

ANNUAL RESEARCH REPORT

Vol. 2
April 2025 - March 2026

研究成果報告書

第2巻
令和7年4月—令和8年3月



RESEARCH INSTITUTE FOR SEMICONDUCTOR
ENGINEERING

HIROSHIMA UNIVERSITY

広島大学 半導体産業技術研究所

Preface

In 2024, the Institute was reorganized as the Research Institute for Semiconductor Engineering (RISE). The Institute now consists of the Semiconductor Strategy Research Division, Nanodevice Research Division, Interdisciplinary Research Division, and the Research Support and Facilities Operations Office. Under this new structure, the Institute develops its own semiconductor research strategies and conducts research activities based on those strategies.

RISE traces its origins to the Research Center for Integrated Systems, established in 1986 by a Ministry of Education ordinance, and has continuously engaged in semiconductor research for nearly 40 years. At a time when the importance of the semiconductor industry is once again being recognized, the Institute is expanding its focus to encompass the entire semiconductor value chain, from upstream components, materials, and utilities to semiconductor device and integrated circuit design and manufacturing processes, as well as downstream applications such as communications and artificial intelligence. Taking this reorganization as an opportunity, the Institute is expanding its scale and strengthening its efforts in both semiconductor research and human resource development. In fiscal 2024, a comprehensive renovation of the cleanroom facilities was carried out through a MEXT program. Furthermore, under the J-PEAKS: Program for Promoting the Enhancement of Regional Core and Distinctive Research Universities, the Institute has been upgrading its prototyping and evaluation equipment over a three-year period beginning in 2024.

The Institute also serves as a core member of the Biomedical Engineering Research Center, a MEXT-designated Joint Usage/Research Center. Through a distinctive network of collaborating institutions—the Institute of Biomaterials and Bioengineering and the Institute of Innovative Research at Institute of Science Tokyo, the Research Institute of Electronics at Shizuoka University, and the Research Institute for the Semiconductor Engineering (RISE) at Hiroshima University—the Center integrates the functions and expertise of the participating organizations to advance collaborative research in biomedical engineering. Its mission is to promote the practical application of biomaterials, medical devices, and healthcare systems in Japan.

The Advanced Research Infrastructure for Materials and Nanotechnology in Japan (ARIM) is a ten-year initiative that began in 2021. In addition to providing shared access to state-of-the-art equipment and technical support from highly skilled specialists, the program introduces advanced facilities equipped with remote, automated, and high-throughput capabilities. It also aims to structure and provide material data generated through equipment use in a form that is easily accessible and reusable. Leveraging the Institute's 830 m² super-cleanroom facility, research and support activities focus not only on silicon but also on energy-conversion materials, including

wide-bandgap semiconductors such as SiC and GaN. In 2024, the Institute was selected as a member of the Semiconductor Platform, further strengthening support for semiconductor integrated circuit prototyping. Through these initiatives, the Institute will continue to develop systems for the collection, accumulation, distribution, and utilization of high-quality materials data.

Under MEXT's Next-Generation X-nics Semiconductor Research and Development Hub Program, which commenced in 2022, Hiroshima University was selected, together with Institute of Science Tokyo and Toyohashi University of Technology, to form the Integrated Green-niX Research and Human Resource Development Hub. Over the course of this ten-year project, the Institute contributes to both research and education with a strong emphasis on sustainability and "green" innovation.

In March 2023, the Institute took the lead in establishing the Setouchi Semiconductor Consortium. The Consortium was founded to promote industry-government-academia collaboration in semiconductor-related research, development, and human resource development. By June 2026, membership had expanded to 35 companies, creating a broader network of 41 participating organizations, including AIST, Hiroshima Prefecture, Higashi-Hiroshima City, Kobe University, Okayama University, and Hiroshima University. Together, these organizations continue to advance R&D and workforce development activities.

The Annual Research Report is published to highlight the research activities and accomplishments of the Research Institute for the Semiconductor Engineering (RISE) over the past year and to share the latest developments with researchers, educators, and professionals engaged in advanced science and technology. We hope that this report will continue to promote academic exchange and collaboration in this field and contribute to further advancements in semiconductor research and education.

July 1, 2026



Akinobu Teramoto

Director

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巻頭言

研究所は2024年度に半導体産業技術研究所として改組しました。これにより、「半導体戦略研究部門」、「ナノデバイス研究部門」、「異分野融合研究部門」及び「研究支援・設備運営室」で構成されます。研究所自ら半導体研究戦略を策定し、それに基づいて研究を実施していく体制です。

半導体産業技術研究所は1986年文科省令により設立された集積化システム研究センターを前身として、半導体研究を40年間に渡り続けてまいりました。半導体産業の重要性が再び見直されている現在、半導体産業全体に目を向け、産業上流の部品・材料・ユーティリティ、半導体デバイス・集積回路の設計・製造プロセス、下流産業である通信やAI等のアプリケーションの研究・開発を行っていきます。改組をきっかけに、研究所を拡大し、半導体研究と人材育成に取り組んでいます。2024年度には、文部科学省「地域中核・特色ある研究大学の連携による産学官連携・共同研究の施設整備事業」により、クリーンルームの全面改修を実施しました。さらに、「J-PEAKS：地域中核・特色ある研究大学強化促進事業」において、2024年から3年かけて研究所に設置された試作装置、評価装置を更新しています。

本研究所は、文部科学省共同利用・共同研究拠点としての「生体医歯工学研究拠点」生体医歯工学研究拠点は、2022年度から第2期目に入りすでに3年が経過しました。東京科学大学生体材料工学研究所、未来産業技術研究所、静岡大学電子工学研究所、そして広島大学半導体産業技術研究所の特色ある拠点ネットワークとして連携研究機関の機能融合により、生体医歯工分野の先進的共同研究を推進し、我が国の生体材料、医療用デバイス、医療システムなどの実用化を促進する拠点形成を目的として活動しています。

マテリアル先端リサーチインフラ事業（ARIM）・半導体基盤プラットフォームは2021年度から10年間の事業であり、最先端装置の共用、高度専門技術者による技術支援に加え、新たにリモート・自動化・ハイスループット対応型の先端設備を導入し、装置利用に伴い創出されるマテリアルデータを、利活用しやすいよう構造化した上で提供するための事業です。本研究所の特徴である総面積830m²のスーパークリーンルームを利用して、Siのみならず、SiCやGaN等のワイドギャップ半導体、高性能太陽電池など、エネルギー変換マテリアルにフォーカスした研究開発・支援を行います。その中から2024年度には、半導体基盤プラットフォームに採択され、半導体集積回路試作の支援を強化していきます。これらの支援を通じて、高品質マテリアルデータを収集・蓄積・流通・利活用できる仕組みの構築を推進していきます。

2022年度から開始された文部科学省「次世代X-nics半導体創生拠点形成事業」では、東京科学大学を中心として、豊橋技術科学大学とともに、「集積Green-niX研究・人材育成拠点」として採択され、10年間の事業で、半導体関連産業の未来のために「Green化」の観点を意識して、研究・開発と人材育成で貢献していきたいと考えています。

2023年3月には、本研究所を中心として、関連企業13社、広島県、東広島市をメンバーとして

「せとうち半導体コンソーシアム」を立ち上げました。半導体関連の人材育成と研究開発を産官学連携で取り組んで参りたいと考えております。2026年6月には参画企業数が35社になり、産業技術総合研究所、広島県、東広島市、神戸大学、岡山大学、広島大学の41団体でさらに研究・開発および人材育成を続けて参ります。

2023年3月に竣工したJイノベ棟(新棟)には、半導体研究のための分析、評価機器、AIや通信技術の研究開発のための設備を導入しました。これにより、本研究所のスーパークリーンルームと合わせて利用できるようにしています。さらに、新棟1階には、関連各位が自由に集うことのできるオープンスペースを開設しています。半導体関連分野の研究者・技術者が活発に意見交換できる場所にしていくとともに、せとうち半導体コンソーシアム活動の中心として、研究・人材育成活動に活用し、地域産業の活性化にも寄与しています。

アニュアルリサーチレポートは広島大学半導体産業技術研究所の最近1年間の研究活動と研究成果の一端をまとめて、先端技術の研究・教育に携わる方々に最新情報を共有していただくために発行しています。このレポートが今後ともこの分野での研究交流の一助になれば幸いです。

2026年7月1日

広島大学
半導体産業技術研究所
所長 寺本 章伸

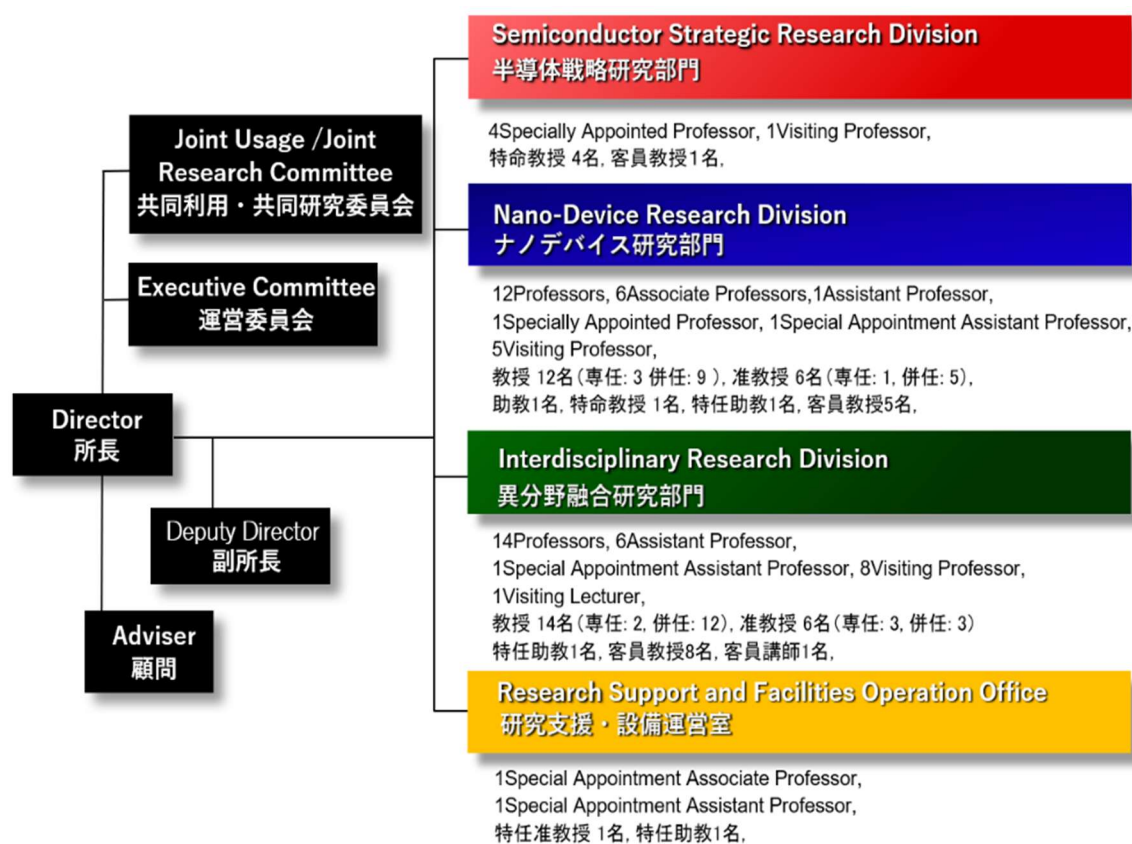
CONTENTS

Preface

1	Organization of Research Institute for Semiconductor Engineering (RISE)	1
2	Staff of RISE	2
3	Executive Committee Members of RISE	10
4	Research Divisions of RISE	12
4.1	Nano-Device Research Division	13
4.2	Interdisciplinary Research Division	22
4.3	Research Support and Facilities Operation Office	28
5	Research Facilities of RISE	29
5.1	Super clean rooms	29
5.2	Equipment for advanced devices and LSI fabrication	30
5.3	Characterization and diagnostics equipment	38
6	Lectures, Invited Talks, and Outreach Activities	42
6.1	High Schools	42
6.2	National Colleges of Technology (KOSEN)	42
6.3	Universities	43
6.4	Academic Societies	43
6.5	Setouchi Advanced Program (Supplementary Lectures)	43
6.6	Joint Seminar	43
6.7	Industry and Professional Associations	43
7	List of Publications	44
7.1	Nano Device Research	44
7.2	Interdisciplinary Research	53

1. Organization of Research Institute for Semiconductor Engineering (RISE)

半導体産業技術研究所組織



2. Staff of Research Institute for Semiconductor Engineering (RISE)

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3. Executive Committee Members of Research Institute for Semiconductor Engineering (RISE)

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Shin-Ichiro Kuroki 黒木 伸一郎	Associate Director and Professor 副研究所長・教授	RISE 半導体産業技術研究所
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Hideki Gotoh 後藤 秀樹	Professor 教授	RISE 半導体産業技術研究所
Seiichiro Higashi 東 清一郎	Professor 教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科
Minoru Fujishima 藤島 実	Professor 教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科
Shuhei Amakawa 天川 修平	Professor 教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科
Akio Kuroda 黒田 章夫	Professor 教授	Graduate School of Integrated Sciences for Life 統合生命科学研究科
Yoshihiro Kuroiwa 黒岩 芳弘	Professor 教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科
Idaku Ishii 石井 抱	Professor 教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科
Hiroki Nikawa 二川 浩樹	Professor 教授	Graduate School of Biomedical and Health Sciences 医系科学研究科(歯)
Anri Nakajima 中島 安理	Associate Professor 准教授	RISE 半導体産業技術研究所
Tetsushi Koide 小出 哲士	Associate Professor 准教授	RISE 研半導体産業技術研究所

Masataka Miyake 三宅 正堯	Associate Professor 准教授	RISE 半導体産業技術研究所
Hang Song 宋 航	Associate Professor 准教授	RISE 半導体産業技術研究所
Akira Sugimoto 杉本 暁	Associate Professor 准教授	Graduate School of Advanced Sciences and Engineering 先進理工系科学研究科

