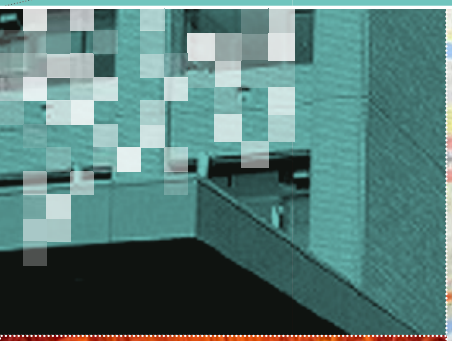
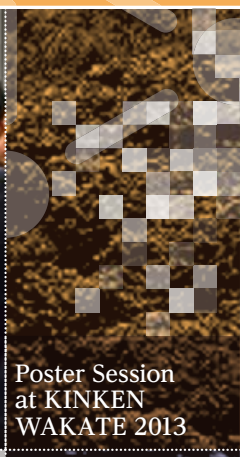
ICC-IMR news No.5

International Collaboration Center

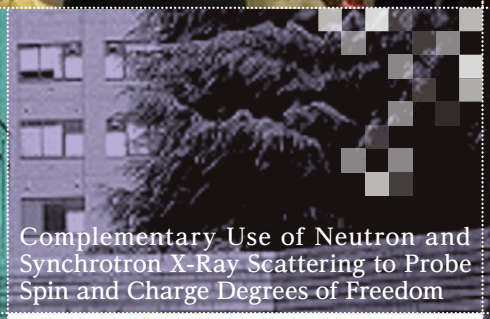
Institute for Materials Research, Tohoku University



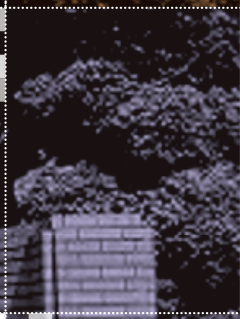


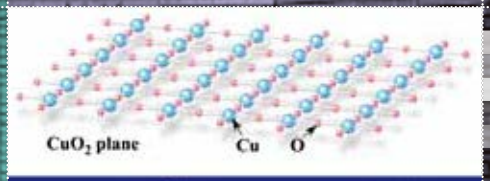
Poster Session at KINKEN WAKATE 2013

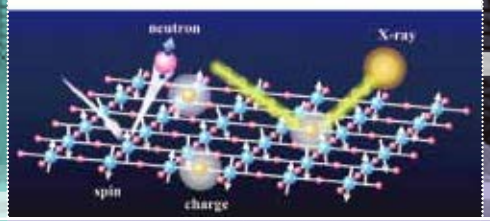
Spin Caloritronics Addresses the Interaction of the Spin Angular Momentum and Heat

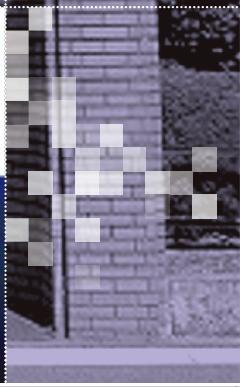


Complementary Use of Neutron and Synchrotron X-Ray Scattering to Probe Spin and Charge Degrees of Freedom









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 six research centers. ICC-IMR works as a gateway of diverse collaborations between international researchers and IMR members. ICC-IMR has invited 34 invited visiting professors and conducted 18 international research projects since the stat-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
2) Visiting Professorship
3) Short Single Research Visits
4) International Workshops
5) Fellowship for young researcher and PhD student
6) Material Transfer Program

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

Highlight of ICC-IMR International Workshop in 2013

The 8th International Workshop on Biomaterials in Biosis-Abiosis Intelligent Interface, Aug. 29–30, 2013, Miyagi Zao, Japan, Organizer, T. Goto, IMR

This workshop focused on recent activities to develop biomaterials with the high functionality and autonomic intelligence at biosis-abiosis interface, which is a crucial issue because of strong demands for replacing various parts in human-body with artificial products. The over 60 scientists and students from various fields, such as dentistry, medical science and material engineering, gathered at this workshop. The technical program included invited lectures by 6 leading scientists from abroad, and 22 papers on the interface science concerned with dental implants, biomaterials, biomedical engineering, cell manipulation and tissue regeneration.

The workshop provided the valuable opportunity for cross-over discussion, interdisciplinary idea sharing and new collaboration to develop and establish the intelligent interface science on biomaterials.

