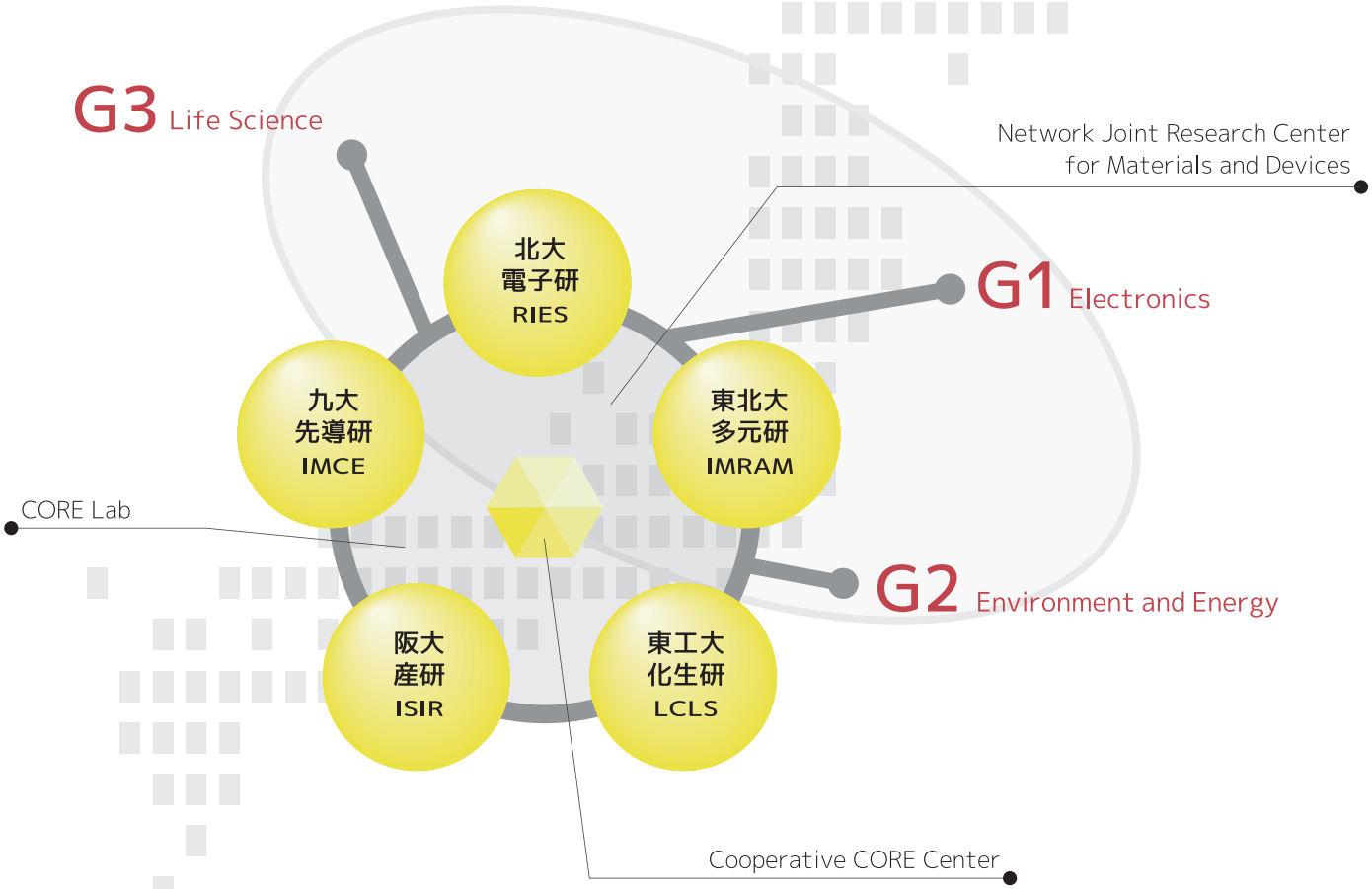


Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials

人・環境と物質をつなぐイノベーション創出ダイナミック・アライアンス

Prospectus

２０１７年

Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials

– Five-star Alliance –

Overview

Based on the former successes of cooperative research projects between two university institutes (FY2005-FY2006) and multi-party alliance projects (Post-Silicon Alliance of FY2007-FY2009, and Nano-Macro Materials, Devices and System Research Alliance of FY2010-FY2015), “Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials”（Five-star Alliance）has been started in fiscal year of 2016 as for the 6 years project to attempt strategic development of next generation “Materials, Devices, and System" for bridging human, environmental and materials as a cooperative research project with five outstanding university institutes including, Research Institute for Electronic Science (RIES) of Hokkaido University, Institute of Multidisciplinary Research for Advanced Materials (IMRAM) of Tohoku University, Laboratory for Chemistry and Life Science (LCLS), Institute of Innovative Research (IIR, former Chemical Resources Laboratory) of Tokyo Institute of Technology, the Institute of Scientific and Industrial Research (ISIR) of Osaka University, and Institute for Materials Chemistry and Engineering (IMCE) of Kyushu University.

The “Five-star Alliance” project is aiming to realize true and clearly-targeted academic and industrial “innovation” through the deeper and more effective cooperation researches among the alliance members. For this purpose, the five-star alliance has strategically established three research groups covering the important topics; “Electronics materials and devices (G1)”, “Environment and energy materials, devices and process (G2)”, and “Life science materials, devices and systems (G3)”. Not only within the group but also between groups, various types of multidisciplinary collaborative researches are carried out.

In addition, the five-star alliance starts new and innovative programs; "Expanded Collaborative Research" is a public offering type program for external researcher, who enforces joint research with two or more institutions members. Of-stay type cooperative research program “CORE Lab” is presided over by a young researcher as a principal investigator for carrying out “covalent” researches. The joint research program “Next Generation Young Scientists” encourages the graduate students. Support program for networking technical staffs beyond the five institutes is also promoted. All these alliance programs are promoted under the strong and mutual correlation with the “Network Joint Research Center for Materials and Devices” project.

Director of Operations
Kazuhiko NAKATANI
(ISIR)

Chair
Tohru SEKINO
(ISIR)

Vice-Chair
Masato KAKIHANA
(IMRAM)

G1Leader
Shiyoshi YOKOYAMA
(IMCE)

G2Leader
Kohtaro OSAKADA
(LCLS)

G3Leader
Kuniharu IJIRO
(RIES)

ダイナミック・アライアンス：沿革

平成17年度
産　研　多元研 ＋ 企業
2附置研＋企業のトライアングル：
新産業創造物質基盤技術センター

平成18年度
産　研　多元研
第1期：2附置研究所間アライアンス

平成19年度～21年度
第2期：4研究所間 ポストシリコン物質・デバイス創製基盤技術アライアンス
産　研　多元研　電子研　資源研 ⟷ 先導研　生産研
協力機関

平成22年度～27年度
第3期：5附置研究所間アライアンスによるナノとマクロをつなぐ物質・デバイス・システム創製戦略プロジェクト
・ナノとマクロとの融合による新物質・新デバイス・システムの創製
・人材・場所・装置のシェアリング、128融合研究

＊平成28年度より 化学生命科学研究所（化生研）

連携

第1期「物質・デバイス領域共同研究拠点」事業
・5附置研が構成する全国規模のネットワーク型共同利用・共同研究拠点
・国内外研究者からの共同利用・共同研究課題（応募数約500課題／年）

平成28年度～
第4期：人・環境と物質をつなぐイノベーション創出ダイナミック・アライアンス
・コバレント（濃密）な共同研究を展開することで、明確なターゲットを指向したイノベーション実現を指向