4. Research Divisions of Research Institute for Semiconductor Engineering (RISE)

半導体産業技術研究所の研究領域

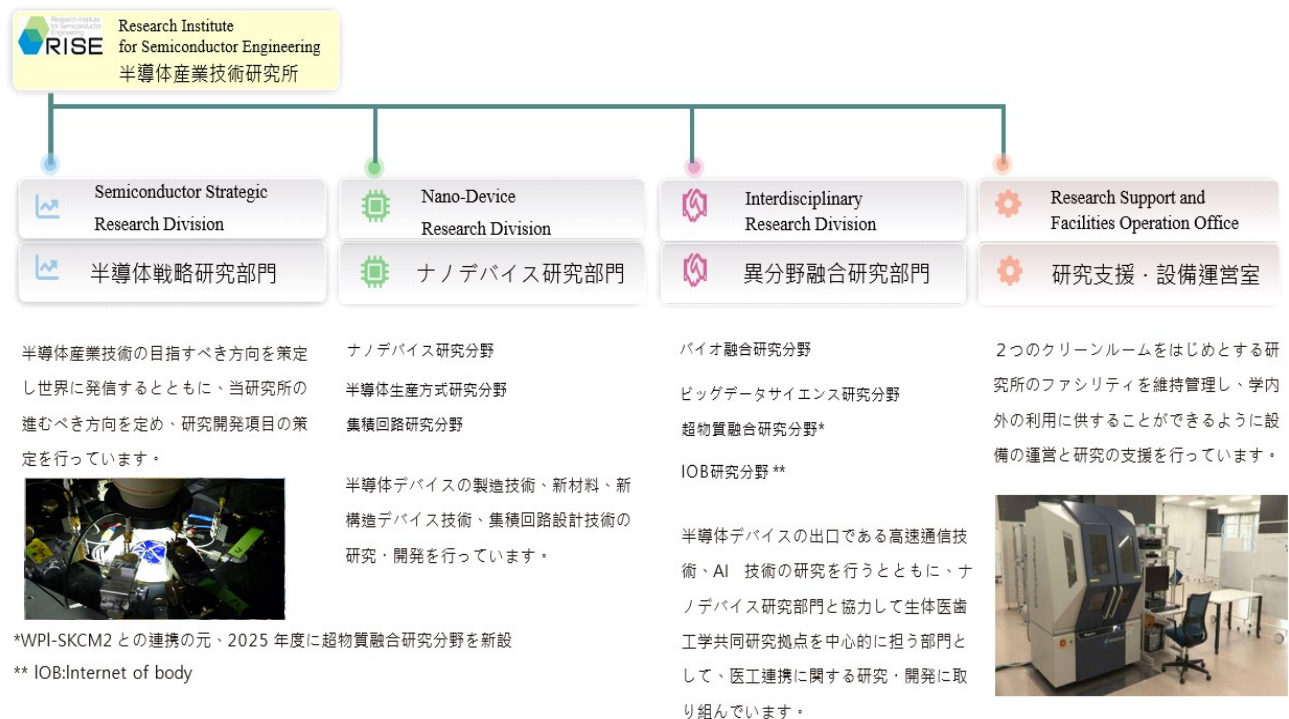
The Research Institute for Semiconductor Engineering

On April 1, 2024, the institute was reorganized as the *Institute for Semiconductor Industrial Technologies* to build upon its accumulated strengths and to establish a comprehensive and integrated framework for research and development across the field of semiconductor industrial technologies.

The newly established institute consists of three core research divisions and one administrative support office:

- The Semiconductor Strategy Division
- The Nano Device Research Division
- The Interdisciplinary Fusion Research Division
- The Research Support and Facility Management Office

本研究所は、2024年4月1日に、これまで培ってきた強みを活かすとともに半導体の産業技術に関する分野を俯瞰して一貫通貫で研究・開発を進めていく体制とするため、半導体産業技術研究所に改組しました。半導体産業技術研究所は、半導体戦略研究部門、ナノデバイス研究部門、異分野融合研究部門の3つの研究部門と研究支援・設備運営室からなります。



Research Divisions

研究領域

4.1 Nano-Device Research Division

ナノデバイス研究部門

At the Nano-Device Research Division we focus the research on nanodevices, Semiconductor Production System, and Integrated Circuits, The outlines of researches at the Nano-Device Research Division are as follows.

ナノデバイス研究部門では、ナノデバイス、半導体生産方式、集積回路、に関する研究を行っている。ナノデバイス研究部門における研究の主なものの概要を紹介する。

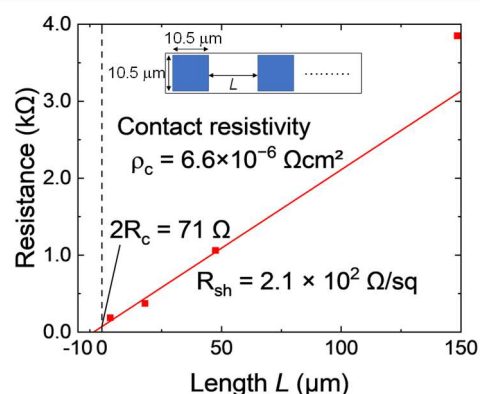


金属と GaN 間のコンタクト抵抗に関する研究
Study on contact resistance between metal and GaN

教授 寺本 章伸
Prof. Akinobu Teramoto

GaN の高電子移動度トランジスタにおけるコンタクト抵抗低減へ向けたプロセスに関する研究を進めている。SiN キヤップを用いた Si イオン注入と活性化アニールで n⁺-GaN 層を作製し、トンネル障壁を狭くすることで低いコンタクト抵抗率が得られた。

We research on processes to reduce contact resistance in gallium nitride (GaN) high-electron-mobility transistors. Low contact resistivity was achieved by forming an n⁺-GaN layer through Si ion implantation using a SiN cap and activation annealing by narrowing the tunneling barrier.



TLM (transfer length method)による n⁺-GaN (電極:Ti/Al) のコンタクト抵抗測定結果。
Contact resistance measurement results for n⁺-GaIn (Electrodes: Ti/Al) using TLM (Transfer Length Method).

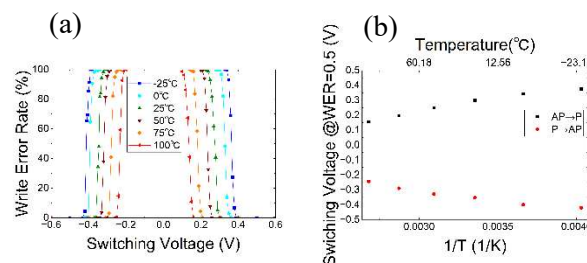


MTJ 素子における書き換え特性の温度依存性
Temperature dependence of switching characteristics in MTJ elements

教授 寺本 章伸
Prof. Akinobu Teramoto

Magnetic Tunnel Junction (MTJ)素子のスイッチング動作時において、温度によって磁化の不安定化や MR 比の低下を引き起こす。-25℃から 100℃の範囲で Write Error Rate (WER)が 50%となる書き換え電圧の絶対値を測定した結果、温度上昇に伴い値が低下することが分かった。

During the switching operation of a Magnetic Tunnel Junction (MTJ) devices, temperature variations cause magnetization instability and a reduction in the MR ratio. Measurements of the absolute value of the write voltage resulting in a Write Error Rate (WER) of 50% within the temperature range of -25 °C to 100 °C revealed that this value decreases as the temperature rises.



(a)書き換え電圧における WER, (b) WER50%における書き換え電圧の温度依存性。

(a) WER at the rewrite voltage and (b) temperature dependence of the rewrite voltage at 50% WER.

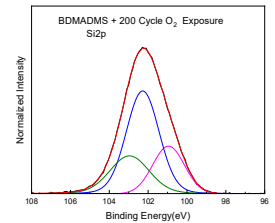
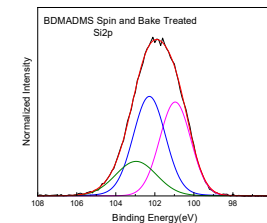
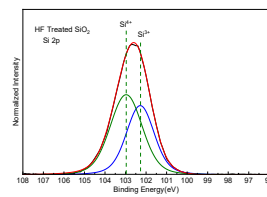


Ru の選択成長技術に関する研究 Study on selective growth technology for Ru

教授 寺本 章伸
Prof. Akinobu Teramoto

原子層堆積法を用いた Ru の選択成長技術の研究を行っている。阻害剤を適切に選択し塗布することで、W 上に Ru を選択成長させることができ、SiO₂ 上には阻害剤が残存することが分かった。

Selective growth technique of Ru has been studied using atomic layer deposition. It was found that by appropriately selecting and applying an inhibitor, Ru can be selectively grown on W, while the inhibitor remains on the SiO₂.



(a) HF 浸漬後, (b) 阻害剤(BDMADMS)塗布後, (c) O₂ 暴露(200 サイクル)後の SiO₂ に関する Si 2p 光電子スペクトル。O₂ 暴露後でも BDMADMS 由来のピークが残存していることが分かる。Si 2p photoelectron spectra of SiO₂ (a) after HF treated, (b) after inhibitor (BDMADMS) treated, and (c) after O₂ exposure (200 cycles). It can be seen that the peak derived from BDMADMS remains even after O₂ exposure.

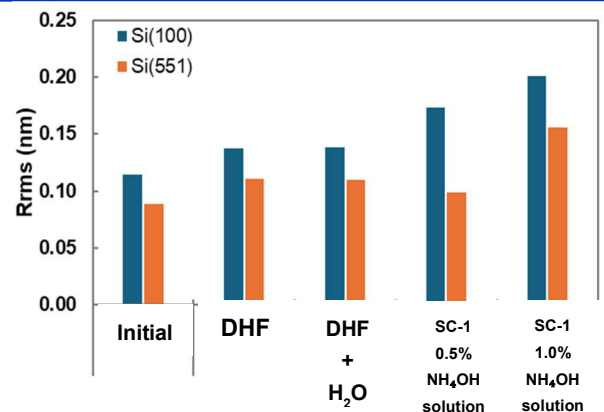


様々な面方位に対応した Si 表面洗浄技術の確立 Si surface cleaning technology with various crystal orientations

教授 寺本 章伸
Prof. Akinobu Teramoto

次世代 Si トランジスタへ向けて、様々な面方位に対応した Si 表面洗浄技術に関する研究を行っている。Si(551)表面は従来の Si(100)よりウェット洗浄において表面ラフネスが抑制されていることが分かった。

Si surface cleaning technologies compatible with various crystal orientations have been studied for realization of developing next-generation Si transistors. We found that the Si(551) surface suppressed surface roughness during wet cleaning compared to the conventional Si(100) surface.



各ウェット洗浄における Si(100)および Si(551)の表面ラフネス (Rrms)。

Comparison of microroughness parameter (Rrms) of Si(100) and Si(551) wafers at different wet cleaning condition.

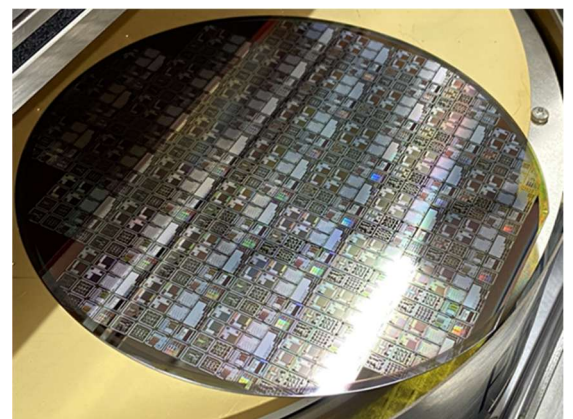


シリコンカーバイド極限環境エレクトロニクス: CMOS 集積回路 SiC CMOS Integrated Circuits

教授 黒木 伸一郎
Prof. Shin-Ichiro Kuroki

シリコンカーバイド(SiC)半導体を用いた極限環境用集積回路の研究を進めている。4H-SiC CMOS 集積回路の研究を進めた。特に 6 インチ基板での試作などを進めた。本研究は産総研、量研機構、スウェーデン王立工科大との共同研究として進めており、社会実装に向けた取組はフェニテックセミコンダクター株式会社と進めている。

In 2025, we began 4H-SiC CMOS circuits fabrication on 6-inch SiC wafers. This research is carried out under the collaboration with AIST QST, KTH Royal Institute of Technology, Sweden, and the social implementation project is carried out under the collaboration with Phenitex Semiconductor Corp.



4H-SiC CMOS IC チップを形成した 6 インチ SiC 基板
4H-SiC CMOS IC chips on 6-inch SiC wafer

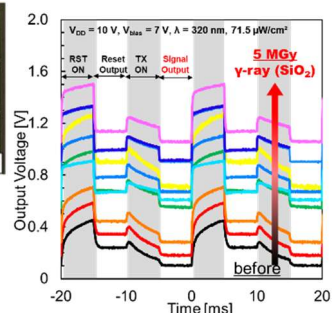
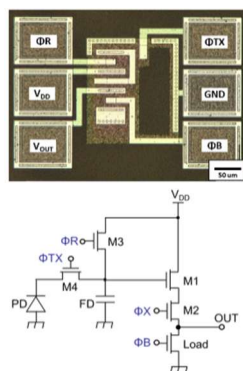


フル SiC 耐放射線 UV イメージセンサの研究 Radiation-Hardened Full-SiC UV Pixel Devices

教授 黒木 伸一郎
Prof. Shin-Ichiro Kuroki

今後のデブリ取り出しなどを見据え、フォトダイオードも SiC で作製したフル SiC UV (紫外光) イメージセンサを提案し、実証研究を進めている。2025 年度は 5MGy までのガンマ線照射後動作を実証し、また周辺回路としてデコーダ回路などの研究を進めた。
本研究は産総研、量研機構との共同研究として進めている。

Full SiC pixel devices for a radiation hardened UV image sensors had been demonstrated. In 2025, we demonstrated the operation after 5 MGy high gamma-ray radiation.
This research has been carried out under the collaboration with AIST, QST.



SiC アクティブピクセルセンサと 5MGy 照射後特性
4H-SiC Active Pixel Sensor and its characteristics after 5MGy radiation.

