ray scattering, angle-resolved photoemission, tunneling spectroscopic, and muon spin resonance were discussed from both experimental and theoretical viewpoints. Numerous participants were investigating newly discovered iron-based superconductors. Based on recent developments in spectroscopic methods that measure charge, spin, and electron excitations, this workshop promoted complementary studies on strongly correlated electron systems, and seems to be unique, indicating a new direction in this research field. A booklet of the presentation files is available upon request from the organizers.



KINKEN WAKATE: 6th Materials Science School for Young Scientists, Dec. 3–4, 2009, Akiu Sendai, Japan, Organizer T. Akahori (IMR)

KINKEN WAKATE on "Bio- and nano-materials for the next generation" was held with wide range of young researchers, including 60 COE fellows and RAs. The lecturers, Prof. Niinomi (IMR), Prof. Morinaga (Nagoya Univ.), Prof. Chiba (IMR), and Prof. Vargas (National Polytechnic Inst., Mexico), gave seminars on "**Bone functionalization of titanium based materials**", "**Electronic approach to alloy design**", "**Grain refinement of biomedical Co-Cr-Mo alloys with and without hot-deformation**", and "**Catalytically active materials prepared by CVD**". The discussion during the lectures as well as the poster presentations was enthusiastic. We are grateful to the participants for helping make this school a success.



Comments from a Visitor

Maria Iavarone, Argonne National Laboratory

Jan. 6–Feb. 8, 2009

Research Proposal: The Effect of Disorder on Superconductivity and Charge Density Wave Systems



For me, the IMR visiting program has been a fruitful and rewarding experience. It gave me the opportunity to strengthen collaborations with IMR scientists as well as develop a better understanding of Japanese culture. The scientific outcome of my short visit has been published in two papers in international journals, and has paved the way for more opportunities and inspired new ideas.

We studied the effect of magnetic atomic impurities on superconductivity and charge density waves in a system where these two ground states coexist. In order to characterize this system, we used low temperature scanning tunneling microscopy (STM) and spectroscopy (STS), which allow visualization of the local electronic density of states with atomic-scale spatial resolution and direct visualization of

Abrikosov vortices. The advanced instrumentation at IMR, the scientists' expertise, and the great Japanese hospitality are unique ingredients that make this program successful.

ICC-IMR Programs

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.

Coordinators

Coordinators plan and oversee international collaborations.

ICC-IMR Activities in FY 2008–2009

Research Projects

Spin Electronics and Spin Caloritronics (FY2008–2009)

PI: G. E. W. Bauer (Kavli Institute of Nanoscience, Delft University of Technology, the Netherlands) and S. Maekawa (Solid State Physics, Theory, IMR)

X-ray and Neutron Experiments in High Magnetic Fields for Developing Advanced Materials (FY2008–2009)

PI: Z. Islam (Advanced Photon Source, Argonne National Lab., USA) and H. Nojiri (Magnetism Division, IMR)

Mobility and Bonding State in Complex Hydrides (FY2008–2009)

PI: A. Züttel (EMPA - Swiss Federal Laboratory for Materials Testing and Research, Switzerland) and S. Orimo (Hydrogen Functional Material, IMR)

Development of CVD Process for Nano-structure Controlled Noble-metal Electrodes (FY2008–2009)

PI: J. R. Vargas Garcia (National Polytechnic Institute, Mexico) and T. Goto (Multi-Functional Materials Science, IMR)

Magnetic Field Heat-treatment for New Superconducting Materials and Ferromagnetic Manganites (2008–2009)

PI: Y. Ma (Institute of Electrical Engineering, Chinese Academy of Sciences, China) and S. Awaji (High Magnetic Field Laboratory for Superconducting Material, IMR)

Visiting Professors

M. Iavarone, Argonne National Laboratory, USA, Jan. 6–Feb. 8, 2009

H-S. Shin, Andong National University, Korea, Jan. 5–Feb. 20, 2009

J. R. Vargas Garcia, National Polytechnic Institute, Mexico, Feb. 1–Apr. 30, 2009

H. W. Lee, Department of Physics, Pohang University of Science and Technology, Korea, Feb. 26–Apr. 3, 2009

K. Leo, Technical University of Dresden and Fraunhofer Institute for Photonic Microsystems, Germany, Mar. 17–June 16, 2009

J. A. Riera, Rosario National University and Institute of Physics, National Council for Science and Technology, Argentina, Mar. 29–June 29, 2009