濃密な相補的連携

第2期「物質・デバイス領域共同研究拠点」事業

ダイナミック・アライアンス：概要と目的

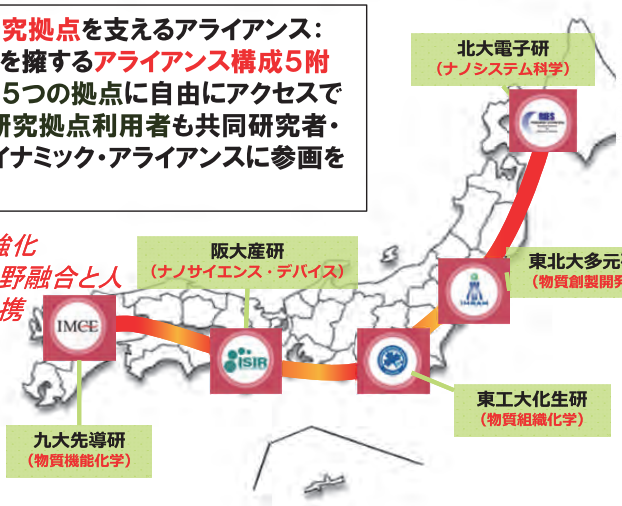
～人・異分野を動的に取り込み常に展開する共同研究の仕組みを構築～

【ダイナミック・アライアンス】
全国5附置研究所の保有する研究資源をコアとして、ナノおよび物質・デバイスに関する共同研究を濃密（コバレント）に深化させ、発展的かつ動的（ダイナミック）に異分野（材料⇔ライフ、物質⇔環境、など）と交流・融合することで、研究を展開させる新規共同研究および実践教育の新たな枠組みを構築し、卓越した成果およびイノベーション創出へと展開。

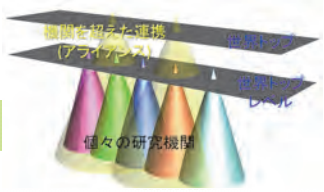
ネットワーク型共同研究拠点を支えるアライアンス：卓越した研究者集団を擁するアライアンス構成5附置研究所 を舞台に、5つの拠点に自由にアクセスできる共同利用・共同研究拠点利用者も共同研究者・連携研究者としてダイナミック・アライアンスに参画を可能とする

・ネットワーク強化
・より動的な分野融合と人材の交流・連携

日本全体の物質・デバイス領域における研究力の飛躍的向上に貢献



「ダイナミック」
❖異分野間の交流・人の移動
❖大学間の人の移動と連携
❖若手・技術職員などの交流・連携



「コバレントな協創」
❖場所・時間の深い”共有”と人材融合
❖実績と強みをイノベーション創出へ展開

ダイナミック・アライアンス：実施体制

共同研究拠点
“地域から世界へ”

- 日本で2番目に規模の大きい研究所
- 3つの研究所を統合
  ⇒ 連携実績
- 豊富な地方創生プロジェクト推進実績

拠点本部：多元研

地域研究者との世界展開
地方創生の積極的推進

電子研
化生研　先導研
多元研　産　研

日本列島を縦断するネットワーク型共同研究拠点アライアンスプロジェクト

東西に本部を設置し利便性向上と効率的運用の実現

ダイナミック・アライアンス
“イノベーション創出”

- 産業に活かす科学
- インキュベーション棟（産学連携の拠点）
- アライアンスラボ設置

などの推進実績

アライアンス事業本部：産研

シーズからのイノベーション推進
COREラボの連携の推進

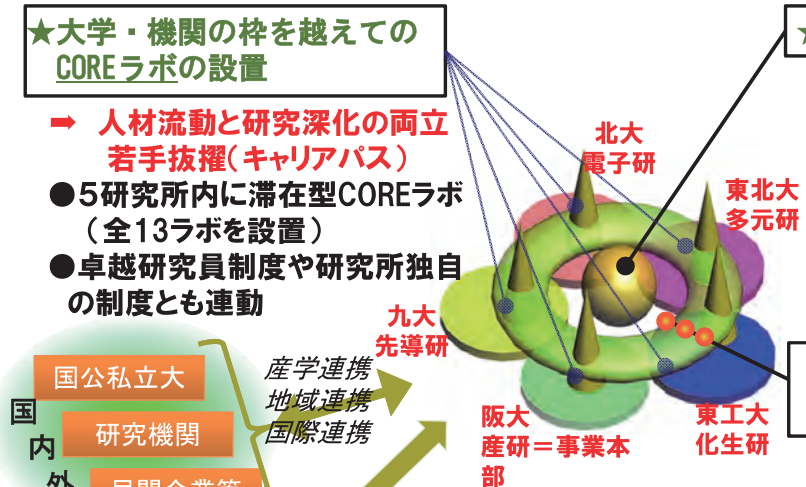
ダイナミック・アライアンス：実施内容

★大学・機関の枠を越えてのCOREラボの設置

➡ 人材流動と研究深化の両立
若手抜擢（キャリアパス）

- ●5研究所内に滞在型COREラボ（全13ラボを設置）
- ●卓越研究員制度や研究所独自の制度とも連動

国内外：国公私立大／研究機関／民間企業等
産学連携／地域連携／国際連携



★コア連携センターの設置

➡ 企画・調整・支援機能

- ●異分野融合促進（横ぐし支援）
- ●分野横断的人材育成支援（若手・技術スタッフ交流支援）
- ●コーディネーター制度（賦眼的研究推進支援）
- ●その他運営企画・支援実務

★5研究所横断的に課題解決型プロジェクト研究

➡ 多様な研究分野間の融合、濃密な共同研究の促進、横串型共同研究の推進

- ✧エレクトロニクス 物質・デバイスG
- ✧環境エネルギー 物質・デバイス・プロセスG
- ✧生命機能 物質・デバイス・システムG

物質・デバイス領域共同研究拠点との連動型プログラム

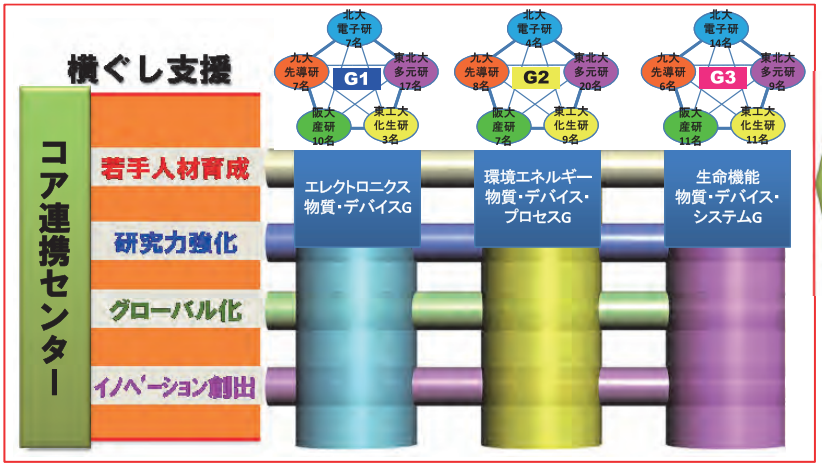
- ●展開共同研究（複数機関のアライアンスメンバーと他機関研究者との共同研究）
- ●次世代若手共同研究（大学院生をPIとしたプログラム）

H28年度成果
・研究論文：709報、・学会発表2,137件（内国際会議：990件）、・各種受賞173件、・プレス記事等：166件など

ダイナミック・アライアンス：プロジェクト研究テーマ

これまでの附置研連携事業の成果を基に、課題解決型の5研究所横断融合共同研究グループ3つを設置し、発展的な異分野融合を視野にした研究展開を図る。これにより、物質・デバイスと人・環境分野間の融合（材料⇔ライフ、物質⇔環境など）を推進するとともに、展開型共同研究（拠点利用者を含めた研究）との連携や、若手研究者交流・特定研究会支援、グループ横断型共同研究推進のための横串型研究グループ設置なども戦略的に行う。

プロジェクト研究テーマ（グループ）
G1：エレクトロニクス　物質・デバイス
G2：環境エネルギー 物質・デバイス・プロセス
G3：生命機能 物質・デバイス・システム



国公私立大・公的研究機関・企業・海外研究者

（グループ研究活動との連携）

展開共同研究チーム

COREラボ研究チーム

次世代若手研究チーム（院生）

ダイナミック・アライアンス：COREラボ

【COREラボ ＝ 平成29年度全13ラボ設置】

- 平成27年度より各拠点（5研）内に先行自助努力として設置した特定共同研究プログラム「COREラボ」を更に拡大展開
- 参加研究者（PI）が共同研究拠点に長期滞在して研究を実施する「滞在型共同研究」
  → 時間・場所・装置・人材の共有：人材流動と研究力強化を両立
- 若手研究者の抜擢による卓越した成果・世界に伍する研究者の輩出（キャリアパス）
- 参加研究者の構成により複数タイプのCOREラボを設置