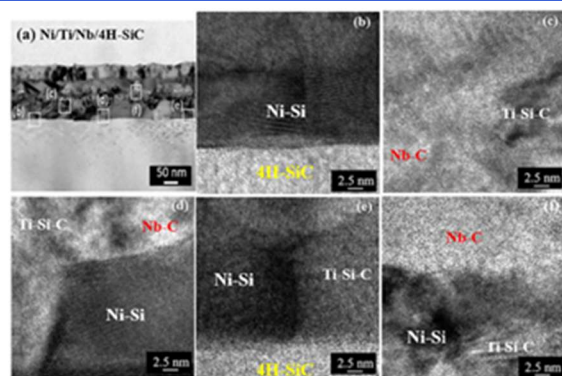


シリコンカーバイド集積回路プロセスの研究 Research on SiC-IC fabrication processes and materials

教授 黒木 伸一郎
Prof. Shin-Ichiro Kuroki

シリコンカーバイド (SiC) 半導体を用いた極限環境用集積回路の研究を進めている。高温でも信頼して使用可能なオーミック電極のためのシリサイドなどの研究を進めた。特に P 型領域でのオーミック電極低抵抗化に向けた研究を進めている。

We are developing silicide technologies for high-temperature operable 4H-SiC CMOS integrated circuits. The Ni-Ti-Nb silicide on 4H-SiC was investigated for reducing contact resistivity on p-type 4H-SiC.



SiC 上に形成した Ni-Ti-Nb シリサイドの断面 TEM 像 (400°C, 100 時間エージング後)

TEM micrographs of Ni-Ti-Nb silicide on 4H-SiC

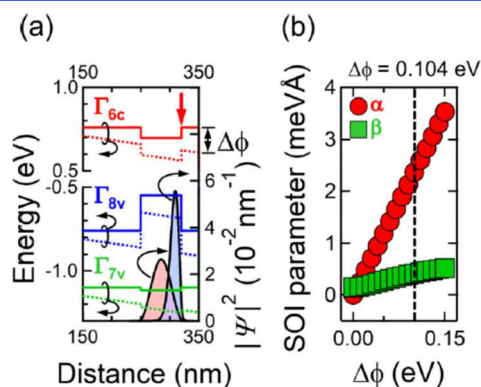


化合物半導体における電子スピンの 関連する光学物性の研究 Electron-spin related optical properties in compound semiconductors

教授 後藤 秀樹
Prof. Hideki Gotoh

省エネルギーで動作する情報処理デバイスの実現をめざし、半導体における電子スピンの物性を解明している。スピン状態を精密に評価するために、光を用いた空間イメージングを可能とした。この手法を用いて、GaAsBi おけるスピン誘起有効磁場が GaAs より 10 倍程度大きいことを示した。

To create IT devices with low energy consumption, electron-spin related optical properties have been studied in semiconductors. We have found an effective magnetic field induced by spin-orbit interaction in GaAsBi is about 10 times larger than that in GaAs with a spatial imaging system developed to image spin states.



(a) GaAsBi ヘテロ界面でのバンド構造モデル (b) 2 種類の有効磁場とバイアス誘起ポテンシャルとの関係。

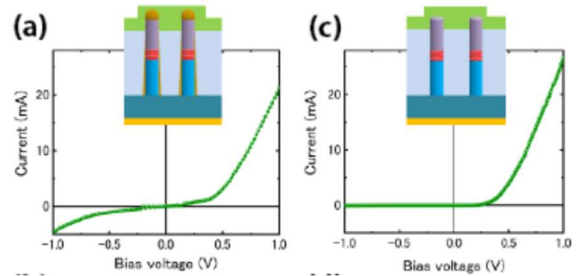
(a) Model of energy band structure in GaAsBi heterointerface. (b) Two kinds of effective magnetic fields as a function of external bias-induced potential.



化合物半導体ナノワイヤの作製とデバイス機能の研究
Fabrication and device functions with semiconductor nanowires (NWs)
教授 後藤秀樹
Prof. Hideki Gotoh

新しい 3 次元ナノ構造の形成と光学新機能の発現が期待できる半導体ナノワイヤの作製と、デバイス機能の研究を行っている。InP/InAs ヘテロナノワイヤを用いた pin 発光ダイオードの作製方法を検討した。ダイオードの電気特性と通信波長帯 (O-band) での発光特性が向上した。

Fabrication technique and device functions of semiconductor nanowires (NWs) have been studied expecting novel 3D nano-structures and useful optical functions. We have examined fabrication process of p-i-n light-emitting diodes with InP/InAs hetero-NWs. We have improved optical and electronic characteristics.



InP/InAs 半導体ナノワイヤ pin ダイオードの構造と電気特性。右が改良プロセスで作製した結果。

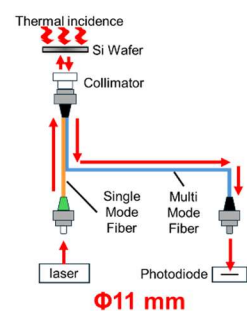
Schematic of light emitting diode with InP/InAs NWs and its electric characteristics. Right figure is the result with improved process.



ファイバーバンドルによる光学干渉非接触温度測定法 (OICT) センサヘッドの超小型化
Miniaturization of Sensor Head for Optical Interference Contactless Thermometry (OICT) by Bundled Fibers
教授 東 清一郎 (併任)
Prof. S. Higashi

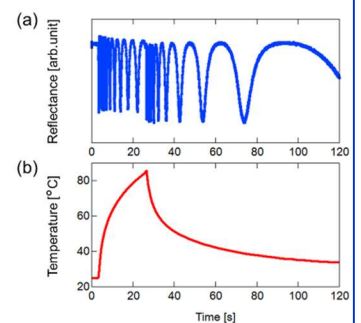
OICT を用いてプロセス中のシリコンウエハ表面温度分布の非接触測定を実現するために、ファイバーバンドルによる超小型センサヘッドの概念を提唱し、これを用いてリアルタイム温度モニタリングが実行可能であることを、実験的に実証した。

Optical Interference Contactless Thermometry (OICT) has been applied to measure transient temperature variation of silicon wafers. We introduced bundled fibers for the sensor head to realize real-time monitoring of temperature distributions of the wafers. Possibility of temperature measurement based on this idea has been successfully demonstrated experimentally.



ファイバーバンドルを用いた OICT センサヘッドの構成法を示す概念図。

Schematic illustration of OICT sensor head constructed by bundled fibers.



ファイバーバンドル型超小型 OICT センサヘッドを用いたシリコンウエハ表面温度の実測例。

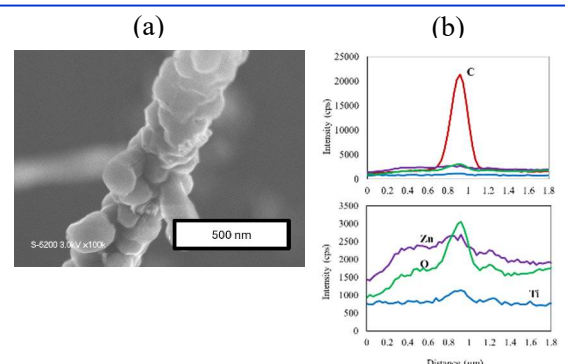
An example of OICT measurement of silicon wafer temperature conducted by an ultra-small sensor head.



ナノ物質の堆積による材料創製と表面汚染
Material Fabrication and Surface Contamination by Deposition of Nanoobjects
教授 島田 学 (併任)
Prof. M. Shimada

ナノサイズのクラスター・粒子状物質を合成し、ガス中に浮遊、堆積させて、有用な構造・組成をもつ薄膜、粒子、およびそれらの複合物を創製する研究を行っている。ナノサイズ物質が汚染物質として表面付着したときの影響も検討している。

Preparation of thin-films, particles, and their composites having useful structure and composition is being studied by synthesizing nano-sized clusters and particulate matter suspended in gases and depositing them in the gas phase. The effects of surface deposition of nanoobjects as contaminants are also being investigated.



浮遊プラズマ CVD 法によりワンステップで気相合成した、ガスセンサーおよび光触媒材料への適用を目的とする ZnO-TiO₂-カーボンナノチューブ三元複合物の顕微鏡写真 (a) と EDS 元素分析ラインスキャン結果 (b)

Microscopic image (a) and EDS elemental line-scan results (b) of ZnO-TiO₂-carbon nanotube ternary composites synthesized in the gas phase via a one-step in-flight plasma-enhanced CVD process, intended for application as gas-sensing and photocatalytic materials.

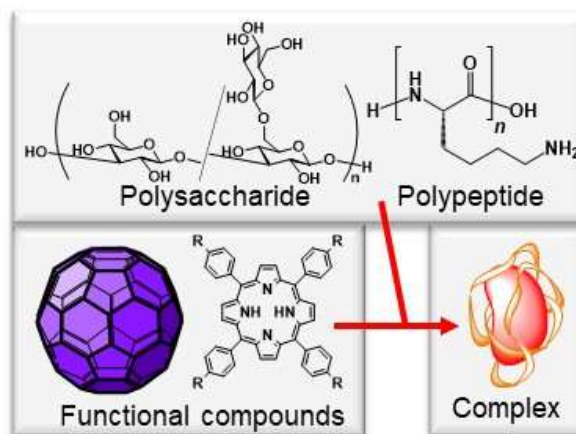


天然高分子による疎水性化合物の水溶化 Water-solubilization of hydrophobic compounds using natural polymers

教授 池田 篤志（併任）
Prof. Atsushi Ikeda

我々は多糖やポリペプチドを可溶化剤として用いて疎水性の機能性化合物を水溶化することに成功した。これらの複合体を用いて、薬剤や機能性材料の開発を目指す。

We succeeded the water-solubilization of hydrophobic functional compounds using polysaccharides or polypeptides as solubilizing agents. Using these complexes, we develop drugs and functional materials.



機能性分子-天然高分子複合体の模式図

Schematic illustration of functional compound-natural polymer complexes



テラヘルツ波デバイス基盤技術の研究 Study on Fundamental Technologies for Terahertz-Wave Devices

教授 藤島 実（併任）
Prof. Minoru Fujishima

次世代の超高速・高効率な無線通信を実現するため、サブテラヘルツ帯のフェーズドアレイ無線通信技術の研究に取り組んでいる。CMOS 集積回路を用いた 2 次元ビーム制御技術により、指向性を自在に操りながら高いエネルギー効率を実現する。現在、100 メートルの通信距離で毎秒 100 ギガビット級のデータ伝送を目指しており、次世代ワイヤレス通信の基盤技術としての応用を視野に入れている。

In pursuit of next-generation ultra-high-speed and energy-efficient wireless communication, we are researching sub-terahertz phased array wireless communication technology. By utilizing CMOS integrated circuits for two-dimensional beamforming, we can dynamically control beam directionality while maximizing energy efficiency. Our current goal is to achieve 100-gigabit-per-second-class wireless transmission over a 100-meter communication distance, paving the way for the fundamental technology of future wireless communication systems.



300GHz 帯 CMOS フェーズドアレイトランシーバによる高速無線伝送実験

High-Speed Wireless Transmission Experiment Using a 300-GHz Band CMOS Phased Array Transceiver

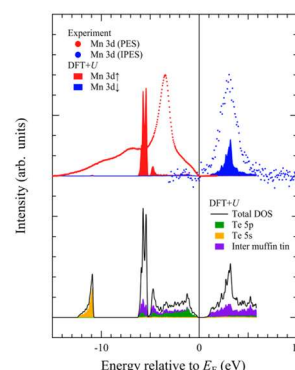


交替磁性体 MnTe の電子状態 Electronic states in altermagnetic MnTe

教授 島田 賢也（併任）
Prof. Kenya Shimada

新たな解析手法を開発し、放射光を用いた光電子分光および逆光電子分光により、交替磁性体 MnTe の占有・非占有電子状態における多体効果を初めて可視化しました。

We developed a new analysis method and, using synchrotron-based photoemission and inverse photoemission spectroscopies, visualized for the first time the many-body effects in the occupied and unoccupied electronic states of altermagnetic MnTe.



MnTe における占有・非占有電子状態の実験結果と理論計算の比較。

Comparison between experimental results and theoretical calculations for the occupied and unoccupied electronic states of MnTe.

K. G. Martuza et al., Materials **18**, 3103 (2025).



有機ナノデバイスのための電気伝導性
フラーレン混合有機レジスト
Fullerene-containing electrically conducting
electron beam resist for organic nanodevices
准教授 中島安理
Associate professor Anri Nakajima

簡便に高集積有機ナノサイズデバイスを作製するために、有機電子線レジストにフラーレンを混合した材料を開発しています。電気伝導性の有機ナノドットや有機ナノワイヤ構造を電子線露光と現像のみのプロセスで作製できます。

Fullerene-incorporated electron beam (EB) organic resists are developed to realize high integration of nanometer lateral-scale organic electronic devices. The structures of nanoscale dots and nanowires having electrical conductivity are able to be fabricated with a simple fabrication process of only EB exposure and development.

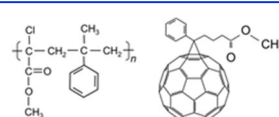


図 ZEP520a と PCBM.

Fig. ZEP520a and PCBM.

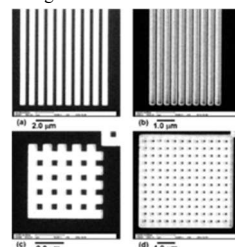


図 ナノスケールドットとナノワイヤ構造の SEM 像。

Fig. SEM micrographs of nanoscale dots and nanowires.

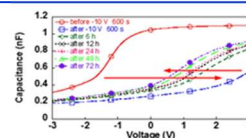


図 C-V 特性.

Fig. C-V characteristics.

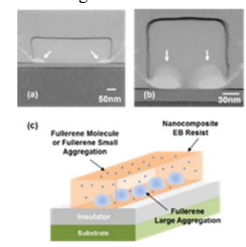


図 ナノワイヤ構造の透過電子顕微鏡像とフラーレンの分布。

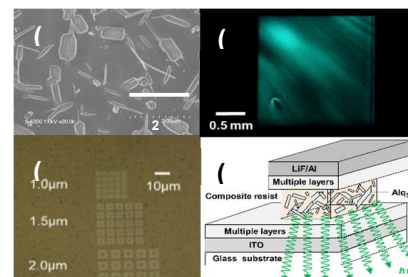
Fig. TEM of micrograph of nanowire and PCBM distribution.



