The 13th MEMS Engineer Forum (MEF) 2022

SMART Society Driven by MEMS

Program Handout

April 20-21, 2022

KFC Hall, Ryogoku, Tokyo, Japan

MEMS Engineer Forum 2022

SMART Society Driven by MEMS

MEMS Engineer Forum (MEF) 2022 will be held on April 20-21 at KFC Hall in Ryogoku, Tokyo. This will be the first time in two years since 2019 that the event will be held in-person.

MEF is a unique venue operated by engineers among the key players in the field, bringing together MEMS researchers, developers, and engineers from all over the world to look at the current state of MEMS technology, which is considered as key technologies of the 21st century, and the future of the technology through the next decade. The MEF has been held its start in 2009 and regularly 850 participants visit the two-day event each year.

The worldwide fusion and creation of the new movement based on MEMS fundamental, application, and interdisciplinary technology field as well as MEMS markets was followed up by MEMS engineers via excellent vision and skills in the forum.

The 2020 event was abandoned in light of the COVID-19 infection, and the 2021 event was held online. The 2022 event is scheduled to be held in-person at the KFC Hall in both countries, with thorough COVID-19 infection control measures in place.

The MEF has invited 22 speakers from the world's top business management, researchers and technical managers in charge of advanced technology development, government policy makers, venture capitalists, etc. The MEF will hold a technical exhibition concurrently with the lecture sessions.

The MEF will be a forum for engineers to share their unique perspectives and skills in the basic technologies of MEMS and adjacent fields to create new forms and fuse them together. Our mission is to verify the process of fusion and its completion on an international level.

The MEF is supported by exhibitors and sponsors. We would like to thank the 36 exhibitors and 27 sponsors for their support.

The in-person MEF2022 will be held with sufficient COVID-19 measures. The seating in the venue will be laid out with plenty of room to prevent droplet infection. Therefore, the maximum number of participants will be limited to less than 50% of the venue's capacity. We would appreciate your cooperation in registering for this event, as priority will be given to those who are able to come on two consecutive days. Please take note of the following information regarding our management policy and the status of our visitor requests when registering.

MEMS Engineer Forum (MEF)は、21 世紀のコアテクノロジーとされる MEMS 技術の現状と、向こう 10 年までの技術の将来に迫る、この分野のキープレイヤーとなるエンジニアを中心に運営されるユニークな場です。世界中の MEMS 研究者、開発者、技術者が一堂に集う MEF は、2009 年 3 月の初開催以降、回を重ね、MEF2022 で第 13 回を迎えます。

シンポジウムと同時に開催される技術展示会には 36 機関・企業の方のご出展、さらに 27 機関・企業の方にスポンサーとしてご支援を賜る予定です。オンラインの良さを生かして、バーチャルプラットフォームで交流を展開していただけるよう、バーチャルブースツアー、参加者・出展者同士の Web アポイントやメッセージ交換など、ネットワーキングツールをフルに活用します。

MEF は、シンポジウムと併設技術展示会の両輪で、MEMS に関する基礎技術ならびに隣接分野の技術において、エンジニアならではの視点と技量で、新しいカタチを形成し、そして融合させて参ります。さらに融合の過程や完成に向かう姿を国際的なレベルで検証することをミッションとしております。

今回も、世界のトップクラスのビジネスマネージメント、先端技術開発を司る研究者・技術管理職、スタートアップなどの講演者を招聘しております。講演セッション、技術展示、出展者プレゼンテーション、ネットワーキングレセプションなど、すべての機会を通して、技術ならびに事業展開の拡大の議論を深めて頂けますことを願っております。

多くの方々のご参加をお待ちしております。

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	Xinxin Li	Shanghai Institute of Microsystem and Information Technology
	Hiroshi Miyajima	SUMITOMO PRECISION PRODUCTS, Co., Ltd.
	Yutaka Nonomura	Formerly with Meijo University
	Kurt Petersen	Silicon Valley Band of Angels

敬称略　氏名 ABC 順

MEF Organizing Committee
MEF2022 Working Group

MEF Organizing committee formed three working groups to enhance the activities. The leaders and members of the following working group contributed to build up new program schemes with the support from the global notable speakers, exhibitors, and sponsors.

<Program Working Group>

Leader	田中　雅彦	SPP テクノロジーズ株式会社
Member	古賀　章浩	キヤノンメディカルシステムズ株式会社
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Co-leader	石田　博之	ズース・マイクロテック株式会社
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<Program Working Group>

Leader	Masahiko Tanaka	SPP Technologies Co., Ltd.
Member	Akihiro Koga	Canon Medical Systems Corporation
	Taeko Ando	Ritsumeikan University
	Mitsugu Ogiura	Murata Manufacturing Co., Ltd

<Business Working Group>

Co-leader	Hiroyuki Ishida	SUSS MicroTec KK
Co-leader	Koichi Ohtaka	Tohoku University
	Yasuo Hayakawa	ALPSALPINE Co., Ltd.
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Leader	Midori Inako	HOLST Centre Japan
Member	Yuko Akabane	TDC Corporation
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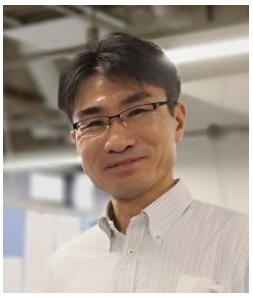
敬称略

Welcome to the 13th MEF

MEF 組織委員長/東北大学 教授　田中　秀治
Shuji Tanaka
MEF Organizing Committee Chair

Professor
Micro Electro Mechanical Systems Lab.
Tohoku University



Welcome to 13th MEMS Engineer Forum (MEF). MEF celebrated 10th anniversary in 2018 and is now recognized as one of the best business development conferences in the field of MEMS.

More than two years have passed since COVID-19 has spread all over the world. We needed to cancel MEF in 2020, and the last year's MEF was held online. MEF 2021 was successful, collecting 941 registrations. However, it was unfortunate that there was less chances for networking because of the limitation of the online format. The benefits of MEF include a plenty of networking chances among attendees as well as lectures on hot topics by excellent invited speakers and the exhibitions of the latest technology by our sponsors/exhibitors. The organizing committee and the international advisory committee continuously discussed how to organize this year's MEF with carefully watching the situation of the pandemic. Finally, we have decided to prepare for the onsite meeting, expecting the progress of booster vaccination and its outcome.

When I am writing this welcome remark, COVID-19 situation is not as expected, and we are not allowed to have MEF in the conventional complete manner. However, we will do the best to create the time and place useful for both updating your knowledge and networking, taking care of disinfection. Please understand that we cannot have a reception party as usual. I sincerely appreciate kind supports, contributions and efforts by our sponsors/exhibitors, speakers, committee members and secretariat team. Without them, there is no success of MEF 2022 in such a difficult situation. Thank you very much.