拠点型COREラボ

公募研究者*PI+5研メンバー
PI:2ヶ月（以上）の滞在
■研究スペース支援
■研究費の支援（雇用経費にも使用可）

アライアンス型COREラボ

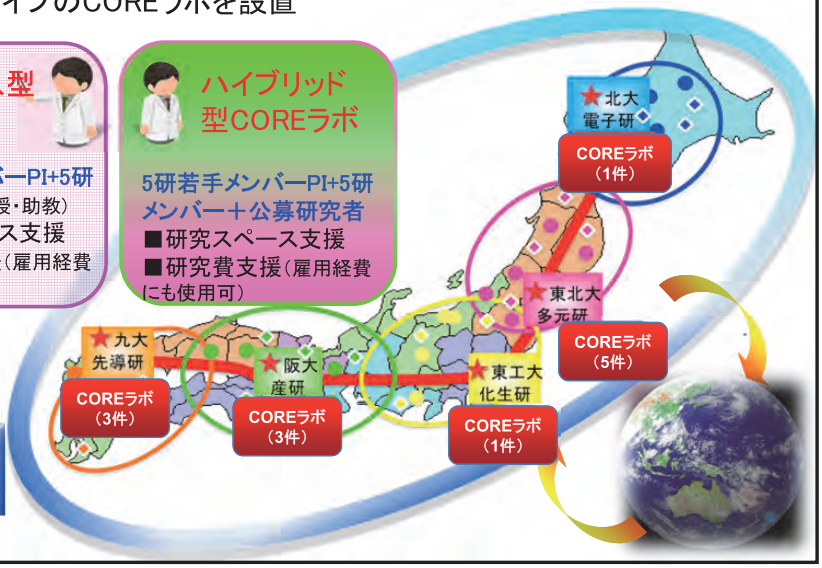
5研若手メンバーPI+5研メンバー（准教授・助教）
■研究スペース支援
■研究費支援（雇用経費にも使用可）

ハイブリッド型COREラボ

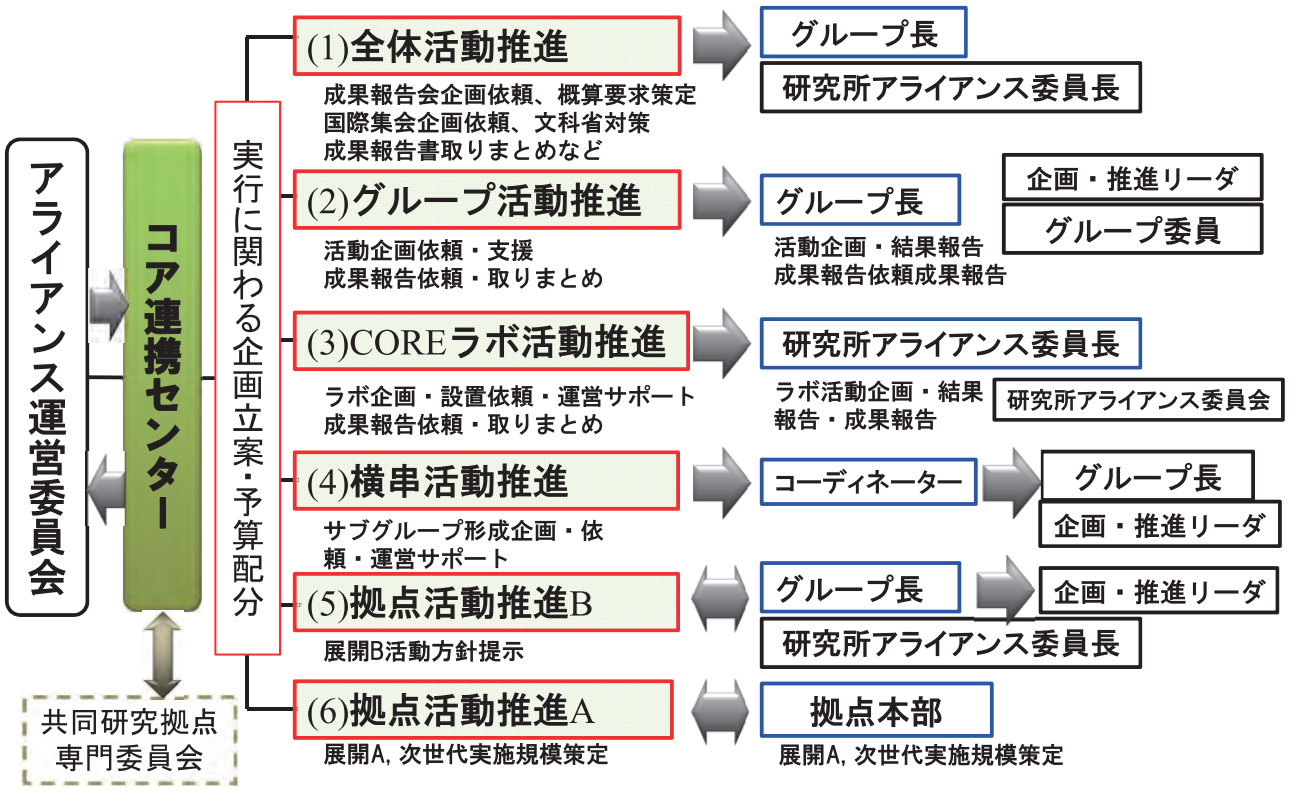
5研若手メンバーPI+5研メンバー＋公募研究者
■研究スペース支援
■研究費支援（雇用経費にも使用可）

＊公募研究者：拠点共同研究に参加実績のある研究者

機関・部局内外の多様な制度とも連動させたCOREラボの設置・運営



ダイナミック・アライアンス：コア連携センターのミッション



物質・デバイス領域共同研究拠点との連動型公募プログラム

■**展開共同研究(B)**：

1(拠点研究者)対 複数(5研)：大型共同研究への展開
：卓越した分野間融合研究を更に進展
：G1～G3アライアンスグループ分科会への参加

■**展開共同研究(A)**：1(拠点研究者)対 1(5研)

：共同研究(B)に繋がる研究
：アライアンスグループ分科会への参加義務無し

■**次世代若手研究**：院生をPIとしたプログラム

：次世代を担うトップレベル研究者育成・研究力醸成
：横串研究会(院生主体の研究会)等への参加

拠点の機能強化：
・第1期拠点事業の成果をさらに発展
・「常に開かれた門戸」を先取りした積極的なプログラム

平成29年度までの各研究の採択実施数　※累積数・(　)内28年度実績

	展開共同研究(A)	展開共同研究(B)	次世代若手共同研究	合計
電子研	20(8)	9(4)	7(2)	36(14)
多元研	64(38)	18(8)	16(7)	98(53)
化生研	25(10)	9(4)	10(4)	44(18)
産研	30(12)	18(8)	13(6)	61(26)
先導研	14(7)	11(4)	7(2)	32(13)
計	153(75)	65(28)	53(21)	271(124)

Dynamic Alliance (Five-star Alliance) Organization Chart

Director of Operations
Kazuhiko NAKATANI

Steering Committee

Chair Tohru SEKINO

Vice-Chair Masato KAKIHANA

RIES Toshiyuki NAKAGAKI、Kuniharu IJIRO

IMRAM Atsushi MURAMATSU

LCLS Munetaka AKITA、Kohtaro OSAKADA

ISIR Kazuhiko NAKATANI

IMCE Jun-ichiro HAYASHI、Shiyoshi YOKOYAMA

CORE Collaboration Center

Director Tohru SEKINO

Vice-Director Masato KAKIHANA

RIES Kuniharu IJIRO、Nobuyuki TAMAOKI

IMRAM Masaru NAKAGAWA

LCLS Kohtaro OSAKADA、Masaaki FUJII

ISIR Tamio OGUCHI、Hidekazu TANAKA

IMCE Shiyoshi YOKOYAMA、Takeshi YANAGIDA

Coordinator Hajime ASAHI

G1 Electronics Materials and Devices

Leader Shiyoshi YOKOYAMA

Planning and Promotion Leader Takeshi YANAGIDA

RIES

Prof. K. SASAKI ※V
Prof. H. OHTA
Assoc. Prof. H. KAIJU
Assoc. Prof. K. KONDO
Prof. T. NAKAMURA
Assoc. Prof. H. FUJIWARA
Assoc. Prof. M. YAMANOUCHI