ナノスケール有機ELデバイスのための Alq₃
混合電子線レジスト
Alq₃-Containing Electron Beam Resists
Nanometer-Scale for Organic EL Devices
准教授 中島安理
Associate professor Anri Nakajima

電子線レジストに導電性の発光性有機分子を混合する事により、露光と現像のみの簡単なプロセスを用いて、ナノメートルスケールで基板面内方向のサイズと位置を制御した有機ELデバイスを実現するための技術を開発してます。

A simple method only using electron beam (EB) exposure and development is developed for fabricating current-drivable light-emitting organic devices with lateral sizes and positions on the nanometer scale. The method uses light emitting molecule-incorporated EB organic resists.



Alq₃ 混合電子線レジストの(a)薄膜の SEM 像、(b)電子線露光及び現像後のドット構造発光層の光学顕微鏡像、(c)薄膜構造からのエレクトロルミネッセンス(EL)、(d)ナノサイズ有機 EL デバイスの概観。

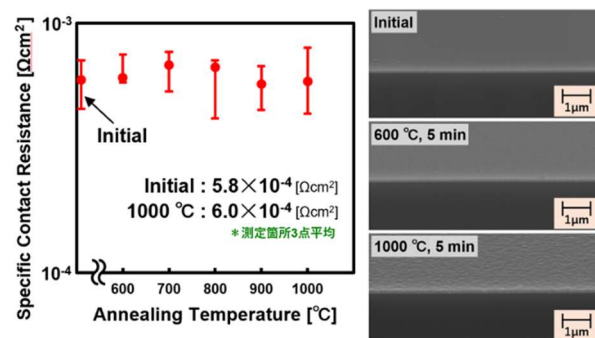
(a) SEM image of a thin film, (b)optical microscopy image of dot structure after electron beam exposures and development, (c) electroluminescence (EL) from a thin film, (d) schematic image of a nanosize EL device. These structures use Alq₃-containing EB resist.



半導体最表面の欠陥構造と金属コンタクトの研究
Research on defect structure and metal
contacts on the surface of semiconductors
准教授 花房 宏明 (併任)
Assoc. Prof. Hiroaki Hanafusa

電極金属のシリサイド化アニールを不要とする SiC 半導体の新たなオーミックコンタクト形成技術“SiCA”の研究を推進している。SiC 半導体の極表面に原子レベルの変質層が形成されており、1000℃の高温環境下でもオーミックコンタクト特性が維持され、デバイスレベルで動作することを明らかにしている。

We are conducting research on "SiCA," a novel ohmic contact formation technology for SiC semiconductors that does not require metal layer annealing. Experimental results have demonstrated that the ohmic contact remains stable even at elevated temperatures of up to 1000°C.



超高温環境下でも電極表面の平坦性を維持しながら低いコンタクト抵抗率を示す

The electrode surface maintains flatness while exhibiting low contact resistivity, even under very high-temperature conditions.

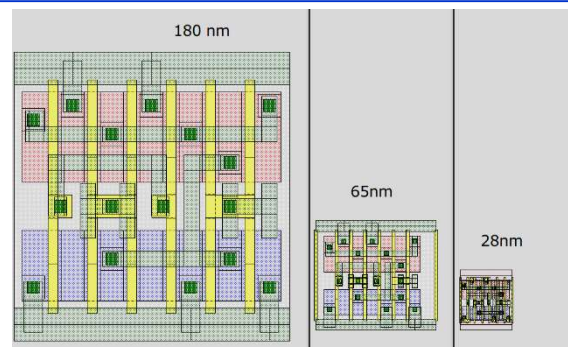


大規模集積システムの設計自動化技術 Electronic Design Automation for Large Scale Integrated Systems

准教授 西澤 真一（併任）
Assoc. Prof. Shinichi Nishizawa

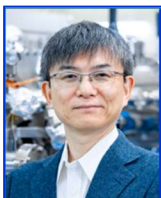
現在の大規模集積システムの実現のための設計自動化技術(Electronic Design Automation: EDA)に関する研究を行っています。スタンダードセルのレイアウトを自動的に設計する技術(Layout Generator), タイミング情報を自動抽出する技術(Characterizer)の開発を行っています。

We are currently conducting research on Electronic Design Automation (EDA) technologies for realizing large-scale integrated systems. We are developing technologies for automatically designing standard cell layouts (Layout Generator) and automatically extracting timing information (Characterizer).



異なるプロセステクノロジーを対象に、レイアウトジェネレータによって生成したスタンダードセル(AOI21_2x)と、28-nm CMOSプロセスで試作したチップ写真(右上)。

The image shows standard cells (AOI21_2x) generated by a layout generator targeting different process technologies, and a prototype chip fabricated using a 28-nm CMOS process (top right).

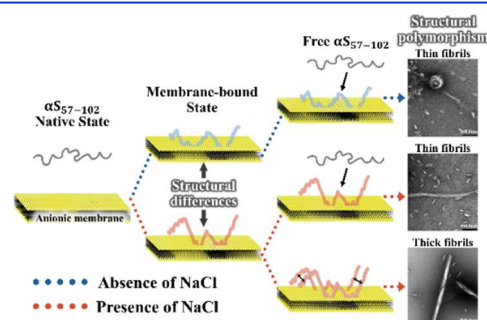


α -シヌクレイン NAC 領域と線維多形 α -Synuclein NAC Region and Fibril Polymorphism

准教授 松尾光一（併任）
Assoc. Prof. Koichi Matsuo

本研究では、 α シヌクレイン NAC 領域の膜相互作用と線維形成に対する塩の影響を解析した。塩存在下で膜結合するヘリックス構造が短縮し、疎水領域が露出することで、異なる 2 つの核形成経路が生じた。これが、線維の異なる構造多形の形成に寄与することが分かった。

In this study, we analyzed the effect of salt on the membrane interaction and fibril formation of α -synuclein NAC region. In the presence of salt, the membrane-bound helical structure shortened, exposing hydrophobic regions and giving rise to two distinct nucleation pathways. This was found to contribute to the formation of structurally polymorphic fibrils.



塩存在下では、 α S₅₇₋₁₀₂(NAC)の膜結合領域が減少し、異なる核形成機構が生じる。これがアミロイド線維の構造多形に寄与する。

In the presence of salt, the membrane-binding region of α S₅₇₋₁₀₂ (NAC) decreases, leading to distinct nucleation mechanisms. This contributes to the structural polymorphism of amyloid fibrils.

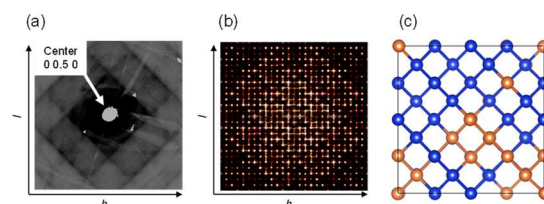


SiGe 混晶の原子配列解明に関する研究 Study on Atomic Arrangement of SiGe

助教 横川 凌
Assist. Prof. Ryo Yokogawa

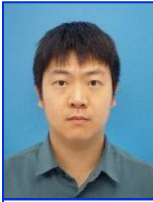
次世代トランジスタ、熱電発電デバイス応用に期待されている SiGe 混晶の原子配列解明に関する研究を行っている。放射光 X 線および第一原理計算を用い解析した結果、完全にランダムで原子が配列しているのではなく同種原子で結合しやすい傾向を示した。

Research on the atomic arrangement of SiGe alloys, which are expected to be used in next-generation transistors and thermoelectric devices, has been carried out. Analysis using synchrotron X-rays and density functional theory calculations revealed that the atoms are not arranged completely randomly, but rather tend to bond with atoms of the same type.



(a)バルク SiGe(Ge 32%)の放射光 X 線逆格子マッピング、(b)第一原理計算から導出した SiGe(Ge 30%)の逆格子空間シミュレーション結果、(a)と比較してチェッカーボード状の分布を再現できていることがわかる、(c)逆格子空間シミュレーションで用いた SiGe の結晶構造(青:Si 原子、黄:Ge 原子)

(a) Synchrotron X-ray reciprocal lattice mapping of bulk SiGe (Ge 32%), (b) reciprocal lattice space simulation results of SiGe (Ge 30%) derived from first-principles calculations, showing that the checkerboard-like distribution can be reproduced compared to (a), and (c) crystal structure of SiGe used in the reciprocal lattice space simulation (blue: Si atom, yellow: Ge atom).

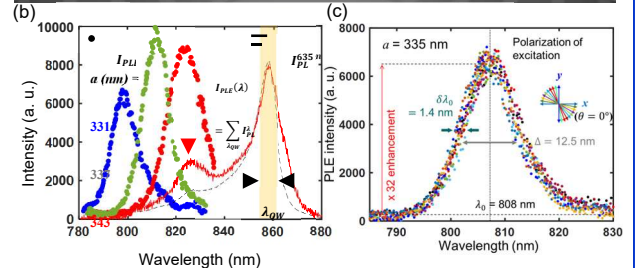
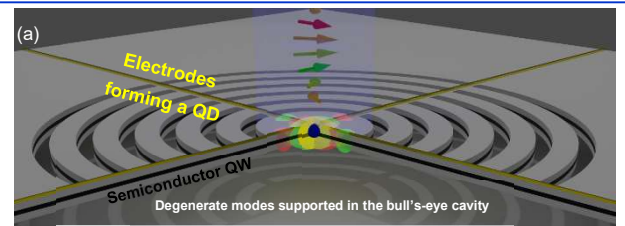


光ナノ構造を用いた新奇光学・量子技術
Novel optical quantum devices using nanostructures

助教 JI SANGMIN
Assist. Prof. Sangmin Ji

光ナノ構造は物質中強く局在した光の状態を作り、光と物質の相互作用を増強する。特に、半導体中のスピン欠陥と偏光無依存の光共振器を結合したデバイスは、大規模量子ネットワークを実現に向けた核心的な技術として位置づけられる。

Optical nanostructures generate strongly confined states of light within materials, significantly boosting light-matter interactions. Devices that couple spin defects in semiconductors with polarization-independent optical cavities represent a technology for realizing large-scale quantum networks.



(a) Schematic of polarization-independent bull's-eye cavity incorporating a spin defect. (b) PL and PLE excitation spectra on the cavity. (c) Polarization dependence of the cavity PLE spectra.

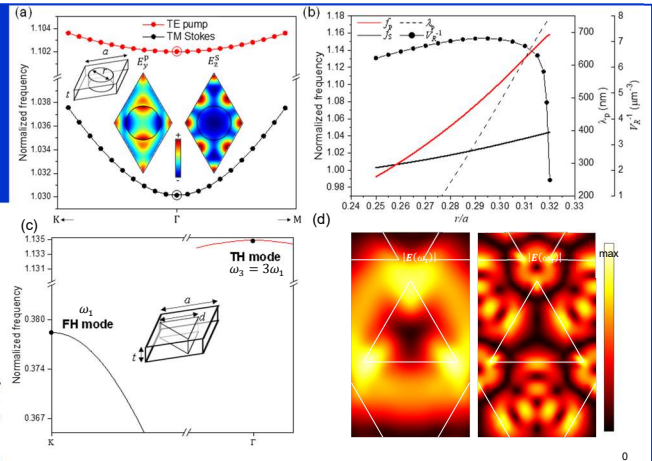


光ナノ構造を用いた新奇光学・量子技術
Novel optical quantum devices using nanostructures

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光ナノ構造は物質中強く局在した光の状態を作り、光と物質の相互作用を増強する。特に、非線形過程の増強は生体、量子、レーザー科学など幅広い分野にわたって重要な課題であり、本研究ではダイヤモンドフォトン結晶を用いた様々な非線形過程の増強を目指している。

Optical nanostructures generate strongly confined states of light within materials, significantly boosting light-matter interactions. Especially in fields spanning biomedical, quantum, and laser sciences, enhancing nonlinear processes remains a crucial objective. This study aims to realize diverse nonlinear optical enhancements by utilizing diamond photonic crystals.



(a) Doubly resonant photonic crystal cavity (PhC) for enhanced simulated Raman scattering (SRS). (b) SRS generation properties in the PhC. (c) Doubly resonant PhC for enhanced third-harmonic generation (THG). (d) Field distribution of fundamental mode and TH mode in the PhC.

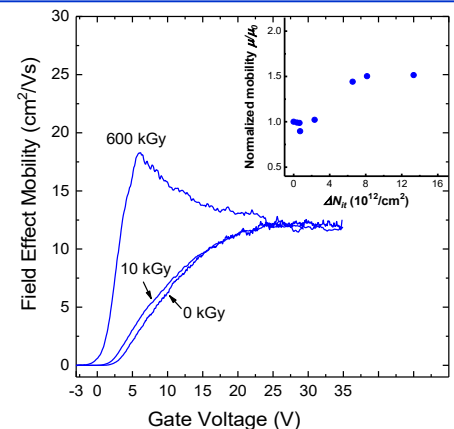


耐放射線性を有する高移動度 SiC-MOSFETs の研究
A study on Rad-Hard SiC-MOSFETs

助教 村岡 幸輔
Assist. Prof. Kosuke Muraoka

宇宙空間や原子炉内等の高放射線環境下においても動作する炭化ケイ素(SiC)半導体素子の研究を進めている。SiC の欠点の一つであるチャネル移動度改善と放射線耐性を両立させるために、ゲート酸化膜界面にバリウム(Ba)を導入し、600 kGy 以上のガンマ線照射後においても高い移動度を維持することを明らかにした(右図)。

Silicon Carbide (SiC) devices are studied for extreme radiation environments. By introducing Barium (Ba) at the gate oxide interface, Both high radiation resistance and improved channel mobility were confirmed even after gamma-ray irradiation over 600 kGy as shown in the figure.



(a) Ba 導入 SiC-MOSFET で確認されたガンマ線誘起移動度増加現象。
(b) ガンマ線で生成された界面トラップと規格された移動度の関係。

(a) Field effect mobility of the MOSFET before and after irradiation at two radiation doses. (b) Relationship between the normalized mobility and interface traps (ΔN_t), for the Ba-incorporated SiO₂.