If you see the program, you can easily notice that there are so many attractive lectures also in this year. I hope that you can feel the dynamism of strongly growing MEMS industry by attending MEF. Please enjoy!

第 13 回 MEMS Engineer Forum（MEF）にご参加くださいまして、ありがとうございます。2018 年に 10 周年を迎えた MEF は、お陰様で世界で最も充実した MEMS 関係のビジネスディベロップメント会議の 1 つになりました。

新型コロナウイルス感染症が世界を覆って、もう 2 年以上になります。2020 年の MEF は残念ながら中止せざるをえず、昨年、第 12 回 MEF はオンライン開催となりました。MEF 2021 は、941 名の方に登録頂き、大きな成功を収めることができましたが、一方でオンラインゆえにネットワーキングの機会は少なかったという声も頂戴しました。MEF の提供する価値には、一流の招待講演者によるホットな話題の講演、スポンサー・展示企業様による最新の技術展示はもちろんのこと、多様なネットワーキングの機会もあります。今回、MEF 2022 をどのような形で開催するのがよいか、組織委員会・国際アドバイザリ委員会の皆様と議論してきました。そして、3 回目のワクチン接種が進み、新型コロナウイルス感染症は落ち着いていくのではないかという希望のもと、現地開催の準備をしてきました。

この文章を書いている時点で、新型コロナウイルス感染症は収まったとは言えず、従来通りの現地開催とはいきませんが、感染予防対策をした上で、情報収取にもネットワーキングにも有益な場を作り出したいと思っています。このような状況ですので、恒例の懇親会は開催できないことをご了承下さい。このような困難な状況の中、MEF 2022 の開催に漕ぎつけられたのは、スポンサー・展示企業様、講師各位、MEF 委員各位、および事務局チーム各位の多大なるご支援・ご協力・ご努力のお陰です。この場を借りて、心より御礼申し上げます。

以下に今年の MEF の見どころをご説明します。今回も他ではなかなか聞けない魅力的な講演を集めました。MEF 2022 に参加することで、力強く発展する MEMS 業界のダイナミズムを感じ取って頂けると確信しています。

【今年の見どころ】

MEMS 分野では､産業として確立したデバイス群が技術的にもビジネス的にも健全に成長を続けるとともに、スタートアップなどを通じてあらたな産業の種が次々として登場しています。これまでと同じように、今年の MEF でも MEMS 分野におけるこれら両方のダイナミズムをカバーします。また、MEMS のサプライチェーンや基盤技術の話題も取り揃えています。

〇MEMS のメインストリーム
慣性センサー、マイクロフォン、圧力センサーなどは代表的な MEMS で、しかも成長を続ける製品群です。STMicroelectronics には新世代の慣性センサープラットフォームの話をして頂きます。本邦初公開です。また、最高性能のマイクロフォンを製造する Infineon Technologies にも講演をお願いしました。Yole Développement からは今年も MEMS の市場動向を解説してもらいます。さらに、元立命館大学の木股雅章先生にはパンデミックで注目される赤外線センサーについて解説して頂きます。スタンフォード大学の Thomas Kenny 先生の講演もお楽しみに。

〇日本の MEMS
日本企業が MEMS 業界で活躍していることは言うまでもありません。多くのプレーヤーの中から、今回は MEMS 光干渉計やマイクロミラーを製造する浜松ホトニクス、光通信用 VOA（Variable Optical Attenuator）や OCT（Optical Coherence Tomography）システムを製造する santec、およびメモリ用半導体プローブカードの大手である日本電子材料に講演をお願いしました。

〇スタートアップ
あらたなデバイスとアプリケーションを生み出す上で、スタートアップの役割はとても重要です。今年も選りすぐりのスタートアップを招待しています。pMUT ベースのパーソナル超音波診断装置を開発する EXO、ボタンレススイッチを実現する超音波タッチセンサーの UltraSense Syetems、ポータブル水再生プラントの WOTA。これらの注目スタートアップの講演は、MEF 以外でなかなか聞くことができないはずです。また、MEMS 分野のスタートアップを俯瞰した講演を、今年も MEMS 業界の重鎮である Kurt Petersen さんにして頂きますが、MEF 2022 を通じて最も注目すべき講演の 1 つになると思います。

〇MEMS ファウンドリ
MEMS スタートアップとペアになるのが MEMS ファウンドリです。最近、MEMS ファウンドリは、圧電 MEMS などの新しいプラットフォーム技術を提供しています。今年は Robert Bosch と Vanguard International Semiconductor に最新の MEMS プラットフォームを紹介して頂きます。

〇バイオ医療 MEMS
MEMS のバイオ医療分野への応用は着実に広がっています。今年は東京大学の佐久間一郎先生に手術支援ロボットシステムに関する特別講演をお願いしています。また、ナノポア DNA シークエンサーを開発されている大阪大学の谷口正輝先生、およびハンドヘルド pMUT 診断装置を開発する EXO の創業者でもある Janusz Bryzek さんの講演にも注目です。

〇基盤技術
プロセスツールは MEMS の基盤技術として最も重要なものの 1 つです。最近、接合技術が注目を集めていますが、接合装置の大手である EVG Group から最新技術を紹介してもらいます。また、SPTS Technologies からは注目を集める圧電材料 ScAlN のドライエッチング技術について講演して頂きます。エッジコンピューティングの 1 つとして、センサーに機械学習機能を搭載する動きが活発ですが、tiny ML Foundation による講演でその最新動向を掴んでください。産業界向けに新しい基盤技術を開発するオランダ・HOLST Center とフランス・CEA-Leti からの講演もお楽しみに。

〇SDG に関する特別講演
MEMS 業界を代表する企業である Robert Bosch の日本法人・ボッシュの Klaus Meder 社長から、同社における SDGs への対応についてお話をして頂きます。

〇パネルディスカッション
MEF 名物のパネルディスカッションを今年も開催します。例年、グランドフィナーレとしてパネルディスカッションを行ってきましたが、海外からのパネラーにオンライン参加頂くことから、時差を考慮し、2 日目の午前中に行います。テーマは「What are the new areas for MEMS innovation and new MEMS Products?」です。モデレーターはおなじみの神永晉さん、パネラーは Kurt Petersen さん、Thomas Kenny 先生（スタンフォード大学）、Weileun Fang 先生（国立清華大学）、Klaus Meder さん（ボッシュ）、Gerog Bischopink さん（Robert Bosch）です。乞うご期待！