IMRAM

Prof. T. AKUTAGAWA ※V
Prof. T. J SATO※V(sub)
Prof. K. UEDA
Prof. H. OIKAWA
Prof. H. OHTANI
Prof. H. KASAI
Prof. O. KITAKAMI
Prof. H. KIMURA
Prof. T. KOMEDA
Prof. D. SHINDO
Prof. H. JINNAI
Prof. Y. TAKAKUWA
Prof. M. TAKATA
Prof. S. CHICHIBU
Prof. M. NAKAGAWA
Prof. M. MITSUISHI
Prof. C. YOKOYAMA

LCLS

Prof. A. SHISHIDO ※V
Assoc. Prof. T. IMAOKA
Prof. T. FUKUSHIMA

ISIR

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Prof. Y. ASO
Prof. A. OIWA
Prof. T. OGUCHI
Prof. T. KOZAWA
Prof. H. TANAKA
Assoc. Prof. M. NOGI
Prof. K. MATSUMOTO
Prof. Y. YOSHIDA
Prof. T. WASHIO

IMCE

Prof. H. KIKUCHI ※V
Assoc. Prof. Y. OKUMURA
Assoc. Prof. F. TANI
Prof. K. TAMADA
Assoc. Prof. K. FUJITA
Prof. T. YANAGIDA
Prof. S. YOKOYAMA

※V・Vice-Leader

G2 Environment and Energy
Materials, Devices and Process

Leader Kohtaro OSAKADA

Planning and Promotion Leader Keiji NAGAI

RIES

Prof. A. ISHIBASHI ※V
Assoc. Prof. S. NORO
Assoc. Prof. K. UENO
Prof. H. MISAWA

IMRAM

Prof. S. YIN ※V
Prof. T. ADSCHIRI
Prof. T. OMATA
Prof. J. KANO
Prof. S. KITAMURA
Prof. A. TSAI
Prof. E. SHIBATA
Prof. S. SUZUKI
Prof. H. NOGAMI
Prof. A. MURAMATSU
Prof. H. FUKUYAMA※V(sub)
Prof. K. AMEZAWA
Prof. M. KAKIHANA
Prof. J. KAWAMURA
Prof. T. KYOTANI
Prof. N. SATO
Prof. H. SHIBATA
Prof. M. TERAUCHI
Prof. I. HONMA
Prof. H. YAMANE

LCLS

Prof. T. YAMAGUCHI ※V
Prof. K. OSAKADA
Assoc. Prof. D. TAKEUCHI
Assoc. Prof. K. NAGAI
Prof. K. YAMAMOTO
Prof. M. AKITA
Assoc. Prof. T. KOIZUMI
Lecturer. T. TAMAKI
Assoc. Prof. J. NOMURA KONDO

ISIR

Prof. H. KOBAYASHI※V
Prof. T. SEKINO
Assoc. Prof. S. TANAKA
Prof. T. MAJIMA
Prof. K. SUGANUMA
Prof. S. TAKEDA
Assoc. Prof. Y. HONDA

IMCE

Prof. S. OKADA ※V
Assoc. Prof. K. OKAMOTO
Assoc. Prof. Y. TAKAHASHI
Assoc. Prof. J. MIYAWAKI
Assoc. Prof. M. ITO
Assoc. Prof. K. KOJIO
Prof. J. HAYASHI
Prof. S. YOON

G3 Life Science
Materials, Devices and System

Leader Kuniharu IJIRO

Planning and Promotion Leader Tomomi NEMOTO

RIES

Prof. M. NAGAYAMA ※V
Prof. K. IJIRO
Prof. T. KOMATSUZAKI
Assoc. Prof. Y. SATO
Prof. N. TAMAOKI
Prof. T. NAKAGAKI
Prof. T. NEMOTO
Assoc. Prof. H. AONUMA
Prof. H. UJII
Assoc. Prof. K. SATO
Assoc. Prof. Y. TAKANO
Assoc. Prof. H. TERAMOTO
Prof. Y. NISHINO
Prof. V. P. BIJU

IMRAM

Prof. T. WADA ※V
Prof. K. INABA
Prof. S. TAKAHASHI
Prof. A. HIBARA
Prof. A. MOMOSE
Prof. M. TAKAHASHI※V(sub)
Prof. S. SATO
Prof. F. NAGATSUGI
Prof. S. MIZUKAMI

LCLS

Prof. T. HISABORI ※V
Assoc. Prof. S. IMAMURA
Prof. K. TANAKA
Prof. N. NISHIYAMA
Assoc. Prof. S. FUSE
Assoc. Prof. K. WAKABAYASHI
Assoc. Prof. S. ISHIUCHI
Prof. H. UEDA
Prof. H. NAKAMURA
Prof. M. FUJII
Assoc. Prof. M. YOSHIZAWA

ISIR

Prof. K. NISHINO ※V
Prof. K. KOMATANI
Assoc. Prof. T. SUZUKI
Prof. T. NAGAI
Prof. M. NUMAO
Specially Appointed Prof. A. YAMAGUCHI
Prof. S. KURODA
Prof. H. SASAI
Prof. M. TANIGUCHI
Prof. K. NAKATANI
Assoc. Prof. Y. MAKIHARA

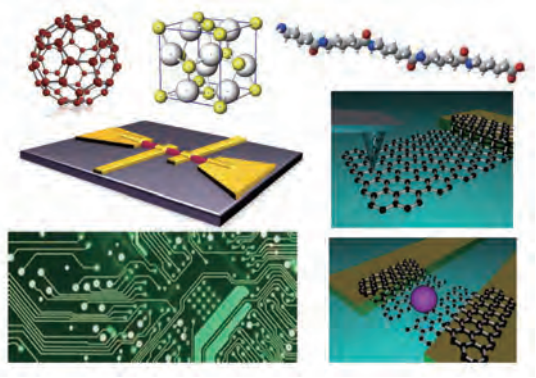
IMCE

Prof. M. TANAKA ※V
Assoc. Prof. A. KANO
Prof. M. SHINDO
Assoc. Prof. H. ISE
Prof. S. KIDOAKI
Prof. A. TAKAHARA

G1 Electronics Materials and Devices Research Project Group

Outline of G1 Research

The object of the "Electronics Materials and Devices" group (G1) is to create and control organic, inorganic, and hybrid materials for the applications of electronics, photonics, and spintronics devices. External control of materials properties and integration technique of the novel devices will be investigated to realize the new functional devices. We aim science and technological contribution to human /environmental harmony.