KINKEN-WAKATE 2013 -10th Materials Science School for Young Scientists-, Nov. 21–22, 2013, Sendai, Organizer M. Mizuguchi and K. Fujiwara, IMR

KINKEN WAKATE 2013 was a great opportunity for young scientists and students to study "Crystal Growth". Four worldwide leading researchers gave lectures, **(1)"Epitaxial growth–fundamentals and advanced applications–", Prof. T. Nishinaga, The Univ. of Tokyo, (2) "Bulk crystal growth–fundamentals and advanced technologies–", Prof. P. Rudolph, CTC, Germany, (3) "Defect engineering–fundamentals and defect chemistry and mediation–", Prof. T. Kuech, Univ. of Wisconsin-Madison, USA, (4) "Fundamental crystal growth mechanism" and "Surface melting: hot low-temperature science", Prof. G. Sazaki, Hokkaido Univ.** Those lectures covered a lot of topics related to crystal growth: from atomic scale phenomena to industrial technologies, from soft materials to semiconductor materials, and from thin films to bulk crystals. Young scientists and students did short oral presentations in English before their poster presentations. Participants also had a good time to promote exchange of ideas and collaborations among them. We would give thanks to all lecturers and participants for the success of KINKEN WAKATE 2013.

Comments from a Visitor

Burak Dikici, Yuzuncu Yil University July 3–Aug. 14, 2013

Research Proposal: Investigation of Electrochemical Biocompatibilities of β-type Ti-Nb-Ta-Zr and Co-Cr-Mo Alloys through Microstructural

In the Tohoku University, IMR, Niinomi laboratory not only provided resources and equipment that I need to work on my field of interest but also gave me the chance to collaborate with renowned Japanese scientists. The ICC-IMR project offers the key attributes of working in academia: the opportunity to use laboratories and a stable environment in which to pursue research goals without any interval.

We aimed to investigate the electrochemical behaviours of β type Ti-Nb-Ta-Zr and Co-Cr-Mo alloys in this collaboration. In-vitro corrosion susceptibilities of the alloys were investigated in this study. The scientific outcome of a short visit has been published in three papers in international journals and opened the route for new ideas. After visiting of the IMR, the Scientific and Technological Research Council of Turkey (TUBITAK) has been accepted the project about "Characterization and surface modification of β-Type titanium alloys with bioactive hybrid coating in order to improve body integration and biocompatibility by sol-gel method" which will be the first steps for the future studies.

In the IMR I encountered so friendly, pleasant and helpful university members.

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.

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 Guideline for Designing Hydrogen Storage Complex Hydrides

Principle investigators: B. C. Hauback, Institute for Energy Technology, Norway &

S. Orimo, Institute for Materials Research, Japan

Collaborators: S. Deledda, Institute for Energy Technology, Norway,

T. Sato and S. Takagi, Institute for Materials Research, Japan

Aluminum based complex hydrides $M(AlH_4)_n$ in which a metal cation M^{n+} (n: valence of metal M) is ionically bonded to a complex anion $[AlH_4]^-$ holds a potential as hydrogen storage material [1]. For practical use, it is required exploratory of $M(AlH_4)_n$ with suitable thermodynamic stabilities and elucidation of the hydrogen absorption and desorption reaction mechanism. The linear correlation between the electronegativity of M and the thermodynamic stability of complex hydrides has been widely acknowledged in the search for promising materials [1, 2]. In order to better understand the mechanism viewed atomic scale, we have experimentally and theoretically investigated the crystal structures of $M(AlH_4)_n$. From our neutron scattering studies [3], it is shown that the bindings between M^{n+} and $[AlH_4]^-$ in $M(AlH_4)_n$ are expected to initially weaken before the hydrogen desorption. Further, we have constructed a crystal structure map of different $M(AlH_4)_n$ compounds (Figure 1) [4], which summarizes the various crystal structures of $M(AlH_4)_n$ [5]. It shows a linear relationship between unit cell volume per formula unit V/Z and ionic volume V_{ion} estimated from ionic radii of M^{n+} and $[AlH_4]^-$ and chemical composition. The map guides towards finding a suitable unit cell volume and chemical composition in search for new $M(AlH_4)_n$.