〇展示会と Exhibitors' Presentation
出展企業による展示とプレゼンテーションは、講演と並ぶ MEF のメインディッシュです。このような難しい状況の中、今年も多くの企業に出展頂きました。Exhibitors' Presentation では、各企業が選りすぐりの情報を短時間にギュッと凝縮して発表しますので、効率よく最新の情報を収集できます。今年は質疑応答時間も確保していますので、プレゼンターと質問者のやり取りの中から、とっておきの話が聞けるかもしれません。

Venue Layout

3F: KFC Hall (Main seminar room) & Annex/Foyer (Exhibition)
Registration desk in Foyer

10F　Room 101-103 (Satellite seminar room)

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4 大学ナノ・マイクロファブリケーションコンソーシアム
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電気学会センサ・マイクロマシン部門
MEMS パークコンソーシアム(MEMS PC)
一般財団法人マイクロマシンセンター
一般社団法人エレクトロニクス実装学会
東京大学　三宅研究室
東北大学マイクロシステム融合研究開発センター(μSIC)
東北大学 田中（秀）研究室

★Regular Exhibitors

Adeia (Xperi)
ADVANCED TECHNOLOGIES CO., LTD.
ASML Japan Co., Ltd.
Crestec Corportaion
Heidelberg Instruments KK
HiSOL, Inc.
KOKEN LTD
KOKUSAI ELECTRIC CORPORATION
Kyodo International, Inc.
MARUBENI INFORMATION SYSTEMS Co., Ltd.
MEMS CORE CO.,Ltd
MIRISE Technologies Corporation
Murata Manufacturing Co., LTD.
Nisshinbo Micro Devices Inc.
Polytec Japan
ROHM Co., Ltd.
SAKAGUCHI E.H VOC CORP.
SHINKO ELECTRIC INDUSTRIES CO., LTD.
SK Global Advisers Co., Ltd.
SPP Technologies Co., Ltd.
SUMITOMO PRECISION PRODUCTS, CO., LTD.
SUSS MicroTec KK/Kanematsu PWS LTD.
TDC Corporation
Ushio Inc.

★Start-up Exhibitors

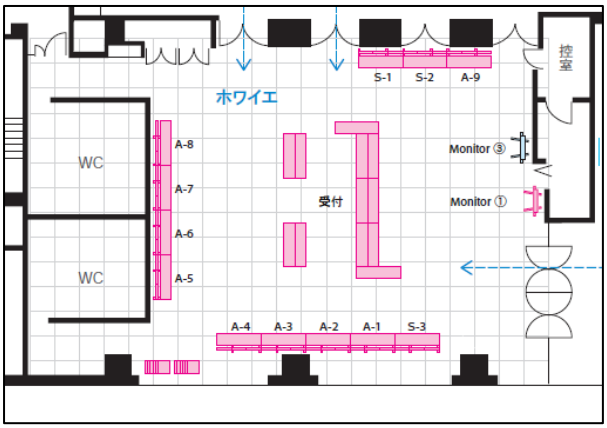
BMF Japan Inc.
Instistute of Microchemical Technology
Touchence Inc.

★Academia Exhibitors

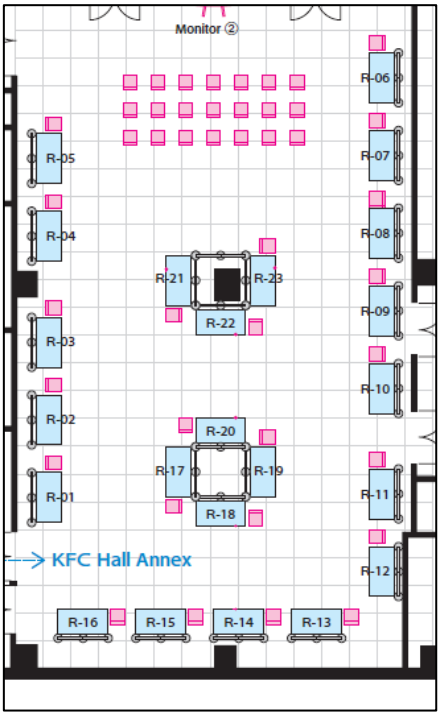
4-University Nano/Micro Fabrication Consortium
CEA-Leti
IEEJ Sensors and Micromachines
MEMS PARK CONSORTIUM
Micromachine Center
The Japan Institute of Electronics Packaging
The University of Tokyo - Miyake Lab
Tohoku University - Micro System Integration Center
Tohoku University Tanaka Shuji Laboratory

MEF 2022 Booth Location

Foyer(3F)



Annex (3F)



Booth #	機関名	Affiliation
R-01	住友精密工業株式会社	SUMITOMO PRECISION PRODUCTS, CO.,LTD.
R-02	株式会社ミライズテクノロジーズ	MIRISE Technologies Corporation
R-03	株式会社アドバンストテクノロジー	ADVANCED TECHNOLOGIES CO.,LTD.
R-04	協同インターナショナル	Kyodo International, Inc.
R-05	丸紅情報システムズ株式会社	MARUBENI INFORMATION SYSTEMS Co., Ltd.
R-06	ハイソル株式会社	HiSOL, Inc.
R-07	興研株式会社	KOKEN LTD
R-08	ポリテックジャパン株式会社	Polytec Japan
R-09	ズース・マイクロテック株式会社 / 兼松PWS株式会社	SUSS MicroTec KK/Kanematsu PWS LTD.
R-10	エーエスエムエル・ジャパン株式会社	ASML Japan Co., Ltd.
R-11	株式会社クレステック	Crestec Corportaion
R-12	Adeia (Xperi)	Adeia (Xperi)
R-13	株式会社メムス・コア	MEMS CORE CO.,Ltd
R-14	株式会社KOKUSAI ELECTRIC	KOKUSAI ELECTRIC CORPORATION
R-15	新光電気工業株式会社	SHINKO ELECTRIC INDUSTRIES CO., LTD.
R-16	SKグローバルアドバイザーズ株式会社	SK Global Advisers Co., Ltd.
R-17	株式会社ティ・デイ・シー	TDC Corporation
R-18	株式会社村田製作所	Murata Manufacturing Co., LTD.
R-19	日清紡マイクロデバイス株式会社	Nisshinbo Micro Devices Inc.
R-20	ローム株式会社	ROHM Co., Ltd.
R-21	ハイデルベルグ・インストルメンツ株式会社	Heidelberg Instruments KK
R-22	坂口電熱株式会社	SAKAGUCHI E.H VOC CORP.
R-23	SPPテクノロジーズ株式会社	SPP Technologies Co., Ltd.
	ウシオ電機株式会社	Ushio Inc.
V-1	タッチエンス株式会社	Touchence Inc.
V-2	BMF Japan株式会社	BMF Japan Inc.
V-3	マイクロ化学技研株式会社	Institute of Microchemical Technology
A-1	4大学ナノ・マイクロファブリケーションコンソーシアム	4-University Nano/Micro Fabrication Consortium
A-2	東京大学　三宅研究室	The University of Tokyo - Miyake Lab
A-3	一般社団法人エレクトロニクス実装学会	The Japan Institute of Electronics Packaging
A-4	（一財）マイクロマシンセンター	Micromachine Center
A-5	電気学会センサ・マイクロマシン部門	IEEJ Sensors and Micromachines
A-6	東北大学 田中（秀）研究室	Tohoku University Tanaka Shuji Laboratory
A-7	MEMSパークコンソーシアム(MEMS PC)	MEMS PARK CONSORTIUM
A-8	東北大学マイクロシステム融合研究開発センター(μSIC)	Tohoku University - Micro System Integration Center
A-9	CEA-Leti	CEA-Leti