Main members and their research subjects

<Group Leader>
Prof.
Shiyoshi YOKOYAMA (IMCE)

■Polymer photonics for high performance optical device application

Keywords: Nonlinear optical polymer, Nano photonics, Electro optic

<Planning and Promotion Leader>
Prof.
Takeshi YANAGIDA (IMCE)

■Creation of functional nanowire materials/properties/devices towards next generation electronics

Keywords: Functional Nanodevices, Nanowires, Electronics

<Vice-Leader>
Prof.
Keiji SASAKI (RIES)

■Optical manipulation of nanomaterials and their structures

Keywords: Optical force, Plasmonics, Nano-shaping, Optical vortex

Prof.
Hiromichi OHTA (RIES)

■Photo-electronic-thermal transport properties of conducting oxide films

Keywords: Thermoelectric, Superstructure, oxide electronics

Assoc. Prof.
Hideo KAIJU (RIES)

■Creation of nanostructured spintronic devices

Keywords: Spintronics, Nanostructures, Magnetic materials, AC impedance

Assoc. Prof.
Kenji KONDO (RIES)

■Theoretical study of spin transport and the calculation of electronic structure of low-dimensional electron gas systems

Keywords: Condensed matter theory, Spintronics, Semiconductor device engineering, First principle electronic structure calculation

Prof.
Takayoshi NAKAMURA (RIES)

■Development of novel electronic materials based on molecular rotators

Keywords: Molecular rotator, Supramolecules, Ferroelectrics, Multiferroics

Assoc. Prof.
Hideki FUJIWARA (RIES)

■Study on the application of resonance-controlled random structures

Keywords: Micro-nano cavity structures, Micro-nano lasers, Microspectroscopic imaging

Assoc. Prof.
Michihiko YAMANOUCHI (RIES)

■Study on oxide spintronics devices

Keywords: Pulsed laser deposition, Spintronics, Oxide halfmetal

<Vice-Leader>
Prof.
Tomoyuki AKUTAGAWA (IMRAM)

■Fabrication of new molecular devices with charge-transfer interactions

Keywords: Molecular crystal, Charge transfer, Ferroelectricity

<Vice-Leader(sub)>
Prof.
Taku J SATO (IMRAM)

■Spin dynamics in condensed matter by neutron inelastic scattering

Keywords: Neutron inelastic scattering, Unconventional superconductor, Quantum spin systems

Prof.
Kiyoshi UEDA (IMRAM)

■Analysis and control of electron and molecular dynamics

Keywords: X-ray free electron laser, Molecular movie, Multi-dimensional spectroscopy

Prof.
Hidetoshi OIKAWA (IMRAM)

■Creation of organic hybridized nanocrystals for optically functional materials

Keywords: Organic hybridized nanocrystal, Photonic material, Reprecipitation method

Prof.
Hiroshi OHTANI (IMRAM)

■Study on materials design based on the evolutionary algorithm

Keywords: First-principles calculations, CALPHAD, Evolutionary algorithm

Prof.
Hitoshi KASAI (IMRAM)

■Fabrication of The Novel Nanodrugs Composed of Poorly Water-Soluble Compounds

Keywords: Nano Drugs, Organic Nanoparticles, Anti-cancer Drugs

Prof.
Osamu KITAKAMI (IMRAM)

■Study on single nanomagnet for development of future memory devices

Keywords: Magnetism, Spin dynamics, Nanomagnet

Prof.
Hiroyuki KIMURA (IMRAM)

■Structural physics on novel condensed matter by complimentary use of SOR-X-ray- Neutron structure analysis

Keywords: SOR- X-ray- Neutron diffraction, Accurate magnetic and crystal structure analysis, Magnetoelectric oxides, Organic ferroelectric and magnetic materials

Prof.
Tadahiro KOMEDA (IMRAM)

■Development of single molecule devices with spin degree of freedom

Keywords: Molecule electronic, Molecular spintronics, Scanning tunneling probes

Prof.
Daisuke SHINDO (IMRAM)

■Multidisciplinary research of microstructure, electromagnetic field and conductivity by advanced electron microscopy

Keywords: Electron holography, Lorentz microscopy, Microprobes

Prof.
Hiroshi JINNAI (IMRAM)

■"In-situ" 3D observations of selfassembling processes soft materials with advanced electron tomography

Keywords: Electron tomography, In-situ visualization, Self-assembling processes, Soft materials

Prof.
Yuji TAKAKUWA (IMRAM)

■Synthesis of functional materials and development of nanoprocesses

Keywords: Surface physics, Material science, Process engineering, Development of surface analysis methods

Prof.
Masaki TAKATA (IMRAM)

■Development of materials visualization photon science

Keywords: Synchrotron radiation, X-ray diffraction, Maximum entropy method, Charge density study

Prof.
Shigefusa CHICHIBU (IMRAM)

■Light-matter coupling and ultrafast spectroscopy in semiconductor nanostructures

Keywords: Femtosecond electron beam, Nitide semiconductors, Oxide semiconductors

Prof.
Masaru NAKAGAWA (IMRAM)

■Process/Material Science and Device Innovation in Nanoimprint Technology

Keywords: Print & imprint method, Lithography, Laser processing

Prof.
Masaya MITSUISHI (IMRAM)

■Hybrid polymer nanoassemblies for optoelectronic applications

Keywords: Polymer nanoassembly, Hybrid polymers, Optoelectronics

Prof.
Chiaki YOKOYAMA (IMRAM)

■Development of environmentally conscious materials using ionic liquids

Keywords: Ionic liquid, Supercritical fluid, Gallium nitride

<Vice-Leader>
Prof.
Atsushi SHISHIDO (LCLS)

■Development of functional soft materials and its application to optoelectronics

Keywords: Soft material, Liquid crystal, Photonics, Polymer

<Vice-Leader>
Assoc. Prof.
Takane IMAOKA (LCLS)

■Functionality programming of metal clusters based on an exact atomicity control

Keywords: Nanoparticles, Clusters, Catalysis, Photoluminescence

Prof.
Takanori FUKUSHIMA (LCLS)

■Development of new soft materials using strategically designed π-electronic systems

Keywords: π-Electronic Materials, Self-assembly, Soft materials, Organic electronics

Prof.
Tsuyoshi SEKITANI (ISIR)

■Flexible integrated circuits for large-area sensor applications

Keywords: Social devices, Flexible transistors, Integrated circuits, Large-area sensors

Prof.
Yoshio ASO (ISIR)

■Development of organic semiconductors for high performance electronics

Keywords: Conjugated compounds, Molecular wires, Organic and molecular devices

<Vice-Leader>
Prof.
Akira OIWA (ISIR)

■Research on novel quantum hybrid devices based on spins and photo

Keywords: Low-dimensional semiconductor physics, Quantum information processing, Quantum hybrid system, Spintronics

Prof.
Tamio OGUCHI (ISIR)

■First-principles prediction of properties for materials design

Keywords: First-principles calculations, Transition metal systems, Surfaces and interfaces, Materials informatics

Prof.
Takahiro KOZAWA (ISIR)

■Development of lithography process and materials for semiconductor devices

Keywords: Quantum beam, Lithography, Biomaterials, Pulse radiolysis

Prof.
Hidekazu TANAKA (ISIR)

■Development of 3 dimensional oxide nano-structured electronics

Keywords: Nanostructures, Functional Oxide, Nano/Spin-electronics

Prof.
Masaya NOGI (ISIR)

■Nanocellulose materials for flexible electronics

Keywords: Nanocellulose, Transparent nanopaper, Flexible substrate

Prof.
Kazuhiko MATSUMOTO (ISIR)

■Nano carbon devices & applications

Keywords: Nanocarbon, Quantum memory, Bio Sensor

Prof.
Yoichi YOSHIDA (ISIR)

■Research of the radiation induced chemical reactions by using the atto-second electron beam

Keywords: Atto-second electron beam, Atto-second pulse radiolysis, Radiation chemistry

Prof.
Takashi WASHIO (ISIR)

■Machine Learning for Advanced Nano-electronics Devices

Keywords: Machine Learning, Advanced Sensing, Statistical Estimation

<Vice-Leader>
Prof.
Hirotsugu KIKUCHI (IMCE)

■Three dimensional lattice structure and Kerr effect of liquid crystal blue phases

Keywords: Liquid crystal blue phase, Electro-optic Kerr effect, Soft matter

Assoc. Prof.
Yasushi OKUMURA (IMCE)

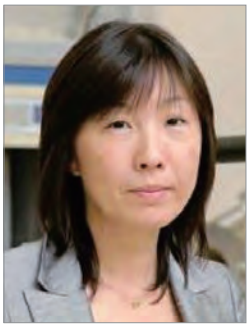
■Dynamics of dissipative system with asymmetric interaction

Keywords: Soft matter, Liquid crystal, Nanoparticle

Assoc. Prof.
Fumito TANI (IMCE)

■Development of functional organic compounds based on unique pi-electron structures

Keywords: Organic pi-compounds
NIR-dye
Redox
Semiconductivity



Prof.
Kaoru TAMADA (IMCE)