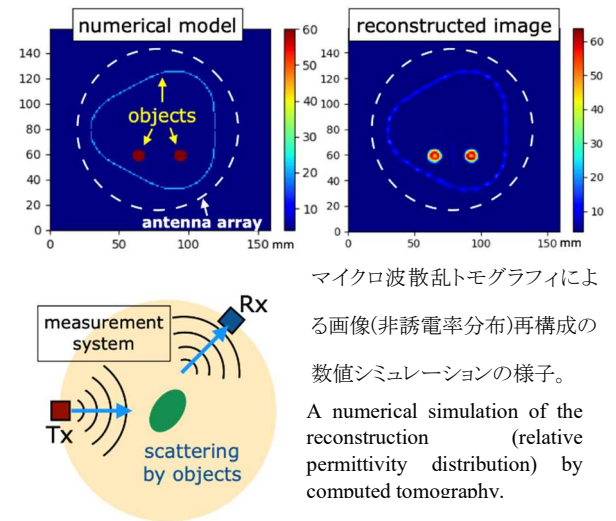


逆問題に対する信号処理技術の構築 Signal Processing Algorithms for Inverse Problems

助教 石川 智己 (特任)
Assist. Prof. T. Ishikawa

計算トモグラフィー(CT)による画像再構成やランダムテレグラフ信号(RTS)の処理を軸に、逆問題として定式化される課題への手法開発および実用性検証を行っている。CTでは電磁波等の散乱データから対象物の形状・電気特性を推定、RTS 処理ではノイズに埋もれた複数の RTS 成分を抽出・解析する。これらの手法を通じ、高速かつ頑健なアルゴリズムを設計し、実用化に向けた基盤を構築する。

We develop and validate fast, robust algorithms for inverse problems, such as those in computed tomography and random telegraph signal processing.



マイクロ波散乱トモグラフィによる画像(非誘電率分布)再構成の数値シミュレーションの様子。

A numerical simulation of the reconstruction (relative permittivity distribution) by computed tomography.

4.2 Interdisciplinary Research Division

異分野融合研究部門

The Interdisciplinary Research Division we focus the research on Bio-integration, Big-Data Science, Supramaterials Integration, and IOB The outlines of researches at the Interdisciplinary Research Division are as follows.

異分野融合研究部門では、バイオ融合、ビックデータサイエンス、超物質融合、IOB、に関する研究を行っている。異分野融合研究部門における研究プロジェクトの主なものの概要を紹介する。

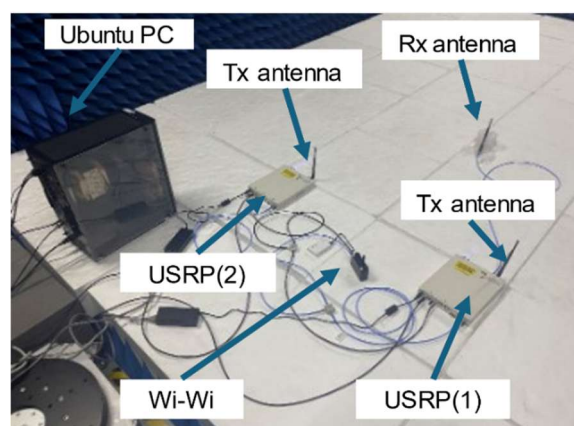


時空間同期による超多数同時接続
無線 IoT の研究
Massive Connect IoT
Based on Space-time Synchronization
教授 亀田 卓
Professor Suguru Kameda

同期スペクトラム拡散・符号分割多元接続(同期 SS-CDMA)に高精度時刻同期・測位技術を適用することで、超多数の無線通信ノードが同一空間に存在する過密環境下においてもチャネル間干渉なく多数端末から同時に通信可能な無線通信システムを実証する。

We have investigated a synchronized spread-spectrum code division multiple access (SS-CDMA) wireless communication system that can simultaneously communicate with a large number of terminals by using high-precision time synchronization and high-accuracy positioning technologies.

[Ref.] T. Watanabe et al., "USRP Implementation of Synchronized SS-CDMA Communication Function Using Wi-Wi: Evaluation in a Wireless Environment," ICUFN 2025.



ソフトウェア無線機 (USRP) を用いた同期 SS-CDMA の実装と実測評価 (RISE J イノベーション HUB 棟 3 階電波暗室内での実験)
Implementation and evaluation of proposed synchronized SS-CDMA using software defined radio (USRP)



可聴音響フォトニクス
Audio Photonics

教授 岩坂 正和
Prof. Maskazu Iwasaka

水滴表面にパルク音響波 (BAW) の高調波成分の定在波を導入し、魚類由来のグアニン微小板による格子パターンを形成させることに成功した。この液滴表面の格子間隔は現在のところ約 100 マイクロメートルの分解能で制御可能である。

Fish guanine platelets exhibited formation of standing lattice patterns on liquid (water) droplet. Fine tuning of the lattice width (app. 100 micrometers~) was available on the liquid surface.



水滴表面にグアニン微小版で形成した音響定在波による格子パターン(格子間隔は~約 150 ミクロン)

Guanine platelets formed lattice patterns on water droplet surface under audible acoustic field exposures.

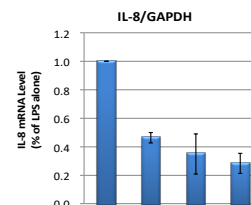
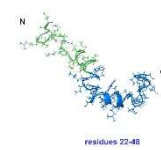
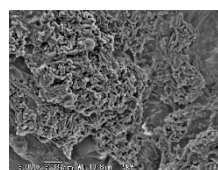


L8020 乳酸菌のバクテリオシン Bacteriocin derived from *L. rhamnosus* L8020

教授 二川 浩樹 (併任)
Professor Hiroki NIKAWA

虫歯・歯周病を抑制する L8020 乳酸菌のバクテリオシン Kog1 には、抗菌作用だけでなく、歯周病菌の内毒素 LPS を不活性化させる作用がある。

Kog1, a bacteriocin produced by *L. rhamnosus* L8020 which suppress both cariogenic bacteria and periodontal burdens in oral cavity, inactivate the LPS produced by periodontal burdens.



L8020 乳酸菌(a)のバクテリオシン Kog1(b)は、歯周病菌の内毒素 LPS を不活性化させる作用がある(c)。

Kog1(b), a bacteriocin produced by *L. rhamnosus* L8020 (a) inactivate the LPS produced by periodontal burdens (c).

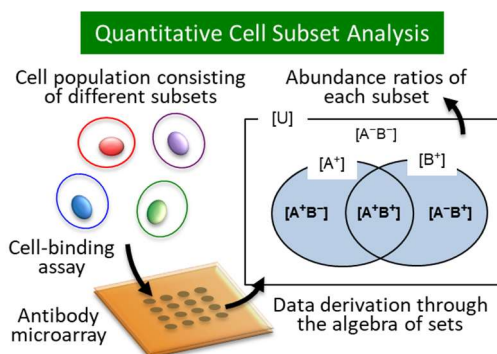


抗体アレイによる定量的サブセット分析 Quantitative Cell Subset Analysis Using Antibody Arrays

教授 加藤 功一 (併任)
Prof. Koichi Kato

微小なチップ上に多種類の抗体を配列固定した抗体アレイを用いて細胞表面マーカーのハイスループット解析が可能です。さらに、データ解析に集合演算の概念を取り入れることによって、細胞の定量的サブセット分析が可能になることを見出しました。

An antibody microarray on which multiple antibodies are immobilized in an array format allows us to conduct the high-throughput analysis of cell surface markers. Recently we reported that the quantitative cell subset analysis can also be made using antibody microarray by incorporating the concept of set operations into data analysis.



抗体アレイを用いた定量的サブセット分析の概要

Overview of quantitative cell subset analysis using antibody array (Reprinted with permission from "Ogasawara T, Kato K. ACS Appl. Bio Mater. 2021, 4:7673–81". Copyright 2021 American Chemical Society)

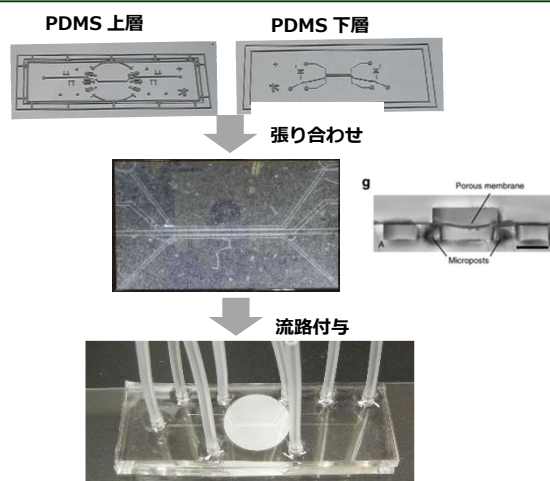


Bone-BBB(blood-brain barrier)関連マイクロ流体デバイスの作製 Development of the Bone-BBB Microfluidic Device

教授 加治屋 幹人 (併任)
Professor. Mikihiro Kajiya

骨と脳認知機能の連関を解明するために、骨細胞と血液脳関門系細胞を適切な位置関係で立体的に培養する還流デバイスの開発に取り組んでいる。本年度は、口腔細菌を還流した状態での培養系を確立し、血液脳関門のバリア機能及びその破綻機序解析実験を前進させた。

To elucidate the bone-brain axis, we are developing a perfusion device for three-dimensional co-culture of bone cells and blood-brain barrier cells in a defined spatial arrangement. This year, we established a culture system with oral bacterial perfusion and advanced analyses of blood-brain barrier dysfunction and its underlying mechanisms..



骨細胞と脳血管内皮細胞・周皮細胞・アストロサイトを上下層に設置して培養可能な還流デバイス

A fluidic device capable of culturing bone cells and brain vascular endothelial cells, pericytes, and astrocytes in upper and lower layers



高速ビジョンを起点とした情報センシング Real-World Sensing Using High-Speed Vision

教授 石井 抱 (併任)
Prof. Idaku Ishii

実世界の見えない動きを可視化し、現場の課題をデータで解決する情報センシングの研究。高速ビジョン、振動センシング、移動体 AI トラッキング、ロボットセンシングなどの情報センシング基盤技術、及び人間・生体システムならびに産業システムにおける 4D デジタルツイン応用
Informatic Sensing for visualizing imperceptible real-world dynamics and solving on-site challenges via data-driven approaches. High-speed vision, vibration sensing, AI-based tracking, robotic sensing, and 4D digital twins for human, biological, and industrial systems.

実世界の「見えない」を捉える Capture "the Invisible" in the Real World

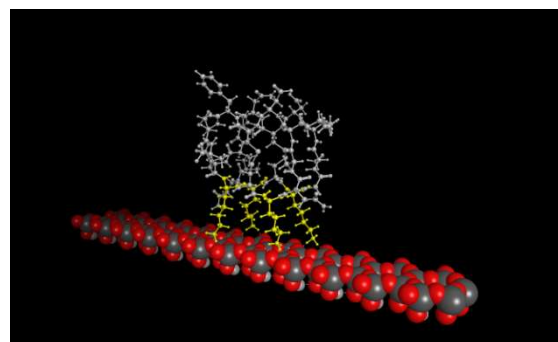


シリコンとバイオの界面制御の研究 Interface Technology between Silicon and Biomolecules

教授 黒田 章夫 (併任)
Prof. Akio Kuroda

Si デバイスの表面に、活性を保ったままバイオ分子を固定化する技術は新しい半導体バイオセンサーの開発に必要である。平坦な表面構造を有するタンパク質分子を改変して、Si との親和性が高いアミノ酸を平面状に配置することで、新規の Si 結合タンパク質の開発を進めている。

The ability to target proteins to specific sites on a Si device while preserving their functions is necessary for the development of new biosensors. We are developing a novel Si-binding protein by engineering a protein to display amino acids with affinity for Si on the flat surface.



作製した Si 結合タンパク質の結合モデル図
平面状に配置したアミノ酸(黄色)が Si 表面と相互作用する
Molecular model of the Si-binding protein.

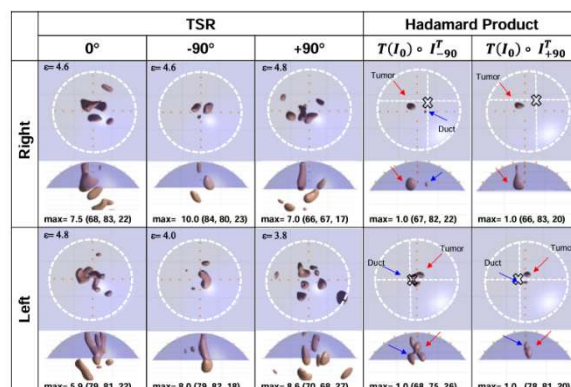


マイクロ波イメージング乳がん検出技術 Breast Cancer Detection Using Microwave Imaging

客員教授 吉川公麿
Professor Takamaro Kikkawa

広島大学病院にて摘出された乳がん組織の検出能を評価した。両側乳がんを3D マイクロ波共焦点画像で再構築した。Hadamard 積(0°, -90°, +90°)のクラッタ抑制効果を確認した。本研究は、広島大学病院、東京科学大学(東京工業大学)、天津大学、トリニティカレッジダブリンとの共同研究の成果である。

Excised breast cancer tissues were investigated by a portable microwave breast cancer detector. Effects of Hadamard products were confirmed for bilateral breast cancer cases. This study was conducted in collaboration with Hiroshima University Hospital, Institute of Science Tokyo, Tianjin University and Trinity College Dublin.



Confocal images by the two-stage rotational surface clutter suppression (TSR) and Hadamard product. The reconstruction permittivity values of (0°, -90°, +90°) orientations for right and left breasts were (4.6, 4.6, 4.8) and (4.8, 4.0, 3.8), respectively. The intensity threshold was 0.4.

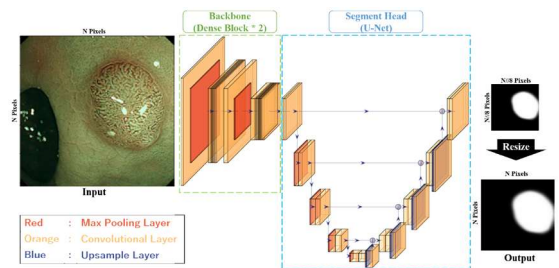


ディープラーニングを用いた全画面 NBI 大腸内
視鏡検査における病変領域の自動検出手法
An Automatic Segmentation Method for Lesion Areas in
Full-screen NBI Colorectal Endoscopy Using Deep Learning

准教授 小出哲士 Assoc.Prof. Tetsushi Koide

大腸内視鏡検査において、定量的な推論結果を提示することで、医師による診断のばらつきを低減するためのコンピュータ支援システムを開発している。本研究では、NICE/JNET 分類に基づき、ディープラーニングを用いた全画面 NBI 大腸内視鏡検査における病変領域の自動セグメンテーション手法を開発しました。

We are developing a computer-assisted system designed to reduce diagnostic variability among physicians by providing quantitative findings during colonoscopies. In this study, we developed a method for automatically segmenting lesion areas in full-field NBI colonoscopies using deep learning, based on the NICE/JNET classification.