MEF 2022 Program Schedule

Wednesday, April 20, 2022 (JST, UTC+0900)

09:10-09:20 Opening Remarks
Prof. Shuji Tanaka
Chairperson of MEF Executive Committee, Professor, Tohoku University

09:20-10:25 Session: New Areas for MEMS Innovation 1 - Biomedical -
Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.

09:20-10:00 Keynote speech: Exponential Disruption of Medical Imaging
Dr. Janusz Bryzek, Co-Founder and Executive Board Chairman
EXO, USA

10:00-10:25 Invited Speech: Commercialization of an AI-nanopore Platform to Revolutionize Inspection Systems
Prof. Masateru Taniguchi, Professor, SANKEN, Osaka University, Japan

10:25-10:35 Break

10:35-11:50 Session: Main Stream of MEMS 1
Chaired by: Mitsugu Ogiura/Murata Manufacturing Co., Ltd

10:35-11:00 Invited Speech: tinyML Solution for New Data Driven World
Dr. Evgeni Gousev, Senior Director, Qualcomm AI Research
and Chairman, Board of Directors, tinyML Foundation, USA

11:00-11:25 Invited Speech: Near-infrared spectrometer using MOEMS technology
Ms. Anna Yoshida, Section Chief, MEMS, Solid state division
Hamamatsu Photonics K.K., Japan

11:25-11:50 Invited Speech: Development of OCT products by using MEMS technology
Dr. Keiji Isamoto, Executive officer, President of OIS company
santec corporation, Japan

11:50-12:40 Lunch Break

12:40-13:40 Exhibitors' presentation & Exhibit Hour
Chaired by: Sadaharu Takimoto/Hamamatsu Photonics
TDC Corporation
ROHM Co., Ltd.
ADVANCED TECHNOLOGIES CO., LTD.
SUSS MicroTec KK/Kanematsu PWS LTD.
Adeia (Xperi)
BMF Japan

13:40-15:05 Exhibit Hour

15:05-15:55 Session: Main Stream of MEMS 2
Chaired by: Nobuaki Kawahara/Denso Corporation

15:05-15:30 Invited Speech: Bosch MEMS Foundry
Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

15:30-15:55 Invited Speech: MEMS Development and Fabrication During the Current Challenging Time

Dr. Rakesh Chand Tripathi, MTS-MEMS(TD)
Vanguard International Semiconductor Corporation, Singapore

15:55-16:05 Break

16:05-17:05 Exhibitors' Presentation & Exhibit Hour

Chaired by: Yasuo Hayakawa/AlpsAlpine

Touchence Inc.
Kyodo International, Inc.
SPP Technologies Co., Ltd.
MARUBENI INFORMATION SYSTEMS Co., Ltd.
Ushio Inc.

17:05-17:15 Break

17:15-18:30 Session: New Areas for MEMS Innovation 2

Chaired by: Hiroshi Miyajima/SUMITOMO PRECISION PRODUCTS, CO., LTD.

17:15-17:40 Invited Speech: What is the fuel that will propel the MEMS market growth?
Dr. Dimtros Damianos, Senior Analyst, Photonics & Sensing Division,
Yole Développement, France

17:40-18:05 Invited Speech: Large-Area Sensing Surfaces and Human Machine Interfaces Enabled by Hybrid Printed Electronics
Dr. Peter Zalar, HOLST Centre, The Netherlands

18:05-18:30 Invited Speech: MEMS technologies in an ever more demanding world
Dr. Samer Dagher, Research Engineer, Department of Silicon Components,
CEA-Leti, France

Thursday, April 21 (JST, UTC+9)

08:40-08:45 The 2nd Day Opening Remarks
Mr. Masahiko Tanaka, MEF Steering Committee
Program Working Group Leader
SPP Technologies Co., Ltd., Japan

08:45-09:50 Special Session: Environmental Technology

Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.

08:45-09:25 Special Lecture: The climate neutral company - How Bosch has become carbon neutral by 2020 and where to go further
Mr. Klaus Meder, President and Representative Director
Bosch Corporation, Japan

09:25-09:50 Invited Speech: Application of Sensing Technology in Small-scale Decentralized Water Recycling System
Mr. Shohei Okudera, Director, WOTA CORP., Japan

09:50-10:00 Break

10:00-11:05 Session: New Areas for MEMS Innovation 3 and Panel Discussion

Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.

10:00-10:40 Keynote Speech: The Impact of Key New Technologies and Capabilities on the Future of MEMS

Dr. Kurt Petersen, Silicon Valley Band of Angels, USA

10:40-11:05 Invited Speech: Lessons Learned from 10+ Years of Epi-Seal Fabrication Runs at Stanford

Prof. Thomas Kenny, Professor, Stanford University, USA

11:05-12:05 Panel Discussion:

What are the New areas for MEMS Innovation and New MEMS Products?

Moderator: Mr. Susumu Kaminaga, Executive Senior Advisor
SPP Technologies Co., Ltd., Japan

Panelists:
Dr. Kurt Petersen, Silicon Valley Band of Angels, USA
Prof. Thomas Kenny, Professor, Stanford University, USA
Prof. Weileun Fang, NTHU Chair Professor, Power Mech. Eng. Department, National Tsing Hua University, Taiwan
Mr. Klaus Meder, President and Representative Director
Bosch Corporation, Japan
Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

12:05-12:50 Lunch Time

12:50-13:30 Special Session: Medical Robotics

Chaired by: Akihiro Koga/Canon Medical Systems Corporation

12:50-13:30 Special lecture: Integration of Bio-Mechatronics, Biomedical Instrumentation, and Bioscience for Minimally Invasive Therapies

Prof. Ichiro Sakuma, Director, Research Institute for Biomedical Science and Engineering, Professor, Medical Device Development and Regulation Research Center, Department of Bioengineering, Department of Precision Engineering. School of Engineering, The University of Tokyo

13:30-13:55 Session: Main Stream of MEMS 3

Chaired by: Akihiro Koga/Canon Medical Systems Corporation

13:30-13:55 Invited Speech: AI Enabled Touch User Interface for Smart Surfaces

Mr. Mo Maghoudnia, Founder/CEO, UltraSense Systems Inc., USA

13:55-14:55 Exhibitors' presentation & Exhibit Hours

Chaired by: Hiroyuki Ishida/Suss Microtec

SAKAGUCHI E.H VOC CORP.
ASML Japan Co., Ltd.
Polytec Japan
Nisshinbo Micro Devices Inc.
SHINKO ELECTRIC INDUSTRIES CO., LTD.
SUMITOMO PRECISION PRODUCTS CO., LTD.