■Innovative nanobio detection with plasmon nanoantenna

Keywords: Plasmonics, Nanomaterials, Bioimaging

Assoc. Prof.
Katsuhiko FUJITA (IMCE)

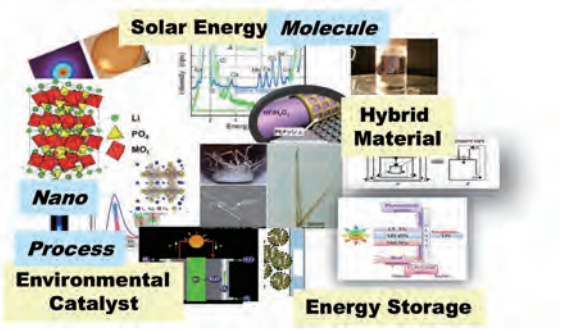
■Development of fabrication process and materials for organic electronic devices

Keywords: Organic electronics, Organic photovoltaic cells, OLED

G2 Environment and Energy Materials, Devices and Process Research Project Group

Outline of G2 Research

The activity of the "Environment and Energy Materials, Devices and Process" group (G2) covers promotion of the studies to design environmental catalysts for industry, to realize ecological processing for a low carbon society, and to create new hybrid substances for environmental and energy issues. The studies will contribute to make new environmentally benign materials and devices as well as ubiquitous system integration.



Main members and their research subjects

<Group Leader>
Prof.
Kohtaro OSAKADA (LCLS)

■Structure and Properties of Organometallic Middle-Molecule Compounds

Keywords: Silane, Organometallics, Oligomer, Optical properties

<Planning and Promotion Leader>
Assoc. Prof.
Keiji NAGAI (LCLS)

■Photoenergy conversion materials -Organophotocatalyst & Quantum beam source-

Keywords: Photocatalyst, Photo-energy conversion, Water purification

<Vice-Leader>
Prof.
Akira ISHIBASHI (RIES)

■High efficiency solar cells and clean systems

Keywords: Solar cell, High efficiency, Clean system

Assoc. Prof.
Kosei UENO (RIES)

■Control of light and matter using dark plasmon modes induced by metal/insulator/metal nanostructures

Metallic nanostructures, Dark plasmon, Optical force

Assoc. Prof.
Shin-ichiro NORO (RIES)

■Synthesis and high functionalization of porous metal complexes

Keywords: Porous metal complexes, Porous properties, Gas separation/ purification, Composites

Prof.
Hiroaki MISAWA (RIES)

■Development of artificial photosynthesis systems using plasmonic antennae

Keywords: Localized plasmon, Nanomaterials, Plasmonic chemistry

<Vice-Leader>

Prof.

Shu YIN (IMRAM)

■Creation of multi-functional environmental responsive nanomaterials

Keywords : Multi-functional, Environmental response, Eco-materials

<Vice-Leader(sub)>

Prof.

Hiroyuki FUKUYAMA (IMRAM)

■High-temperature physical chemistry of materials

Keywords : Chemical thermodynamics, Thermophysical properties of high-temperature melts, Crystal growth

Prof.

Tadafumi ADSCHIRI (IMRAM)

■Supercritical hydrothermal synthesis of organic-inorganic hybrid nanoparticles

Keywords : Supercritical fluid, Organic inorganic hybrid materials, Nanoparticles

Prof.

Koji AMEZAWA (IMRAM)

■Development of environmentally-friendly energy conversion devices based on solid state ionics

Keywords : Solid state ionics, Energy conversion, Fuel cells Batteries

Prof.

Takahisa OMATA (IMRAM)

■Development of inorganic energy conversion materials using ion-exchange

Keywords : Material Design, Topotactic Ion-Exchange, Proton Conductor, Solar Cell Absorber

Prof.

Masato KAKIHANA (IMRAM)

■Construction of high-performance photoceramics

Keywords : Photocatalyst, Phosphor, Exploration of new materials

Prof.

Junya KANO (IMRAM)

■Novel powder processing for renewable energy and its efficiency improvement

Keywords : Biomass, Mechanochemical processing, DEM simulation

Prof.

Junichi KAWAMURA (IMRAM)

■Measurement of ion dynamics by NMR and laser spectroscopy for the application to energy storage materials

Keywords : Lithium ion battery, NMR imaging, In-situ spectroscopy, Solid state ionics

Prof.

Shin-ya KITAMURA (IMRAM)

■Study on valorization of steelmaking slag as ecofriendly material

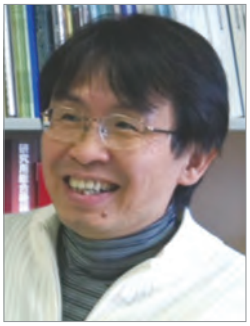
Keywords : Steelmaking slag, Fertilizer, Leaching, Recycle

Prof.

Takashi KYOTANI (IMRAM)

■Synthesis and design of novel nanocarbon materials and their nanohybrids

Keywords : Energy storage media, Bio-application of nanocarbons, Graphene



Prof.
An-Pang TSAI (IMRAM)

■Studies on formation of quasicrystal and catalysts in terms of metallurgy

Keywords: Quasicrystal, Intermetallic compound, Electron compound, Catalysts

Prof.
Nobuaki SATO (IMRAM)

■Development of dry and wet processes for rare metal resources containing radioactive materials

Keywords: Rare metal resources, Radioactive materials, Material processing

Prof.
Etsuro SHIBATA (IMRAM)

■Establishment of metal resource circulation engineering

Keywords: Non-ferrous metallurgy, Recycling, Waste treatment

Prof.
Hiroyuki SHIBATA (IMRAM)

■Thermal properties of molten silicates and solution growth of SiC

Keywords: Thermal property, Molten silicates, Silicon carbide, Solution growth

Prof.
Shigeru SUZUKI (IMRAM)

■Characterization and control of functional base-metal oxides and alloys

Keywords: Functional materials, Iron based oxides, Iron based alloys

Prof.
Masami TERAUCHI (IMRAM)

■Electron crystallography & spectroscopy based on electron microscopy

Keywords: Convergent-beam electron diffraction, Electron energy-loss spectroscopy, Soft-X-ray emission spectroscopy

Prof.
Hiroshi NOGAMI (IMRAM)

■Development of novel material processing through kinetic based reaction analysis

Keywords: Process analysis, Thermal fluid analysis, Reaction kinetics

Prof.
Itaru HONMA (IMRAM)

■Advanced nanotechnologies for energy conversion devices

Keywords: Lithium ion batteries, Supercapacitor, Solar cells/Fuel cells, Nanomaterials/Nanoprocessing

Prof.
Atsushi MURAMATSU (IMRAM)

■Synthesis processing of nanoparticulate functional materials in liquid-phase

Keywords: Nanoparticles, Synthesis process, Hybrid materials

Prof.
Hisanori YAMANE (IMRAM)

■Synthesis and crystal structure analysis of new ceramic materials

Keywords: Multinary nitrides and oxides, X-ray diffraction, Flux growth

<Vice-Leader>
Prof.
Takeo YAMAGUCHI (LCLS)

■Design and deve;opment for fuel cell materials and devices

Keywords : Electrolyte membrane, Catalysts, Polymer electrolyte fuel cell, Solid alkaline fuel cell

Prof.
Munetaka AKITA (LCLS)

■Visible light-driven organic synthesis by photoredox catalysis

Keywords : Visible light, Photoredox catalysis, Organic synthesis

Assoc. Prof.
Take-aki KOIZUMI (LCLS)

■Development of transition metal complexes bearing functional ligands

Keywords : Transition metal complexes, Low Environmental load type reaction, Dynamic behavior

Assoc. Prof.
Daisuke TAKEUCHI (LCLS)

■Synthesis of Polyolefins with Polar Functional Groups

Keywords : Polyolefins, Late Transition Metal Catalysts, Controlled Polymerization

Lecturer
Takanori TAMAKI (LCLS)

■Development of High-Performance Enzymatic Biofuel Cells

Keywords : Bioelectrochemistry, Enzyme, Systematic material design

Assoc. Prof.
Junko NOMURA KONDO (LCLS)