図：大腸 NBI 内視鏡における診断支援のための病変エリア検出器の Dense U-net の構造

Fig. Structure of a Dense U-Net Lesion Area Detector for Diagnostic Support in NBI Colonoscopy

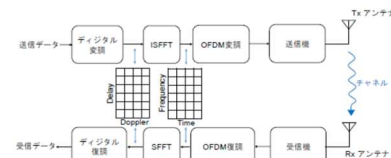


地球低軌道衛星通信に向けた OTFS
多元接続と遅延事前補償の研究
OTFS-Based Multiple Access and Delay Pre-
Compensation for LEO Satellites

准教授 三宅 正亮
Associate Professor Masataka Miyake

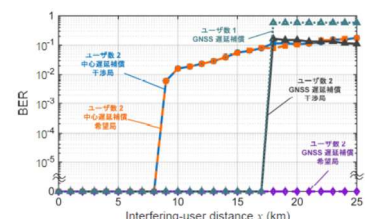
地球低軌道 (LEO) 衛星通信に向け、OTFS を用いた上り多元接続方式を検討している。Delay-Doppler 領域における遅延分割多元接続 (DDMA) と遅延事前補償を組み合わせて評価した結果、特に GNSS 情報を用いた補償が有効であり、広い通信エリアでの通信信頼性向上を確認した。

An uplink multiple access scheme based on OTFS is being investigated for LEO satellite communications. Performance evaluation of delay-division multiple access (DDMA) in the delay-Doppler domain combined with delay pre-compensation schemes showed that GNSS-based compensation is particularly effective in improving communication reliability over a wide coverage area.



OTFS 通信システムの概略ブロック図。

Simplified block diagram of an OTFS communication system.



ビームエリア内複数局に対するビット誤り率特性の計算結果例。

Example BER performance for multiple users in the beam area.

OTFS: 直交時間周波数空間変調方式, GNSS: 全球測位衛星システム

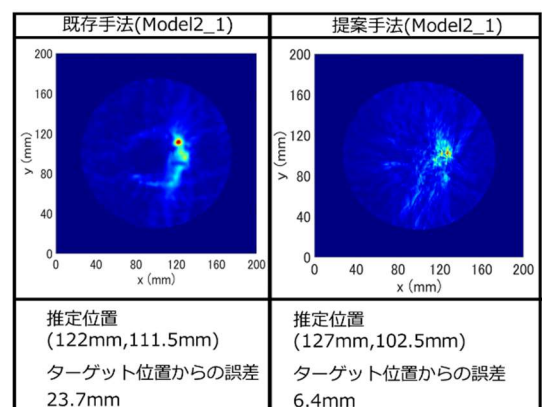


マイクロ波による乳がん検出
Breast Cancer Detection using Microwave

准教授 宋航
Associate Prof. Hang Song

マイクロ波による乳がん検出において、乳房内部の誘電率分布情報を利用した共焦点イメージング手法を提案した。既存手法と提案手法を比較し、乳がん検出精度への影響を評価した。結果より、誘電率分布を考慮することで乳がんの位置推定の精度が向上する可能性が示唆された。

A dielectric-informed confocal imaging method was proposed for microwave breast cancer detection. By comparing the proposed method with conventional methods, the impact on breast cancer detection accuracy was evaluated and the results suggest the dielectric distribution may improve the accuracy of cancer position estimation.



乳がん推定位置と実際の位置との誤差の比較

Comparison of the error between the estimated and actual positions of breast cancer

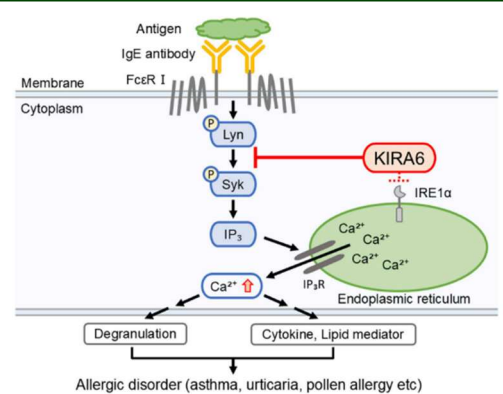


抗アレルギー物質の探索と作用機序の解明 Exploration of molecules with anti-allergic effects and elucidation of their mechanisms

准教授 柳瀬 雄輝（併任）
Associate Professor. Yuhki Yanase

アレルギー原因細胞であるマスト細胞・好塩基球の活性化を抑制する物質が求められている。我々は、小胞体ストレスの機能を調整する物質である KIRA6 が、本来の働きとは別に、Lyn というチロシンキナーゼの働きを制御して、これらの細胞の活性化を抑制することを発見した。本研究成果は Frontier in pharmacology 誌に掲載された。

We aimed to investigate the roles of ER stress-related molecules in mast cell and basophil activation and found that KIRA6 prevents allergic reactions by inhibiting the kinase activity of Lyn via an IRE1 α -independent pathway.



KIRA6 はチロシンキナーゼ Lyn の働きを制御してマスト細胞・好塩基球の活性化を抑制する

KIRA6 inhibits the activation of mast cells and basophils by suppressing the function of tyrosine kinases, Lyn.

(Front Pharmacol. 2025 Jul 25;16:1625798)

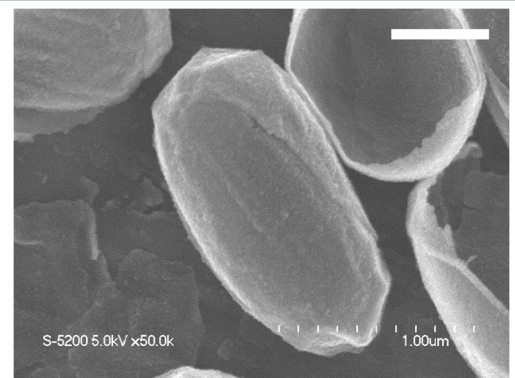


細菌の SiO₂ 形成機構の解析と半導体バイオ融合デバイス開発への応用 Molecular Mechanisms of SiO₂-Forming Bacteria and Their Applications

准教授 池田 丈（併任）
Assoc. Prof. Takeshi Ikeda

グラム陽性細菌 *Bacillus cereus* が細胞内でマイクロカプセル状の SiO₂ を形成することを発見し、その分子メカニズムの解析を進めている。SiO₂ 形成に関与する生体分子を本菌より単離し、半導体バイオ融合デバイス開発のためのツールとして利用している。

We found that a Gram-positive bacterium *Bacillus cereus* and its close relatives form a microcapsule-like structure of SiO₂ in the cell. Several biomolecules involved in silica formation have been identified and are used to fabricate Si-based biomaterials and biodevices.



B. cereus が形成したマイクロカプセル状 SiO₂ 構造体の

SEM 像 スケールバー: 500 nm

SEM image of microcapsule-like SiO₂ structures isolated from *B. cereus*. Scale bar: 500 nm.

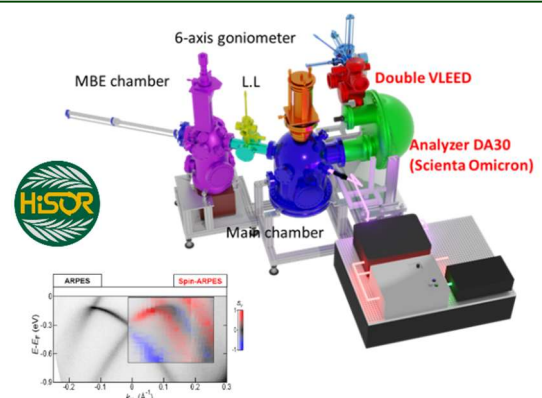


レーザー Spin-ARPES を用いた反強磁性体におけるスピン偏極電子状態の研究 Study of spin-polarized electronic states in antiferromagnets using Laser Spin-ARPES

准教授 黒田 健太（併任）
Professor Kenta KURODA

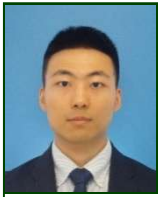
スピン・角度分解光電子分光 (Spin-ARPES) は、電子バンド構造をスピン自由度まで直接可視化できる強力な実験技術である。2024 年度は、マイクロ集光レーザーを導入した走査型 Spin-ARPES 顕微鏡を広島大学放射光科学研究所 (HiSOR) で開発し、この装置を用いて反強磁性体におけるスピン偏極電子状態の発現機構を解明した。

Spin- and angle-resolved photoemission spectroscopy (Spin-ARPES) is a powerful experimental technique that enables direct visualization of electronic band structures, including spin degrees of freedom. In the 2024 fiscal year, a scanning Spin-ARPES microscope incorporating a micro-focused laser was developed at the Hiroshima University Synchrotron Radiation Research Center (HiSOR). Using this apparatus, the mechanism of spin-polarized electronic states in antiferromagnets was elucidated.



HiSOR の Spin-ARPES 装置の概要図。電子バンド構造をスピン自由度まで決定することができる。

Laser Spin-ARPES system at HiSOR. This system enables us to visualize electronic band structures, including spin information.



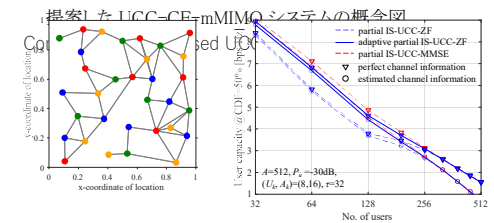
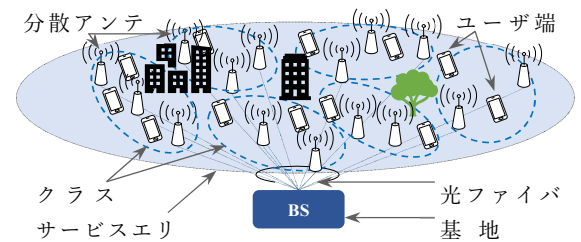
ユーザクラスタ中心 CF-mMIMO システムにおける干渉抑圧・リソース割当の研究
Interference Mitigation and Resource Allocation for UCC-CF-mMIMO Systems

特任助教 夏 斯傑

Assist. Prof. (Special Appointment) XIA SIJIE

移動通信システムの大容量化に向け、CF-mMIMO 技術が提唱されるが、干渉の増加と拡張性の確保が課題となる。本研究は、ユーザクラスタ中心 CF-mMIMO を提案するとともに、干渉抑制およびリソース割当手法を検討し、高い適応性と拡張性を備えたシステム構築を目指す。

To achieve higher capacity in mobile communication systems, cell-free massive MIMO (CF-mMIMO) has been proposed. However, increased interference and scalability remain challenges. This study proposes a user cluster-centric (UCC) CF-mMIMO framework and investigates interference mitigation and resource allocation techniques to achieve a highly adaptive and scalable system.



パイロット割当結果(左)と干渉抑圧型通信方式の評価(右)
Pilot assignment (left) and interference mitigation performance (right)

4.3 Research Support and Facilities Operation Office

研究支援・設備運営室

The Research Support and Facilities Operation Office maintains and manages the institute's facilities, operates equipment (R&D) activities, supporting internal and external users. The outlines of researches at the Research Support and Facilities Operation Office.

研究支援・設備運営室では、2つのクリーンルームをはじめとする研究所のファシリティを維持管理し、学内外の利用に供することができるように設備の運営と研究の支援を行っています。現在行われている研究支援・設備運営室における研究の主なものの概要を紹介する。

トンネル電界効果トランジスタを用いた極低電圧シリコン光変調器の研究
Ultralow drive voltage Si optical modulator utilizing tunnel field-effect transistors
特任准教授 田部井 哲夫
Special Appointment Associate Professor

トンネル電界効果トランジスタ(TFET)を利用した、極低電圧駆動シリコンマッハツェンダー光変調器の研究を行っている。現在は光ファイバからの外部光をSOI基板上のシリコン細線導波路へ高効率に導入するためのスポットサイズ変換器の最適化を進めている。

We study an ultralow drive voltage silicon Mach-Zehnder modulator utilizing tunnel field-effect transistors (TFETs). Currently, we are working on optimizing a spot-size converter to efficiently couple external light from an optical fiber into silicon nanowire waveguides on a SOI substrate.

逆テーパースポットサイズ変換器の概略図
Schematic of an inverted taper spot-size converter.

Input light Output light
Spot-size converter
器内での光導波シミュレーション
A guided-wave simulation inside the spot-size converter.

光学素子の異種基板上への接合技術
Bonding technology of optical devices on heterogeneous substrate
助教 雨宮 嘉照 (特任)
Assist. Prof. Y. Amemiya

SOI基板を用いたシリコン pn 接合素子および窒化ガリウム LED 素子について、同一異種基板上に集積化することを目的として、常温大気圧下で石英基板等の透明基板に接合する技術の研究を行っている。40 μm ×100 μm 素子の接合には成功しており、より微細な素子の接合についても検討している。

We are studying bonding technology of silicon pn junction devices using SOI substrate and gallium nitride LED devices on quartz substrates under room temperature and atmospheric pressure for heterogeneous integration. The bonding of 40 μm ×100 μm devices is successful and the bonding of further smaller-size devices is also studied.

石英基板上に常温接合した窒化ガリウム LED 発光時の光学顕微鏡写真とより微細な素子の走査型電子顕微鏡像
Optical micrograph of gallium nitride LED at light emitting bonded on quartz substrate under room temperature and scanning electron micrograph of further smaller-size devices.