14:55-15:30 Exhibit Hour Exhibition ends at 15:30

15:30-16:45 Session: Main Stream of MEMS 4

Chaired by: Akihiro Koga/Canon Medical Systems Corporation and Yasuo Hayakawa/AlpsAlpine

15:30-15:55 Invited Speech: Improving the performance of intelligent MEMS motion sensors with ST's new Thelma Double technology
Mr. Giorgio Allegato, Technology Development Manager, Analog, MEMS & Sensors Group, STMicroelectronics, Italy

15:55-16:20 Invited Speech: Uncooled Infrared Focal Plane Arrays
Dr. Masafumi Kimata, Formerly Ritsumeikan University, Japan

16:20-16:45 Invited Speech: How context awareness can help to further extent battery lifetime in TWS
Dr. Gunar Lorenz, Senior Director, Technical Marketing Sensor
Infineon Technologies AG, Germany

16:45-16:55 Break

16:55-18:15 Session: Core Equipment Technology for MEMS

Chaired by: Taeko Ando/Ritsumeikan University

16:55-17:20 Invited Speech: Probe cards with MEMS probes
Ms. Sachiko Hattori, Senior Specialist, MEMS Division
JAPAN ELECTRONIC MATERIALS CORPORATION, Japan

17:20-17:45 Invited Speech: Wafer bonding for 3D/Heterogeneous integration application
Mr. Hiroshi Yamamoto, Representative Director
EV Group Japan K.K., Japan

17:45-18:10 Invited Speech: Etch Challenges and Solutions for Highly Doped AlScN Films used in PiezoMEMS Applications
Mrs. Joanne Carpenter, Senior Product Manager - Etch
SPTS Technologies Ltd., U.K.

18:10-18:15 Closing Ceremony

18:10-18:15 Closing Remarks
Prof. Ryo Miyake, Vice Chair of MEF Steering Committee
Professor, The University of Tokyo

MEF 2022 プログラムスケジュール

Wednesday, April 20, 2022 (JST, UTC+0900)

09:10-09:20 Opening Remarks
Prof. Shuji Tanaka
Chairperson of MEF Executive Committee, Professor, Tohoku University
開会の辞　MEF 組織委員会委員長
東北大学　大学院 工学研究科 ロボティクス専攻　教授　田中 秀治氏

09:20-10:25 Session: New Areas for MEMS Innovation 1 - Biomedical -
Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.
田中　雅彦氏（SPP テクノロジーズ株式会社）

09:20-10:00 Keynote speech: Exponential Disruption of Medical Imaging
Dr. Janusz Bryzek, Co-Founder and Executive Board Chairman
EXO, USA

10:00-10:25 Invited Speech: Commercialization of an AI-nanopore Platform to Revolutionize Inspection Systems
Prof. Masateru Taniguchi, Professor, SANKEN, Osaka University, Japan
検査システムを革新する AI ナノポアプラットフォームの事業化
大阪大学　産業科学研究所 教授　谷口 正輝氏

10:25-10:35 Break

10:35-11:50 Session: Main Stream of MEMS 1
Chaired by: Mitsugu Ogiura/Murata Manufacturing Co., Ltd
荻浦　美嗣氏（株式会社村田製作所）

10:35-11:00 Invited Speech: tinyML Solution for New Data Driven World
Dr. Evgeni Gousev, Senior Director, Qualcomm AI Research
and Chairman, Board of Directors, tinyML Foundation, USA

11:00-11:25 Invited Speech: Near-infrared spectrometer using MOEMS technology
Ms. Anna Yoshida, Section Chief, MEMS , Solid state division
Hamamatsu Photonics K.K., Japan
MOEMS 技術を用いた近赤外分光器
浜松ホトニクス株式会社　固体事業部　MEMS 部　専任部員　吉田 杏奈氏

11:25-11:50 Invited Speech:Development of OCT products by using MEMS technology
Dr. Keiji Isamoto, Executive officer, President of OIS company
santec corporation, Japan
MEMS 技術を用いた OCT 技術の開発
Santec 株式会社　執行役員、OIS カンパニー長 諫本 圭史氏

11:50-12:40 Lunch Break

12:40-13:40 Exhibitors' presentation & Exhibit Hour

Chaired by: Sadaharu Takimoto/Hamamatsu Photonics
瀧本 貞治氏（浜松ホトニクス）

TDC Corporation　株式会社ティ・デイ・シー
ROHM Co., Ltd.　ローム株式会社
ADVANCED TECHNOLOGIES CO.,LTD.　株式会社アドバンストテクノロジー
SUSS MicroTec KK/Kanematsu PWS LTD.
ズース・マイクロテック株式会社 / 兼松 PWS 株式会社
Adeia (Xperi)
BMF Japan

13:40-15:05 Exhibit Hour

15:05-15:55 Session: Main Stream of MEMS 2

Chaired by: Nobuaki Kawahara/Denso Corporation
川原　伸章氏（株式会社デンソー）

15:05-15:30 Invited Speech: Bosch MEMS Foundry
Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

15:30-15:55 Invited Speech: MEMS Development and Fabrication During the Current Challenging Time
Dr. Rakesh Chand Tripathi, MTS-MEMS(TD)
Vanguard International Semiconductor Corporation, Singapore

15:55-16:05 Break

16:05-17:05 Exhibitors' Presentation & Exhibit Hour

Chaired by: Yasuo Hayakawa/AlpsAlpine
早川 康男氏（アルプスアルパイン）

Touchence Inc.　タッチエンス株式会社
Kyodo International, Inc.　協同インターナショナル
SPP Technologies Co., Ltd.　SPP テクノロジーズ株式会社
MARUBENI INFORMATION SYSTEMS Co., Ltd.　丸紅情報システムズ株式会社
USHIO Inc.　ウシオ電機株式会社