■Preparation of mesoporous metal oxides and IR characterization of solid calayst surfaces

Keywords : Porous material, Metal oxide, IR, Catalyst

Prof.
Kimihisa YAMAMOTO (LCLS)

■Development of Subnano Hybrid Materials

Keywords : Subnano Particles, Dendrimer, Hybrid Materials

Prof.
Hikaru KOBAYASHI (ISIR)

■New chemical methods to fabricate highly efficient Si solar cells, and fabrication and application of Si nanopowder

Keywords : silicon, surface control, hydrogen generation, Li ion battery

<Vice-Leader>
Prof.
Katsuaki SUGANUMA (ISIR)

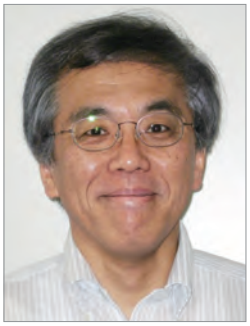
■Wearable stretchable and WBG power intrconnections

Keywords : Printed electronics, Stretchable wiring, WBG Power interconnection

Prof.
Tohru SEKINO (ISIR)

■Creation of multifunctional materials via low-dimensional nano-macro structure controls

Keywords : Nanocomposite, Low-dimentional nanomaterials, Functional Structure Ceramics



Prof.

Seiji TAKEDA (ISIR)

■Operando study of nanoparticulate catalysts

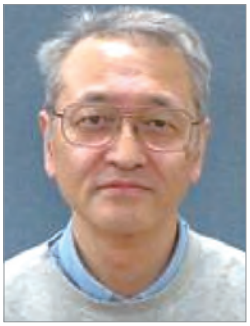
Keywords : CO oxidation, Environmental transmission electron microscopy, Gold

Assoc. Prof.

Shin-ichiro TANAKA (ISIR)

■Electron dynamics in the solid and on the solid surface by means of the electon spectscopies

Keywords : Electron dynamics in the condensed matter, High-resolution angle-resolved photoelectron spectroscopy, Time-resolved two-photon photoelectron spectroscopy



Assoc. Prof.

Yoshihide HONDA (ISIR)

■Development of diagnost ic methods for materials based on radiation-related technology

Keywords : Polymer, Clay, Positron, Electron beam

Prof.

Tetsuro MAJIMA (ISIR)

■Beam-induced Chemistry

Keywords : Photochemistry of supra-molecules, Metal nanoparticles and metal, oxides photocatalysts, Single molecule chemistry, Radiation chemistry

<Vice-Leader>

Prof.

Shigeto OKADA (IMCE)

■Development of post lithium-ion batteries

Keywords : Sodium-ion battery, Cathode active material, Intercalation, Conversion reaction

Assoc. Prof.

Masato ITO (IMCE)

■Molecular design for energy saving

Keywords : Electrode active material, Gas barrier material, Molecular catalyst

Assoc. Prof.

Koichi OKAMOTO (IMCE)

■Applications of plasmonics for green nanotechnologies

Keywords : Plasmonics, LED, Solar cell

Assoc. Prof.

Ken KOJIO (IMCE)

■Development of solid polymer electrolytes based on oligocarbonate for lithium ion battery

Keywords : Polymer electrolyte, Oligocarbonate, Lithium ion battery

Assoc. Prof.

Yoshiaki TAKAHASHI (IMCE)

■Hierarchical structure and physical properties of polymers

Keywords : Natural polymers, Ionic liquids, Rheology

Prof.

Jun-ichiro HAYASHI (IMCE)

■Energy/material-efficient conversion of fossils and biomass to fuels/chemicals/materials

Keywords : Reactor/process design, Chemical kinetics, Thermal/catalytic reactions

Assoc. Prof.

Jin MIYAWAKI (IMCE)

■Design and development of high-performance porous adsorbent materials

Keywords : Porous materials, Adsorption, Heat pump

Prof.

Seong-Ho YOON (IMCE)

■Development of Polypyrrole nano-particle supported PCNF and its application to DMFC as non-Pt catalyst

Keywords : Fuel Cell
Polypyrrole nano-particle
Carbon nanofiber

G3 Life Science Materials, Devices and System Research Project Group

Outline of G3 Research

The objective of the "Life Science Materials, Devices and System" group(G3) is to create cutting-edge technologies for the elucidation of biological functions by advanced optical imaging, molecular structural analyses, and utilizing mathematical and information sciences. By the harmonized developments in information of both biomolecules and biological functions and the synthesis of molecules, we provide novel functional materials and devices that contribute to life-innovation in the 21st century.

Main members and their research subjects

<Group Leader>
Prof.
Kuniharu IJIRO (RIES)

■Development of biomimetic nanofabrication method using molecular self-assembly

Keywords: Biomimetics, Nanomaterial, Self-assembly

<Planning and Promotion Leader>
Prof.
Tomomi NEMOTO (RIES)

■Cutting-edge optical imaging and cell physiology of neural and secretory activities

Keywords: Two-photon microscopy, Super-resolution microscopy, Molecular and cellular physiology

<Vice-Leader>
Prof.
Masaharu NAGAYAMA (RIES)

■Understanding of nonlinear phenomena using mathematical modeling

Keywords: Mathematical modeling, Reaction-diffusion system, Numerical simulation

Assoc. Prof.
Hitoshi AONUMA (RIES)

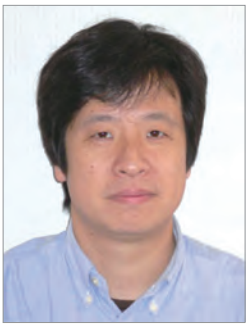
■Understanding real time adaptability of animal behavior

Keywords: Neurobiology, Synthetic neuroethology, Neuro-robotics

Prof.
Hiroshi UJI-I (RIES)

■Investigations of heterogeneous dynamics at mesoscopic scale using super-resolution fluorescence (single molecule) and Raman microscopy, particularly, biological issues.

Keywords: Single molecule, Heterogeneous dynamics, Nanoscopy



Prof.
Tamiki KOMATSUZAKI (RIES)

■Developments of data-driven mathematics and concepts in single molecule biology

Keywords: Single molecule biology, Multiscale dynamics in complex systems, Molecular data science

Assoc. Prof.
Katsuhiko SATO (RIES)

■Role of mechanical forces in complex phenomena in biological systems

Keywords : Mechanical models, Morphogenesis, Rheology

Assoc. Prof.
Yuzuru SATO (RIES)

■Random dynamical systems approaches to nonlinear complex phenomena

Keywords : Complex systems, Chaos, Random dynamical systems, Time series analysis

Assoc. Prof.
Yuta TAKANO (RIES)

■Development of photofunctional molecular tools for understanding and controlling biological functions

Keywords : Photoinduced electron transfer, Luminescence sensor, Phototherapy, Carbon nanomaterials

Prof.
Nobuyuki TAMAOKI (RIES)

■Synthesis of light-driven molecular machines

Keywords : Motor protein, Photochromic compound, Liquid crystal

Assoc. Prof.
Hiroshi TERAMOTO (RIES)

■Applications of dynamical system theory and singularity theory to material sciences

Keywords : Reaction coordinates switching, Dynamical systems theory, Singularity theory, Band/electron energy level crossing

Prof.
Toshiyuki NAKAGAKI (RIES)

■Ethology of single celled organism viewed from physical equation of motion

Keywords : Mathematical modeling, Protozoa, Nonlinear dynamics, Biomechanics

Prof.
Yoshinori NISHINO (RIES)

■Deep Nano-Imaging using synchrotron radiation and X-ray free-electron lasers

Keywords : Phase imaging, Controlled environment imaging, Coherent X-rays

Prof.
Vasudevan P. BIJU (RIES)

■Photonic molecules and nanomaterials for single-molecule detections, bio–imaging, and optical displays

Keywords : Photonic molecules, Single molecule fluorescence, Fluorescence sensors

<Vice-Leader>
Prof.
Takehiko WADA (IMRAM)