E. Tsymbal, Department of Physics and Astronomy, University of Nebraska-Lincoln, U.S.A. Apr. 27–June 12, 2009

T. Ziman, Institut Laue Langevin and CNRS, France, Apr. 15–July 15, 2009

E. R. Hodgson, Euratom/CIEMAT Fusion Association, Spain, July 7–Sep. 29, 2009

Y. Uemura, Physics Department, Columbia University, U.S.A, Aug. 15–Sep. 30, 2009

A. Züttel, EMPA - Swiss Federal Laboratory for Materials Testing and Research, Switzerland, Sep. 28–Nov. 25, 2009

J. Vanhellefont, Ghent University and Government of Flanders, Belgium, Nov. 8–Dec. 11, 2009

Y. Ma, Institute of Electrical Engineering, Chinese Academy of Sciences, China, Feb. 21–Mar. 30, 2010

Workshops

The 3rd International Workshop on NANO-BIO and AMORPHOUS Materials, Aug. 7–8, 2008

Inelastic Neutron and X-Ray Scattering in Strongly Correlated Electron Systems, Oct. 1–3, 2008

5th Material Science School for Young Scientists (KINKEN-WAKATE 2008), "Challenge to Integration of Advanced Material Science", Dec. 4–5, 2008

KINKEN Workshop on Organic Light Emitting Devices, Jan. 23–24, 2009

The Third General Meeting of ACCMS-VO, Feb. 16–18, 2009

Physics of Transition Metal based Superconductors, June 24–26, 2009

The 4th International Workshop on Nano, Bio and Amorphous Materials, Aug. 7–8, 2009

International Workshop on the Current Status and Prospects of Collaboration between IMR and SCK/CEN Using BR2, Sep. 14, 2009

International ICC-IMR Workshop on Group-IV Spintronics, Oct. 5–6, 2009

6th Material Science School for Young Scientists (KINKEN-WAKATE 2009), "Bio- and Nano-materials for Next Generation", Dec. 3–4, 2009

4th International Workshop on Spin Currents and 2nd International Workshop on Spin Caloritronics, Feb. 8–10, 2010

Highlights of an ICC-IMR Research Project

X-ray and Neutron Experiments in High Magnetic Fields to Develop Advanced Materials

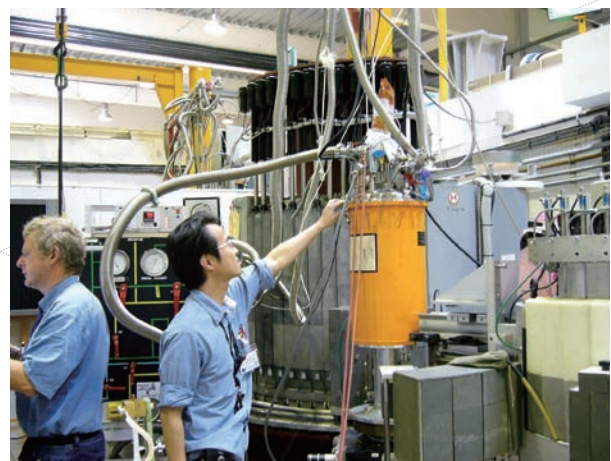
Principle investigators: H. Nojiri (Magnetism Division, IMR) and Z. Islam (Advanced Photon Source, Argonne National Lab.)

Ten Foreign Collaborators from Five Facilities: Advanced Photon Source (USA), Spallation Neutron Source (USA), McMaster University (Canada), Laboratoire National des Champs Magnétiques Intenses - Toulouse(France), and the Institute for Laue Langevin (France)

An international team has developed advanced techniques for X-ray and neutron experiments in high magnetic fields. These experiments have enabled advanced materials, including multiferroic compounds, martensitic metals, etc., to be investigated. Prior to this collaboration, the highest field available was limited to around 15 T. However, this team established the use of X-rays and neutrons in pulsed magnetic fields of 30-40 T by employing the Tohoku mini-coil concept. Throughout this international collaboration, pulsed magnetic fields were used at many world-class facilities such as SPring-8, J-PARC, ILL, APS, and SNS. The exchange of advanced techniques as well as mutual cooperation has been very successful in establishing this emerging field.



30 T Mini-coil for a neutron experiment



Experiments at ILL reactor (Grenoble)

Publications

- 1) Zahirul Islam et al., A portable high-field pulsed-magnet system for single-crystal x-ray scattering studies, *Rev. Sci. Instrum.* **80** (2009) 113902.
- 2) M. Matsuda et al., Universal magnetic structure of the half-magnetization phase in Cr-based Spinel, *Phys. Rev. Lett.* **104** (2010) 047201.



Visitors supported by ICC-Programs (Except workshop participants) Graph on the world map

USA (9), China (6), France (5), Korea (4), Germany (3), Iran (2), Mexico (2), Netherlands (2),
UK (2), Argentina (1), Belgium (1), Canada (1), Singapore (1), Slovenia (1), Spain (1), Switzerland (1),

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