17:05-17:15 Break

17:15-18:30 Session: New Areas for MEMS Innovation 2

Chaired by: Hiroshi Miyajima/SUMITOMO PRECISION PRODUCTS, CO., LTD.
宮島　博志氏（住友精密工業株式会社）

17:15-17:40 Invited Speech: What is the fuel that will propel the MEMS market growth?
Dr. Dimtros Damianos, Senior Analyst, Photonics & Sensing Division, Yole Développement, France

17:40-18:05 Invited Speech: Large-Area Sensing Surfaces and Human Machine Interfaces Enabled by Hybrid Printed Electronics
Dr. Peter Zalar, HOLST Centre, The Netherlands

18:05-18:30 Invited Speech: MEMS technologies in an ever more demanding world
Dr. Samer Dagher, Research Engineer, Department of Silicon Components, CEA-Leti, France

Thursday, April 21 (JST, UTC+9)

08:40-08:45 The 2nd Day Opening Remarks
Mr. Masahiko Tanaka, MEF Steering Committee
Program Working Group Leader
SPP Technologies Co., Ltd., Japan
田中　雅彦氏（SPP テクノロジーズ株式会社）

08:45-09:50 Special Session: Environmental Technology
Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.
田中　雅彦氏（SPP テクノロジーズ株式会社）

08:45-09:25 Special Lecture: The climate neutral company - How Bosch has become carbon neutral by 2020 and where to go further
Mr. Klaus Meder, President and Representative Director
Bosch Corporation, Japan

09:25-09:50 Invited Speech: Application of Sensing Technology in Small-scale Decentralized Water Recycling System
Mr. Shohei Okudera, Director, WOTA CORP., Japan
小規模分散型水循環システムにおけるセンシング技術の活用
WOTA 株式会社　取締役　奥寺 昇平氏

09:50-10:00 Break

10:00-11:05 Session: New Areas for MEMS Innovation 3 and Panel Discussion
Chaired by: Masahiko Tanaka/SPP Technologies Co., Ltd.
田中　雅彦氏（SPP テクノロジーズ株式会社）

10:00-10:40 Keynote Speech: The Impact of Key New Technologies and Capabilities on the Future of MEMS
Dr. Kurt Petersen, Silicon Valley Band of Angels, USA

10:40-11:05 Invited Speech: Lessons Learned from 10+ Years of Epi-Seal Fabrication Runs at Stanford.
Prof. Thomas Kenny, Professor, Stanford University, USA

11:05-12:05 Panel Discussion:
What are the New areas for MEMS Innovation and New MEMS Products?
MEMS イノベーションのための新しい領域と新しい MEMS 製品は何か？
Moderator:
Mr. Susumu Kaminaga, Executive Senior Advisor
SPP Technologies Co., Ltd., Japan
SPP テクノロジーズ株式会社エグゼキュティブシニアアドバイザー
神永 晉氏
Panelists:
Dr. Kurt Petersen, Silicon Valley Band of Angels, USA
Prof. Thomas Kenny, Professor, Stanford University, USA
Prof. Weileun Fang, NTHU Chair Professor, Power Mech. Eng. Department, National Tsing Hua University, Taiwan

Mr. Klaus Meder, President and Representative Director
Bosch Corporation, Japan
Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

12:05-12:50 Lunch Time

12:50-13:30 Special Session: Medical Robotics

Chaired by: Akihiro Koga/Canon Medical Systems Corporation
古賀　章浩氏（キヤノンメディカルシステムズ株式会社）

12:50-13:30 Special Lecture: Integration of Bio-Mechatronics, Biomedical Instrumentation, and Bioscience for Minimally Invasive Therapies
Prof. Ichiro Sakuma, Director, Research Institute for Biomedical Science and Engineering, Professor, Medical Device Development and Regulation Research Center, Department of Bioengineering, Department of Precision Engineering. School of Engineering, The University of Tokyo
低侵襲治療のためのバイオメカトロニクス，生体計測，生命科学の統合
東京大学　臨床生命医工学連携機構 機構長、大学院工学系研究科
医療福祉工学開発評価研究センター　教授　佐久間 一郎氏

13:30-13:55 Session: Main Stream of MEMS 3

Chaired by: Akihiro Koga/Canon Medical Systems Corporation
古賀　章浩氏（キヤノンメディカルシステムズ株式会社）

13:30-13:55 Invited Speech: AI Enabled Touch User Interface for Smart Surfaces
Mr. Mo Maghoudnia, Founder/CEO, UltraSense Systems Inc., USA

13:30-14:30 Exhibitors' presentation & Exhibit Hours

Chaired by: Hiroyuki Ishida/Suss Microtec
石田 博之氏（ズース・マイクロテック）

SAKAGUCHI E.H VOC CORP.	坂口電熱株式会社
ASML Japan Co., Ltd.	エーエスエムエル・ジャパン株式会社
Polytec Japan	ポリテックジャパン株式会社
Nisshinbo Micro Devices Inc.	日清紡マイクロデバイス株式会社
SHINKO ELECTRIC INDUSTRIES CO., LTD.	新光電気工業株式会社
SUMITOMO PRECISION PRODUCTS CO., LTD.	住友精密工業株式会社

14:30-15:30 Exhibit Hour Exhibition ends at 15:30

15:30-16:45 Session: Main Stream of MEMS 4

Chaired by: Akihiro Koga/Canon Medical Systems Corporation and Yasuo Hayakawa/AlpsAlpine
古賀　章浩氏（キヤノンメディカルシステムズ株式会社）
早川 康男氏（アルプスアルパイン）

15:30-15:55 Invited Speech: Improving the performance of intelligent MEMS motion sensors with ST's new Thelma Double technology
Mr. Giorgio Allegato, Technology Development Manager, Analog, MEMS & Sensors Group, STMicroelectronics, Italy

15:55-16:20 Invited Speech: Uncooled Infrared Focal Plane Arrays
Dr. Masafumi Kimata, Formerly Ritsumeikan University, Japan
非冷却赤外線イメージセンサ
元立命館大学 木股 雅章氏

16:20-16:45 Invited Speech: How context awareness can help to further extent battery lifetime in TWS
Dr. Gunar Lorenz, Senior Director, Technical Marketing Sensor
Infineon Technologies AG, Germany

16:45-16:55 Break

16:55-18:15 Session: Core Equipment Technology for MEMS
Chaired by: Taeko Ando/Ritsumeikan University
安藤　妙子氏（立命館大学）

16:55-17:20 Invited Speech: Probe cards with MEMS probes
Ms. Sachiko Hattori, Senior Specialist, MEMS Division
JAPAN ELECTRONIC MATERIALS CORPORATION, Japan
MEMS プローブカード
日本電子材料株式会社 シニアスペシャリスト／MEMS 統括　服部 佐知子氏

17:20-17:45 Invited Speech: Wafer bonding for 3D/Heterogeneous integration application
Mr. Hiroshi Yamamoto, Representative Director
EV Group Japan K.K., Japan
最新接合技術による 3D およびヘテロ集積化
イーヴィグループジャパン株式会社 代表取締役 山本 宏氏

17:45-18:10 Invited Speech: Etch Challenges and Solutions for Highly Doped AlScN Films used in PiezoMEMS Applications
Mrs. Joanne Carpenter, Senior Product Manager - Etch
SPTS Technologies Ltd., U.K.