References

[1] S. Orimo *et al.*, Chem. Rev. **107**, 4111–4132 (2007)

[2] S. Takagi *et al.*, Appl. Phys. Lett. **104**, 203901 (2014)

[3] T. Sato *et al.*, J. Alloys Compd. **586**, 244–247 (2014)

[4] T. Sato *et al.*, MH2014, Manchester, July 20–25, 2014

[5] B. C. Hauback. Z. Kristallogr. **223**, 636–648 (2008)

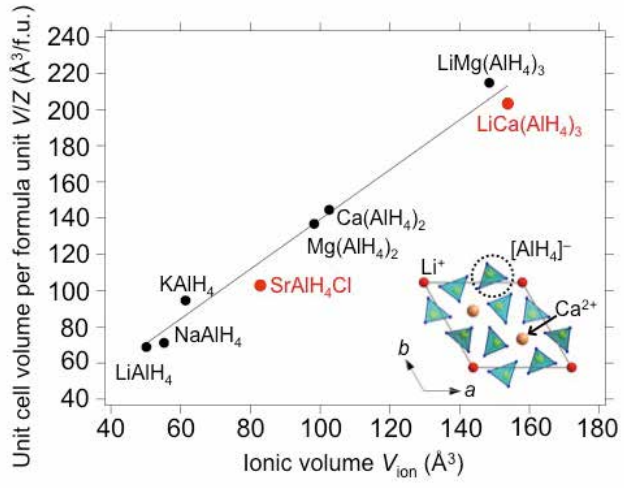


Figure 1 Crystal structure map of $M(AlH_4)_n$. The inset is the crystal structure of $LiCa(AlH_4)_3$ [4]. Red indicates discoveries in this project.

ICC-IMR activities in FY 2013

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—2014)
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. Dikici, Yuzuncu Yil University, Turkey, July 3—Aug. 14, 2013
"Investigation of electrochemical biocompatibilities of β-type Ti-Nb-Ta-Zr and Co-Cr-Mo alloys through microstructural refinement"

V. Kochurikhin, General Physics Institute, Russian Academy of Sciences, Russia, Nov. 5—Dec. 5, 2013
"Development of Growth Technology for Large Size Bulk and Shaped Growth on Scintillator, Piezo-Electric and Halogen Single Crystals"

C. Boehlert, Michigan State University, USA, Jan. 6—Feb. 6, 2014
"Analysis of Deformation Behavior of Beta-Type Titanium Alloys for Biomedical Applications"

A.Hirohata, University of York, United Kingdom, FY 2013
"Experimental Demonstration of a Persistent Current"

T. Ziman, Institut Laue Langevin, France, FY2013
"Transport and Non-Linear Correlation Functions in Frustrated Metallic Antiferromagnets"

C. Schröder, University of Applied Sciences Bielefeld, Germany, FY2013
"Large Scale Simulations of Hybrid Nano-Magnetic Systems, Molecular Based Magnets, Magnetic Multi-Layers and their Composites"

Workshops

The 8th International Workshop on Biomaterials in Biosis-Abiosis Intelligent Interface Science, Aug.29—30, 2013

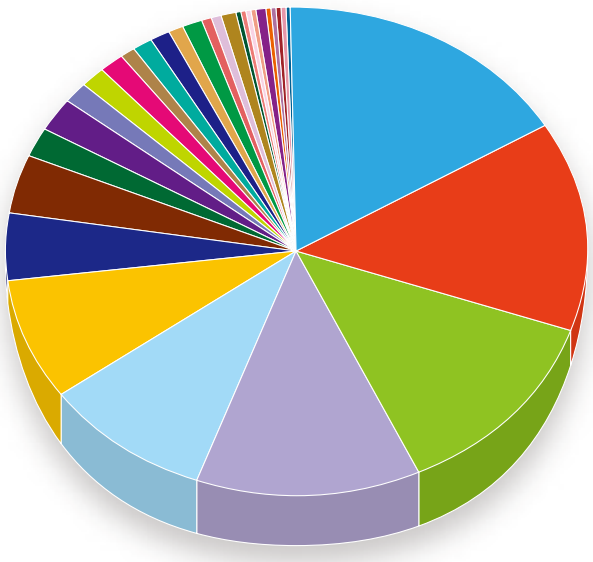
Superconductivity Research Advanced by New Materials and Spectroscopies, July. 23—25, 2013

6th International Workshop on Amorphous and Nanostructured Magnetic Materials, Oct. 1—3, 2013

KINKEN-WAKATE2013: 10th Materials Science School for Young Scientists, Nov. 21—22, 2013

Visitors supported by ICC-Programs Graph on the world map

USA	50	Iran	5	Ukraine	2
China	43	Canada	4	Argnentina	1
Germany	39	Taiwan	4	Australia	1
Korea	38	Italy	3	Austria	1
France	29	Mexico	3	Belgium	1
UK	24	Norway	3	Czech Republic	1
Netherlands	14	Singapore	3	Hong-Kong	1
Russia	12	Spain	3	Slovakia	1
India	6	Poland	2	Thailand	1
Switzerland	6	Slovenia	2	Turkey	1
				Vietnam	1



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