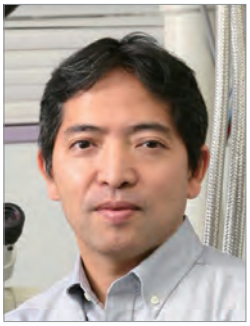
■Novel strategy for ischemia cell specific oligonucleotide therapeutics with intracellular environmental condition responsible artificial nucleic acid

Keywords : Oligonucleotide therapeutics, Active Control

<Vice-Leader(sub)>
Prof.
Masahiko TAKAHASHI (IMRAM)

■Towards investigation of the origins of molecular functions by developing methods to visualize electron motion in matter

Keywords : Electron Compton scattering, Electron momentum spectroscopy, Momentum space wave function



Prof.
Kenji INABA (IMRAM)

■Structural and mechanistic basis of cellular systems involved in protein quality control

Keywords : Protein quality control, Redox, Molecular chaperone, X-ray crystal structure analysis

Prof.
Shunichi SATO (IMRAM)

■Laser application for material science

Keywords : Photonics, Vector beam, Intense laser

Prof.
Satoshi TAKAHASHI (IMRAM)

■Dynamics of protein folding and function based on single molecule fluorescence spectroscopy

Keywords : Dynamics, Protein folding, Single Molecule Spectroscopy

Prof.
Fumi NAGATSUGI (IMRAM)

■Development of the functional molecules for regulation of gene expression

Keywords : Antisense, Reactive oligonucleotide, miRNA

Prof.
Akihide HIBARA (IMRAM)

■Nano-microfluidic analytical devices and microscopy

Keywords : Nanoflluidics, Microfluidics, Light scattering, Liquid ingterfaces

Prof.
Shin MIZUKAMI (IMRAM)

■Development of bioanalytical technology based on functional molecular probe design

Keywords : Bioimaging probes, Chemical biology, Photofunctional molecules

Prof.
Atsushi MOMOSE (IMRAM)

■Visualization of biomedical materials with X-ray phase imaging

Keywords : X-ray, Phase contrast, Tomography

<Vice-Leader>
Prof.
Toru HISABORI (LCLS)

■Functional Analysis of Redox-Regulated Biological Systems

Keywords : Photosynthesis, Redox regulation, Bioenergetics, ATP synthase

Assoc. Prof.
Shun-ichi ISHIUCHI (LCLS)

■Elucidation of molecular recognition mechanism by bottom-up approach

Keywords : Molecular Recognition, Laser Spectroscopy, Mass spectrometry

Assoc. Prof.
Sousuke IMAMURA (LCLS)

■Biofuel production using microalgae

Keywords : Biofuel production, Microalga, Nitrogen signaling

(LCLS)Prof.

Hiroshi UEDA (LCLS)

■Developing novel diagnostic systems by protein modification and split reactions

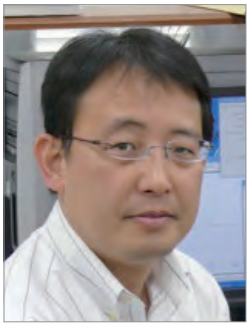
Keywords: Fluorescence Quenching, Luciferase, Protein-Protein Interaction

Prof.

Kan TANAKA (LCLS)

■Development of tetrapyrrole sensory devices toward the control of cell processes

Keywords: Tetrapyrrole, Organelle, Cell proliferation



Prof.

Hiroyuki NAKAMURA (LCLS)

■Control of Biofunctions Using Photosensitizing Molecules and Application to Medicinal Chemsitry

Keywords: Protein modification, Photosensitizer, Anticancer drug design

Prof.

Nobuhiro NISHIYAMA (LCLS)

■Development of smart diagnostic and therapeutic systems based on synthetic functional polymers

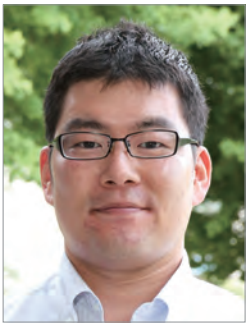
Keywords: DDS, Nanomedicine, Functional polymer, Imaging

Prof.

Masaaki FUJII (LCLS)

■Functional Analysis of Molecular Building Blocks by Advanced Laser Spectroscopy

Keywords: Molecular Recognition, Laser Spectroscopy, Intermolecular Interaction



Assoc. Prof.

Shinichiro FUSE (LCLS)

■Natural product science based on micro-flow synthesis

Keywords: Micro-flow, Natural product, Medicinal Chemistry

Assoc. Prof.

Michito YOSHIZAWA (LCLS)

■Functional molecular capsules with polyaromatic panels

Keywords: Assembly, Capsule, Polyaromatic, Recognition

Assoc. Prof.

Ken-ichi WAKABAYASHI (LCLS)

■Photomovement in the green algae: from photoreception to flagellar regulation

Keywords: Chlamydomonas, Volvox, Flagella, Channelrhopsin

<Vice-Leader>

Prof.

Kunihiko NISHINO (ISIR)

■Development of new strategies to tackle infectious diseases

Keywords: Multidrug resistance, Antimicrobial chemotherapy, Systems biology

Prof.

Shun'ichi KURODA (ISIR)

■Development of In Vivo Pinpoint Drug Delivery System Inspired by the Viral Infection Machinery

Keywords: Virus, Nanocarrier, DDS

Prof.
Kazunori KOMATANI (ISIR)

■Robot dialogue system based on speech information processing technology

Keywords: Speech recognition, Dialogue system, Humanoid robot, Ontology

Prof.
Hiroaki SASAI (ISIR)

■Development of Novel Enantioselective Reactions

Keywords: Multi-functional Catalyst, Enantioselective Catalyst, Domino Reaction, Helicenes

Assoc. Prof.
Takeyuki SUZUKI (ISIR)

■Development of environmentally benign oxidation for the catalytic asymmetric synthesis

Keywords: Iridium catalyst, Hydrogen transfer, Oxidation

Prof.
Masateru TANIGUCHI (ISIR)

■Development of bio-nanodevices using single-molecule analysis

Keywords: Single Molecular Science, Single Molecule Analysis, Biomolecules

Prof.
Takeharu NAGAI (ISIR)

■Development and application of fluorescent and chemiluminescent protein for bioscience research

Keywords: Fluorescent protein, Chemiluminescent protein Bioimaging

Prof.
Kazuhiko NAKATANI (ISIR)

■Studies on interaction of small molecules to nucleic acids

Keywords: Micro RNA, Riboswitch, Regulation of gene expression

Prof.
Masayuki NUMAO (ISIR)

■Artificial intelligence and visualization for the diagnosis of fuel cells and rechargeable batteries

Keywords: Machine learning, Acoustic emission, Fuel cell

Assoc. Prof.
Yasushi MAKIHARA (ISIR)

■iNPH diagnosis support based on gait image analysis

Keywords: Gait, Computer vision, iNPH

Specially Appointed Prof.
Akihito YAMAGUCHI (ISIR)

■Studies on the structural basis of bacterial multidrug efflux transport

Keywords: Multidrug efflux, Multidrug resistance, X-ray crystallography

<Vice-Leader>
Prof.
Masaru TANAKA (IMCE)

■Design of biocompatible soft-biomaterials for medical devices

Keywords: Biocompatibility, Cell adhesion, Bio-interfaces, Water structure

Assoc. Prof.
Hirohiko ISE (IMCE)

■Development of medical devices using carbohydrate-bearing polymers

Keywords: Carbohydrates, Biomaterials, Cell biology

Assoc. Prof.
Arihiro KANO (IMCE)

■New strategy for cancer treatment based on the metabolic abnormalities

Keywords: Cancer, Glycolysis, Warburg Effect

Prof.
Satoru KIDOAKI (IMCE)

■Development of mechanobio-materials for cell manipulation

Keywords: Mechanobio-materials, Cell machanotaxis, Microelasticity patterning

Prof.
Mitsuru SHINDO (IMCE)

■Design and synthesis of useful organic molecules for life science

Keywords: Organic synthesis, Chemical biology, Bioactive compounds

Prof.
Atsushi TAKAHARA (IMCE)

■Precise structure control of soft interfaces for biomedical applications

Keywords: Soft Interfaces, Biointerface, Soft material

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