18:10-18:15 Closing Remarks
Prof. Ryo Miyake, Vice Chair of MEF Steering Committee
Professor, The University of Tokyo
閉会の辞 MEF 組織委員長副委員長
東京大学 大学院工学系研究科 バイオエンジニアリング専攻　教授 三宅 亮氏

MEF 2022 Exhibitor Presentation

Date/Time	#	Affiliation	Presentatioin Title	Presenter
April 20, 2022		**Exhibitors Presentation Session Chaired by: Sadaharu Takimoto/Hamamatsu Photonics**		
12:40-13:40	1	TDC Corporation	Ultra Precise Polishing Service ~Plasma-Assisted Polishing~	Chisato Maeda
	2	ROHM Co., Ltd.	ROHM Group Technology Synergies Enable Innovative Products	Takashi Naiki
	3	ADVANCED TECHNOLOGIES CO.,LTD.	Introduction of the latest case studies/trends of IntelliSuite, Total MEMS Solutions	Hirade Ryuichi
	4	SUSS MicroTec KK/Kanematsu PWS LTD.	SUSS MICROTEC“GREEN” WAFER CLEANER AND INKJETPRINTER FOR MEMS APPLICATIONS	Hiroyuki Ishida
	5	Adeia (Xperi)		Abul Nuruzzaman
	6	BMF Japan	Application of PμSL 3D Printing inResearch and Fabrication in Laboratory	Junhui Lu (June)
April 20, 2022		**Exhibitors Presentation Session Chaired by: Yasuo Hayakawa/AlpsAlpine**		
16:05-17:05	1	Touchence Inc.	actile sensors based on MEMS technology	Naoya Maruyama
	2	Kyodo International, Inc.	Introduction of MEMS foundry & Micro-Nanofabrication Prototyping service, and Polymer MEMS	Toshinori Ichijo
	3	SPP Technologies Co., Ltd.	MEMS Manufacturing Equipment of SPP Technologies	Tsuyoshi Fujimura
	4	MARUBENI INFORMATION SYSTEMS Co., Ltd.	Surface activated bonding system	Hirotaka Takeda
	5	Ushio Inc.	Full projection field aligner Introduction for UX-4 series	Masato Kaneda
April 21, 2022		**Exhibitors Presentation Session Chaired by: Hiroyuki Ishida/Suss Microtec**		
13:55-14:55	1	SAKAGUCHI E.H VOC CORP.	Atomic-Antialiasing Annealing Minimal Fab Tool	Kengo Hamada
	2	ASML Japan Co., Ltd.	ASML products and services for MEMS market	Yuji Takai
	3	Polytec Japan	Visualization of dynamic response of capped MEMS	Francois Bouteille
	4	Nisshinbo Micro Devices Inc.	Smart sensing module design technologies of Nisshinbo Micro Devices	Takashi OMICHI
	5	SHINKO ELECTRIC INDUSTRIES CO., LTD.	Introduction of Sensing Edge Device	Horiuchi Takuya
	6	SUMITOMO PRECISION PRODUCTS CO., LTD.	"MEMS Solutions" in Sumitomo Precision Group	Hiroshi Miyajima

Date/Time	#	所属機関名	プレゼンテーションタイトル	プレゼンター
April 20, 2022		**Exhibitors Presentation Session Chaired by: Sadaharu Takimoto/Hamamatsu Photonics 瀧本 貞治氏（浜松ホトニクス）**		
12:40-13:40	1	株式会社ティ・デイ・シー	超精密研磨加工～プラズマ援用研磨～	前田 知里
	2	ローム株式会社	ROHM Group Technology Synergies Enable Innovative Products	内貴 崇
	3	株式会社アドバンストテクノロジー	MEMS用統合解析ツールIntelliSuiteの最新事例と動向の紹介	平出 隆一
	4	ズース・マイクロテック株式会社／兼松PWS株式会社	SUSS MICROTEC“GREEN” WAFER CLEANER AND INKJETPRINTER FOR MEMS APPLICATIONS	石田 博之
	5	Adeia (Xperi)		Abul Nuruzzaman
	6	BMF Japan	Application of PμSL 3D Printing inResearch and Fabrication in Laboratory	Junhui Lu (June)
April 20, 2022		**Exhibitors Presentation Session Chaired by: Yasuo Hayakawa/AlpsAlpine 早川 康男氏（アルプスアルパイン）**		
16:05-17:05	1	**タッチエンス株式会社**	MEMS技術による触覚センサ	丸山 尚哉
	2	協同インターナショナル	MEMSファウンドリ及びマイクロ・ナノファブリケーションサービス、及びポリマーMEMSの紹介	一條　智義
	3	SPPテクノロジーズ株式会社	SPPテクノロジーズのMEMS製造装置	藤村 剛
	4	丸紅情報システムズ株式会社	表面活性化接合装置	武田 弘高
	5	ウシオ電機株式会社	一括プロジェクション露光装置のご紹介（UX-4シリーズ）	金田 優人
April 21, 2022		**Exhibitors Presentation Session Chaired by: Hiroyuki Ishida/Suss Microtec 石田 博之氏（ズース・マイクロテック）**		
13:55-14:55	1	坂口電熱株式会社	原子レベルアンチエイリアス熱処理ミニマル装置	濱田 健吾
	2	エーエスエムエル・ジャパン株式会社	エーエスエムエルの提供するMEMS市場向け製品とサービス	高井 雄司
	3	ポリテックジャパン株式会社	Siパッケージング MEMSの3次元ダイナミクスの可視化	フランソワ プテイ
	4	日清紡マイクロデバイス株式会社	日清紡マイクロデバイスのスマートセンシング・モジュール設計技術	大道 貴志
	5	新光電気工業株式会社	センシングエッジデバイス紹介	堀内 拓哉
	6	住友精密工業株式会社	住友精密グループの「MEMSソリューション」	宮島 博志

The following program schedule by time zone only for your reference.