5. Research Facilities of RISE

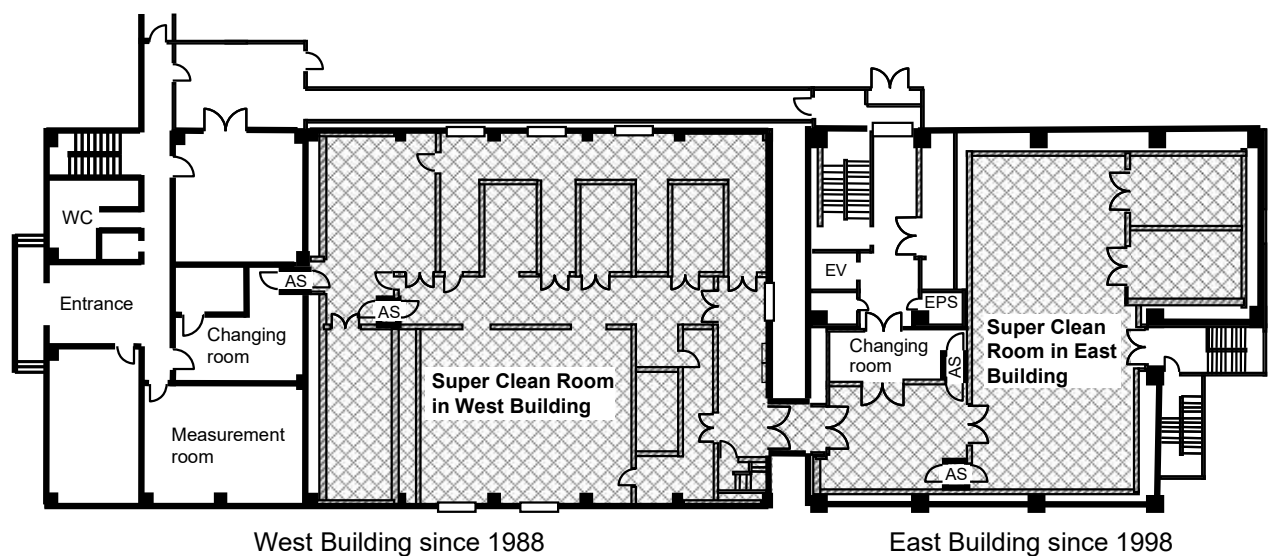
研究設備

5.1 Super clean rooms

スーパークリーンルーム

Super clean rooms, partly class 10 at $0.1\text{-}\mu\text{m}$ particles, are used for fabrication of advanced devices and LSI's.

先端デバイス及び LSI の製作はスーパークリーンルームで行われる。最も清浄度の高いセクションはクラス 10 (1 立方フィート内に $0.1\mu\text{m}$ 以上の粒径の粒子が 10 個以下)である。



Plan view of clean rooms in west and east buildings. The total clean room area measures 830 m^2 . Chemical filters are set in the east clean room to avoid hazardous gases.

西棟及び東棟クリーンルーム平面図。クリーンルーム総面積は 830m^2 。東棟クリーンルームには危険ガス除去用のケミカルフィルターが設置されている。



Super clean room in west building.
西棟スーパークリーンルーム



Super clean room in east building.
東棟スーパークリーンルーム

5.2 Equipment for advanced devices and LSI fabrication

先端デバイス及びLSI作製のための設備

5.2.1 Lithography

リソグラフィー

- ◆ Point-beam type electron beam lithography system (ELIONIX ELS-G100)

ポイントビーム型電子ビーム描画装置
(エリオニクス ELS-G100) Resolution 6nm



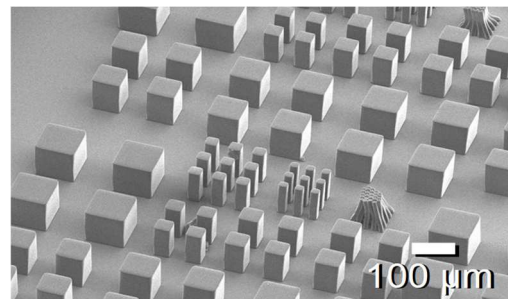
- ◆ Maskless photolithography system (Heidelberg DLA150)

マスクレス露光装置
(ハイデルベルグ DLA150) Resolution 1 μ m



- ◆ Maskless photolithography system (Nanosystem Solutions D-light DL-1000)

マスクレス露光装置 (ナノシステムソリューションズ D-light DL-1000) Resolution 1 μ m



Photoresist patterns by D-light DL-1000.
D-light DL-1000によるレジストパターン

5.2.2 Dry etching

ドライエッチング

- ◆ ICP (Inductively Coupled Plasma) etcher for Si (YOUTEC)

Si用ICP(誘導結合プラズマ)エッチング装置
(ユーテック) Cl_2 , HBr , N_2 , O_2 使用可能



- ◆ Si deep etching system (Sumitomo Precision Products)

Si用深堀りエッチング装置
(住友精密工業) C_4F_6 , SF_6 , Ar 使用可能



- ◆ ICP etcher for SiO_2 (SAMCO)

SiO_2 用ICPエッチング装置
(サムコ) CF_4 , H_2 , O_2 , Ar 使用可能



- ◆ ICP etcher for Al (YOUTEC)

Al用ICPエッチング装置
(ユーテック) Cl_2 , BCl_3 , N_2 使用可能



- ◆ Chemical dry etching system for Si_3N_4 and poly-Si (KOBELCO)

Si_3N_4 及び SiO_2 用ケミカルドライエッチング
装置(神戸製鋼) CF_4 , N_2 , O_2 使用可能



- ◆ Plasma asher for removing photoresist (KOBELCO)

レジスト除去用プラズマアッシング装置
(神戸製鋼) N_2 , O_2 使用可能



◆ RIE Plasma Etching System RIE-200NL
(SAMCO)

SiO₂用RIE装置
サムコ/RIE-200NL



◆ ICP-RIE Plasma Etching System RIE-
400iP (SAMCO)

Si用ICPエッチング装置
サムコ/RIE-400iP



5.2.3 Oxidation, annealing, and doping

酸化、アニール、不純物注入

- ◆ Oxidation and diffusion furnaces (Tokyo Electron)

酸化・拡散炉
(東京エレクトロン) Max. Temp. 1150°C



- ◆ Ion implanter (ULVAC)

高温イオン注入装置 IMax 3500
(アルバック) Al, B, As, P, F 等注入可能



- ◆ RTA (Rapid Thermal Annealing) system (Samco HT-1000)

高速熱処理装置
(サムコ HT-1000) Max. Temp. raise rate 200°C/s



- ◆ Phosphorus diffusion furnaces (SHINKO SEIKI)

リン拡散炉
(神港精機) Max. Temp. 900°C



- ◆ Annealing furnaces for general purpose (Koyo Thermo System)

汎用熱処理装置 H₂, N₂, O₂, Low Pressure
(光洋サーモシステム) Max. Temp. 1000°C



酸化炉講習風景
Training of oxidation

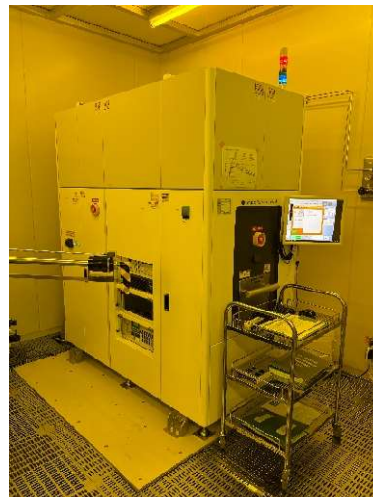
◆ Super High-Temperature Annealing System
(EpiQuest)

超高温活性化アニール装置
エピックエスト



◆ Laser Annealing Equipment
(Sumitomo Heavy Industries)

裏面電極形成用レーザアニーリング装置
住友重機械工業



◆ Lamp Annealing System for Rapid
Thermal Processing (JTEKT)

卓上ランプ加熱装置
ジェイテクトサーモシステム



5.2.4 Dielectric film deposition and epitaxial growth

絶縁膜堆積・エピタキシャル成長

- ◆ Low-pressure chemical vapor deposition (CVD) reactors for SiO₂, SiN, poly-Si(Tokyo Electron)

減圧CVD(化学気相成長)炉 (東京エレクトロン)
SiO₂, SiN, poly-Si堆積可能



- ◆ Atmospheric pressure CVD reactor for SiO₂
Doing of P and B possible (AMAYA)

SiO₂堆積用常圧CVD装置
(天谷製作所) PおよびBドーピング可能



- ◆ Atomic Layer Deposition (ALD) Equipment
(Oxford Instruments)

ALD(原子層堆積)装置
オックスフォード・インストルメンツ



常圧CVDウェハセッティング風景

Wafer setting to atmospheric CVD reactor

- ◆ Atmospheric Pressure CVD System (APCVD) for SiO₂ Deposition (Katagiri Engineering)

SiO₂堆積用常圧CVD装置
片桐エンジニアリング



- ◆ Multi-target Sputtering System
(Kenix)

多元スパッタ装置
ケニックス



5.2.5 Metal deposition

金属薄膜堆積

- ◆ Vacuum evaporation system for variety of metals (Donated: RICOH)

真空蒸着装置 (寄贈:リコー)
Al 等堆積可能



- ◆ Sputtering machine for metal interconnects for Al, Ti, TiN (EIKO)

金属配線用スパッタリング装置
(エイコー) Al, Ti, TiN 堆積可能



- ◆ Sputtering system for general purpose for variety materials (EIKO)

汎用スパッタ装置 (エイコー)
広範な材料堆積



5.2.6 Others

その他



スパッタリング装置ウェハセッティング風景

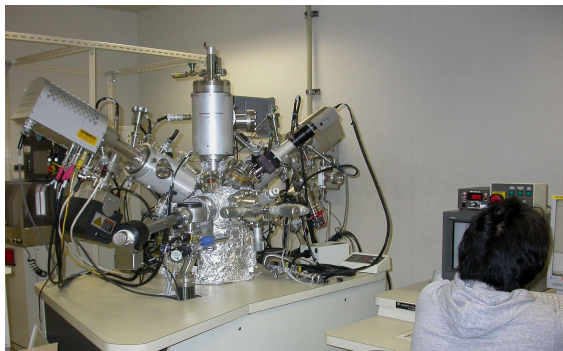
Wafer setting to sputtering machine

5.3 Characterization and diagnostics equipment

評価・分析装置

- ◆ Secondary ion mass spectroscopy (SIMS) system with Cs and O ion gun (ULVAC-PHI PHI-6650)

2次イオン質量分析装置 (アルバック-ファイ
PHI-6650) Cs, Oガン装備



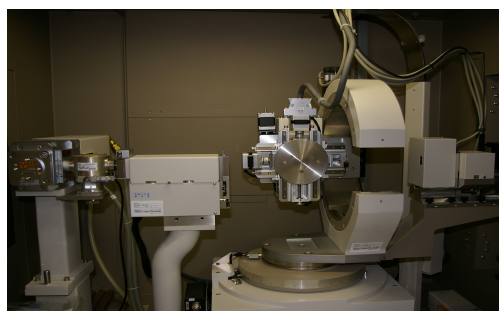
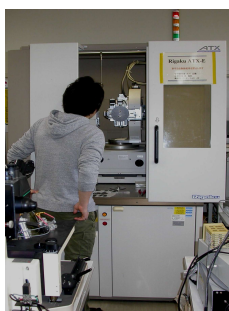
- ◆ Atomic force microscope (AFM) (Seiko Instruments Inc. SPI3800)

原子間力顕微鏡 (セイコーインスツルメンツ
SPI3800) Resolution Z:0.01nm, X, Y:0.1nm



- ◆ High resolution X-ray diffractometer (Rigaku ATX-E)

高解像度X線回折装置
(リガク ATX-E) Angle resolution 0.0002°



- ◆ X-ray diffractometer (Rigaku RINT2100)

X線回折装置
(リガク RINT2100)



◆ Focused ion (Ga) beam (FIB) system
(Hitachi FB-2000)

集束イオン(Ga)ビーム加工装置
(日立 FB-2000) Min. beam diameter 10nm



◆ Spectroscopic ellipsometer
(J.A.Woollam JAPAN M-2000D)

分光エリプソメーター (ジェー・エー・ウーラム・
ジャパン M-2000D) Measurable thickness > 10nm



◆ Hall effect measurement system
(ACCENT HL5500PC)

ホール効果測定装置 (ACCENT HL5500PC)
Input impedance $10^{10} \Omega$



◆ High-resolution X-ray photoelectron spectroscopy
(XPS) system (KRATOS ESCA-3400)

X線光電子分光分析装置
(KRATOS ESCA-3400) X ray source: Mg, Ka



◆ Field emission scanning electron microscope (FE-
SEM) (JEOL Ltd JSM-IT800)

電界放出型走査電子顕微鏡
(日本電子 JSM-IT800)



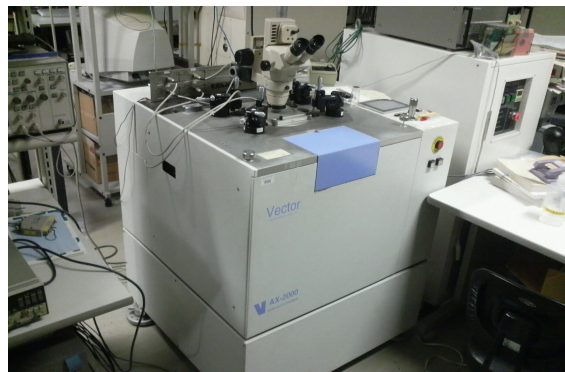
◆ Manual wafer prober (Vector Semiconductor) and semiconductor parameter analyzer (Keithley)

マニュアルプローバー(ベクターセミコン)及び
半導体パラメーターアナライザー(ケースレー)

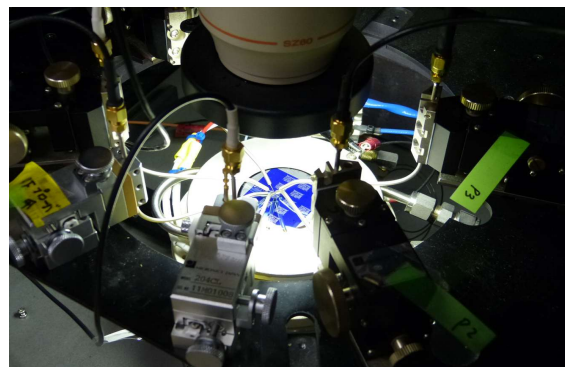


◆ Semi-automatic wafer prober (Vector Semiconductor AX-2000)

セミオートプローバー
(ベクターセミコンAX-2000)



SEMロードロック室へのウェハセッティング風景
Wafer setting to SEM load-lock chamber



マニュアルプローバーによる電気特性測定
Measuring electrical properties using manual prober

◆ X-ray diffraction (XRD)
(Rigaku SmartLab XRD)

薄膜評価用X線回折装置
(リガク SmartLab XRD)



◆ Atomic Force Microscope
(Bruker Dimension Icon)

AFM原子間力顕微鏡(ブルカーDimension Icon)



◆ Scanning X-ray photoelectron spectrometer
(ULVAC-PHI PHI VersaProbe 4)

走査型X線光電子分光分析装置
(アルバック-ファイ PHI VersaProbe 4)



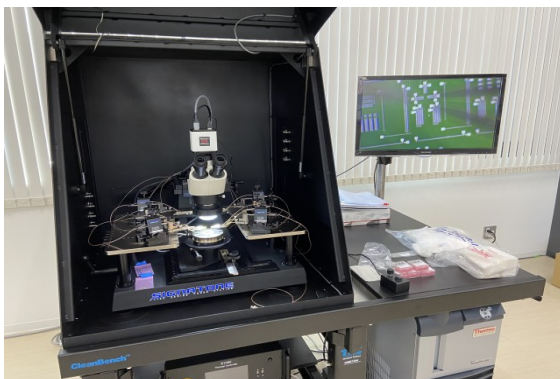
◆ Semi-auto probing system and semiconductor
parameter analyzer (MPITS3000-SE)

セミオートプロービングシステム、及び
半導体パラメータアナライザ(MPITS3000-SE)



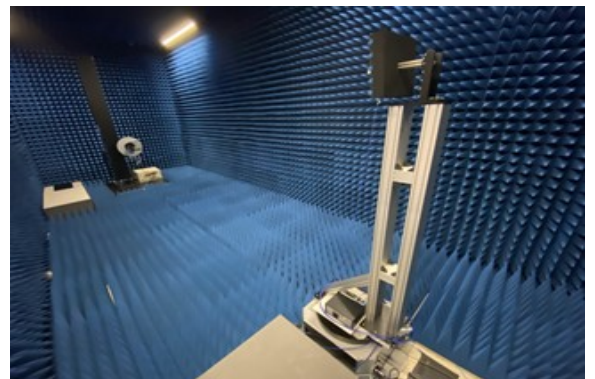
◆ Ic probing system under an extreme environment,
600°C.

600°C超高温プローバ 半導体パラメータアナライザ



◆ Test facility for high-frequency wireless
communication system and devices up to 100GHz

100GHz程度までの高周波通信・デバイス評価設備



6. Lectures, Invited Talks, and Outreach Activities

by Specially Appointed Professor Nahomi Aoto (FY2025)

6.1 High Schools

Year	Date	Institution / Event	Participants
2025	12-Jun	Outreach Lecture at Hiroshima Prefectural Fukuyama Technical High School (Grades 10-12): University Admission, Engineering, and Semiconductors	16
2025	25-Jun	Hiroshima University Information Session for High School Teachers (Higashi-Senda Campus)	18
2025	3-Jul	Outreach Lecture at Hiroshima Prefectural Hiro High School (Grades 10-12): Science, Engineering, and Semiconductors	29
2025	15-Jul	Outreach Lecture at Hiroshima Prefectural Sogo Gijutsu High School (Grade 10): Science, Engineering, and Semiconductors	119
2025	18-Jul	Outreach Lecture at Hiroshima Prefectural Hiroshima High School (Grades 10-12): Science, Engineering, and Semiconductors	13
2025	22-Jul	Online Hiroshima University Information Session for High School Teachers	65
2025	25-Jul	Visit to Hiroshima University by Yasuda Girls' High School (Grades 10-11): Science, Engineering, and Special Admission Program for Women	29
2025	8-Aug	Hiroshima University Open Campus (Research Institute): Science, Engineering, and Semiconductors	30
2025	10-Nov	Outreach Lecture at Hiroshima Municipal Motomachi High School (Grades 10-12): Engineering and Semiconductors	10
2025	19-Nov	Poster Presentation Mentoring for Grade 11 Students at Hiroshima Municipal Motomachi High School	25
2026	12-Feb	Outreach Lecture at Private Jogakuin High School (Grade 10)	220

6.2 National Colleges of Technology (KOSEN)

Year	Date	Institution / Event	Participants
2025	13-May	Kure National College of Technology, Advanced Course (2nd Year): Semiconductor Lecture	8
2025	30-May	Sasebo National College of Technology, Undergraduate and Advanced Course Students: Semiconductor Lecture	20
2025	20-Jun	National Institute of Technology, Toyama College, Advanced Course (1st Year): Semiconductor Lecture (with Prof. Kameda)	11
2025	20-Jun	National Institute of Technology, Toyama College, 3rd-Year Undergraduate Students: Semiconductor Class (with Prof. Kameda)	41
2025	20-Oct	Oshima National College of Maritime Technology, Department of Electronic Mechanical Engineering and Department of Information Engineering: Semiconductor Lecture	85
2025	22-Oct	Kumamoto National College of Technology, Advanced Course (1st Year): Semiconductor Lecture	27
2025	11-Nov	Kurume National College of Technology, 4th-Year Students: Semiconductor Lecture	43
2025	11-Nov	Kurume National College of Technology, Advanced Course Students: Seminar on Semiconductors	40
2025	8-Dec	Hiroshima National College of Maritime Technology, Undergraduate and Advanced Course Students: Semiconductor Lecture	43
2025	9-Dec	Tsuyama National College of Technology, Undergraduate and Advanced Course Students: Semiconductor Lecture (with Prof. Goto)	18
2026	5-Jan	Suzuka National College of Technology, 5th-Year and Advanced Course Students: Semiconductor Lecture	15
2026	8-Jan	Numazu National College of Technology, 5th-Year Students: Semiconductor Lecture and Introduction to Green-niX	200
2026	15-Jan	Matsue National College of Technology, 4th-Year and Advanced Course Students: Semiconductor Lecture (with Prof. Kameda and Associate Prof. Tominaga)	24
2026	22-Jan	Ube National College of Technology, 4th-Year Students: Semiconductor Lecture (with Associate Prof. Kuboki)	38

6.3 Universities

Year	Date	Institution / Course	Participants
2025	26-May	Nagasaki University, Electronic Circuits I (3rd-Year Undergraduate Students)	100
2025	26-May	Hiroshima University, Fundamentals of Semiconductor Devices and Circuits (2nd-Year Undergraduate Students)	100
2025	10-Jun	Tohoku University, Liberal Arts Lecture: Inclusive Society	100
2025	10-Jun	Tohoku University Women's Student Networking Session	25
2025	4-Jul	Hiroshima University, Semiconductors Connecting Hiroshima and the World (1st- and 2nd-Year Undergraduate Students)	80
2025	8-Jul	Okayama University, Introduction to Business Administration (1st-Year Undergraduate Students)	190
2025	12-Sep	Okayama University, Introduction to Advanced Semiconductor Technology (Open Lecture)	100
2025	30-Sep	Okayama University, Advanced Semiconductor Technology (Master's Students/Open Lecture)	15
2025	18-Nov	Kyushu University, Special Topics in Semiconductor Business Strategy	54
2025	1-Dec	Tohoku University, Advanced Topics in Electronic Engineering	70
2025	4-Dec	Hiroshima University, Introduction to Semiconductor Memory Technology (Lecture 1)	35
2025	11-Dec	Hiroshima University Industry-Academia-Government Diversity Promotion Network: Invited Lecture	30

6.4 Academic Societies

Year	Date	Event	Participants
2025	1-Oct	Japan Air Cleaning Association Research Meeting	20
2026	15-Mar	The Japan Society of Applied Physics (JSAP), Diversity & Inclusion and International Affairs Committees Symposium: Speaker and Panel Moderator	80

6.5 Setouchi Advanced Program (Supplementary Lectures)

Year	Date	Event	Participants
2025	24-Jul	Setouchi Advanced Program Supplementary Lecture	45
2025	23-Oct	Setouchi Advanced Program Supplementary Lecture	45
2025	28-Nov	Setouchi Advanced Program Supplementary Lecture	45
2026	20-Feb	Setouchi Advanced Program Supplementary Lecture	45

6.6 Joint Seminar

Year	Date	Event	Participants
2026	5-Mar	Joint Seminar: What Does DEI Mean for Companies	106

6.7 Industry and Professional Associations

Year	Date	Organization / Event	Participants
2025	1-Apr	Air Liquide Japan: DEI Lecture	225
2025	2-Apr	ASM: DEI Lecture	30
2025	6-Jun	Mitsubishi Chemical: Semiconductor Seminar	60
2025	19-Jun	Lam Research: Semiconductor Seminar	30
2025	26-Aug	RORZE Corporation: Semiconductor Seminar	130
2025	11-Sep	SEMI Diversity & Inclusion Study Group: Invited Lecture	20
2025	3-Dec	International Semiconductor Executive Summits (ISES) 2025: Panel Discussion	50
2025	19-Dec	SEMICON Japan 2025 "Women in Business": Panel Discussion	100
2026	3-Feb	Chugoku Bureau of Economy, Trade and Industry & Chugoku Semiconductor Council Seminar: What Does DEI Mean for Companies	173

7. List of Publications

7.1 Nano Device Research

1. H. Kosaka, H. Iwata, R. Shirota, Y. Amemiya, S. Takatani, T. Suwa, and A. Teramoto, " GaN High-Electron-Mobility Transistor with Floating Gate for Accurate Threshold Voltage Control," ECS J. Solid State Sci. Technol. 15 033001, 2026.
2. M. D. Alam, T. Takaoka, T. Komeda, and A. Teramoto, "Organic Molecule-Induced Charge Exchange in MoS₂ FETs: Experimental and Theoretical Insights," ACS Appl. Electron. Mater. 8, pp. 2108–2115, 2026.
3. M. D. Alam, S. Nagata, J. Jang, H. Kosaka, N. Matsunaga, Y. Amamiya, R. Yokogawa, H. Wakabayashi, and A. Teramoto, "Healing Atom Vacancy and Oxidation Suppression in Solution-Processed MoS₂ through Sulfur Vapor Annealing," ACS Appl. Mater. Interfaces 18, pp. 6088–6097, 2026.
4. G. T. Rahman, S. Okugawa, R. Yokogawa, Y. Amemiya, D. Tanaka, and a. Teramoto, "Area-Selective Atomic Layer Deposition of Ruthenium on SiO₂/W Patterns Using Silicon-Based Inhibitors," ECS J. Solid State Sci. Technol. 15 014002, 2026.
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6. J. Jang, S. Imai, N. Matsunaga, S. Ito, K. Teraoka, M.D. Alam, T. Hoshii, K. Kakushima, A. Teramoto, and H. Wakabayashi, "P-Type Doping of Solid-Phase Crystallized PVD-MoS₂ Film Using Nitrogen Annealing Accelerated by Hydrogen," IEEE Journal of the Electron Devices Society, 13, pp.1288-1298, 2025.
7. A. Teramoto, I Shinke, Y. Amemiya, H. Kosaka, and T. Okuno, "Low Metal-GaN Contact Resistance by Using Highly Si Doped n⁺ -GaN," ECS Meeting Abstracts MA2025-02(36), p. 1738.
8. S. Okugawa, G. Rahman, R. Yokogawa, Y. Amemiya and A. Teramoto, "Area Selective Atomic Layer Deposition of Ruthenium on SiO₂ and W," ECS Meeting Abstracts MA2025-02, p. 1605.
9. N. Kuhakongkiat, S. Nagata, A. Suzuki, H. Yamamoto, K. Matsukawa, K. Matsumoto, R. Yokogawa, and A. Teramoto, "Roughness Resistance of Si(551) Surface under Wet Cleaning Evaluation toward Next-Generation CMOS Technologies," The 2025 International Workshop on Dielectric Thin Films for Future Electron Devices: Science and Technology, S3-4, 2025.
10. M. I. Alam, S. Nagata, J. Jang, H. Kosaka, N. Matsunaga, Y. Amemiya, R. Yokogawa, H. Wakabayashi, and A. Teramoto, "Md Iftekharul Alam, Shungo Nagata, Jaehyo Jang, Hayato

- Kosaka, Naoki Matsunaga, Yoshiteru Amemiya, Ryo Yokogawa, Hitoshi Wakabayashi, Akinobu Teramoto," The 2025 International Workshop on Dielectric Thin Films for Future Electron Devices: Science and Technology, S5-05, 2025.
11. C. Watanabe, Y. Miyazaki, J. Tsuchimoto, H. Hatanaka, H. Hosoya, K. Yamanaka, Y. Amemiya, R. Yokogawa and A. Teramoto, "Switching Characteristics of Intermediate State in Magnetic Tunnel Junctions for Multi- Bit Memory Applications", IEDM MRAM Poster Session, No.19, 2025.
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 14. V. T. Ha, T. Meguro, K. Kojima, H. Tanaka, and S. -I. Kuroki, "Designing and Simulations of 4H-SiC Neutron Sensors for Boron Neutron Capture Therapy," ICSCRM2025 (International Conference on Silicon Carbide and Related Materials) , 2025 年 9 月.
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- short channel effects by LDD structure in 4H-SiC n-channel MOSFETs,” ICSCRM2025 (International Conference on Silicon Carbide and Related Materials) , 2025 年 9 月.
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 22. Shin-Ichiro Kuroki, "Semiconductor Research and Education in Hiroshima University" Vietnam–Japan Semiconductor Symposium 2025 (VJSS 2025) ,2025 年 10 月.
 23. Shin-Ichiro Kuroki, “"SiC CMOS Integrated Circuits and Image Sensors for Extreme Environment Applications," OPTIC2025(Optics&Photonics Taiwan International Conference), 2025 年 12 月.
 24. Shin-Ichiro Kuroki, “Research on SiC Extreme Environment Electronics,” IEEE Malaysia Circuits and System Society, Outreach Initiative 2025, 2025 年 12 月
 25. Shin-Ichiro Kuroki, “SILICON CARBIDE CMOS INTEGRATED CIRCUITS AND IMAGE SENSORS FOR EXTREME ENVIRONMENT APPLICATIONS,” VANJ Conference 2025, 2025 年 12 月.
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