April 20, 2022

April 20, 2022 (JST, CST, MYT, SGT, CEST)/April 19-20, 2022(PDT, EDT)												
JST Start time	**JST Ending Time**	**Length**	**Presentation Title**	**Prefix**	**1st Name**	**Last Name**	**Affiliation**	**JST UCT+9**	**CST/MYT/ SGT UCT+8**	**USA(PDT) UCT-7**	**USA(EDT) UCT-4**	**CEST UTC+2**
9:10	9:20	0:10	Opening	Prof.	Shuji	Tanaka	Tohoku University	9:10	8:10	17:10	20:10	2:10
Session: New Areas for MEMS Innovation 1 - Biomedical -												
9:20	10:00	0:40	Exponential Disruption of Medical Imaging	Dr.	Janusz	Bryzek	EXO	9:20	8:20	17:20	20:20	2:20
10:00	10:25	0:25	Commercialization of an AI-nanopore Platform to Revolutionize Inspection Systems	Prof.	Masateru	Taniguchi	Osaka University	10:00	9:00	18:00	21:00	3:00
10:25	10:35	0:10						10:15	9:15	18:15	21:15	3:15
Session: Main Stream of MEMS 1												
10:35	11:00	0:25	tinyML Solution for New Data Driven World	Dr.	Evgeni	Gousev	Qualcomm Technologies, Inc.	10:35	11:00	18:35	21:35	3:35
11:00	11:25	0:25	Near-infrared spectrometer using MOEMS technology	Ms.	Anna	Yoshida	Hamamatsu Photonics K.K.	11:00	10:00	19:00	22:00	4:00
11:25	11:50	0:25	Development of OCT products by using MEMS technology	Dr.	Keiji	Isamoto	santec corporation	11:25	10:25	19:25	22:25	4:25
11:50	12:40	0:50						11:15	10:15	19:15	22:15	4:15
Exhibitors' Presentation & Exhibit Hour												
12:40	13:40	1:00	**Exhibitor Presentation**					12:40	11:40	20:40	23:40	5:40
13:40	15:05	1:25	**Exhibit Hour**					13:40	12:40	21:40	0:40	6:40
Session: Main Stream of MEMS 2												
15:05	15:30	0:25	Bosch MEMS Foundry	Dr.	Georg	Bischopink	Robert Bosch GmbH, Germany	15:05	14:05	23:05	2:05	8:05
15:30	15:55	0:25	MEMS Development and Fabrication During the Current Challenging Time	Dr.	Rakesh Chand	Tripathi	Vanguard International Semiconductor C	15:30	14:30	23:30	2:30	8:30
15:55	16:05	0:10	Break					15:15	14:15	23:15	2:15	8:15
16:05-16:55 Exhibitors' Presentation & Exhibit Hour												
16:05	17:05	1:00	**Exhibitor Presentation**					16:05	15:05	0:05	3:05	9:05
17:05	17:15	0:10	Break					17:05	16:05	1:05	4:05	10:05
Session: New Areas for MEMS Innovation 2												
17:15	17:40	0:25	What is the fuel that will propel the MEMS market growth?	Dr.	Dimtros	Damianos	Yole Développement	17:15	16:15	1:15	4:15	10:15
17:40	18:05	0:25	Large-Area Sensing Surfaces and Human Machine Interfaces Enabled by Hybrid Printed Electronics	Dr.	Peter	Zalar	HOLST Centre	17:40	16:40	1:40	4:40	10:40
18:05	18:30	0:25	MEMS technologies in an ever more demanding world	Dr.	Samer	Dagher	CEA-Leti	18:05	17:05	2:05	5:05	11:05

April 21, 2022

April 21, 2022 (JST, CST, MYT, SGT, CEST)/April 20-21, 2022(PDT, EDT)												
JST Start time	**JST Ending Time**	**Length**	**Presentation Title**	**Prefix**	**1st Name**	**Last Name**	**Affiliation**	**JST UDT+9**	**CST/MYT/ SGT UDT+8**	**USA(PDT) UDT-7**	**USA(EDT) UDT-4**	**CEST UTC+2**
Special Session: Environmental Technology												
8:40	8:45	0:05	2nd Day Opening	Mr.	Masahiko	Tanaka	SPP Technologies Co., Ltd., Japan	8:40	7:40	16:40	19:40	1:40
8:45	9:25	0:40	The climate neutral company - How Bosch has become carbon neutral by 2020 and where to go further	Mr.	Klaus	Meder	Bosch Corporation, Japan	8:45	7:45	16:45	19:45	1:45
9:25	9:50	0:25	Application of Sensing Technology in Small-scale Decentralized Water Recycling System	Mr.	Shohei	Okudera	WOTA CORP.	9:25	8:25	17:25	20:25	2:25
9:50	10:00	0:10	Break									
Session: New Areas for MEMS Innovation 3 and Panel Discussion												
10:00	10:40	0:40	The Impact of Key New Technologies and Capabilities on the Future of MEMS	Dr.	Kurt	Petersen	Silicon Valley Band of Angels	10:00	9:00	18:00	21:00	3:00
10:40	11:05	0:25	Lessons Learned from 10+ Years of Epi-Seal Fabrication Runs at Stanford	Dr.	Thomas	Kenny	Stanford University	10:40	9:40	18:40	21:40	3:40
11:05	12:05	1:00	**What are the New areas for MEMS Innovation and New MEMS Products?**					11:05	10:05	19:05	22:05	4:05
				Mr.	Susumu	Kaminaga	SPP Technologies Co., Ltd., Japan					
				Dr.	Kurt	Petersen	Silicon Valley Band of Angels					
				Prof.	Thomas	Kenny	Stanford University					
				Prof.	Weileun	Fang	National Tsing Hua University, Taiwan					
				Mr.	Klaus	Meder	Bosch Corporation in Japan					
				Dr.	Georg	Bischopink	Robert Bosch GmbH, Germany					
12:05	12:50	0:45	Lunch Time					12:05	11:05	20:05	23:05	5:05
Special Session: Medical Robotics												
12:50	13:30	0:40	Integration of Bio-Mechatronics, Biomedical Instrumentation, and Bioscience for Minimally Invasive Therapies	Prof.	Ichiro	Sakuma	The University of Tokyo	12:50	11:50	20:50	23:50	5:50
Session: Main Stream of MEMS 3												
13:30	13:55	0:25	AI Enabled Touch User Interface for Smart Surfaces	Mr.	Mo	Maghoudnia	UltraSense Systems Inc.	13:30	12:30	21:30	0:30	6:30
Exhibitors' Presentation & Exhibit Hour												
13:55	14:55	1:00	**Exhibitor Presentation**					13:55	12:55	21:55	0:55	6:55
14:55	15:30	0:35	**Exhibit Hour**					14:55	13:55	22:55	1:55	7:55
Session: Main Stream of MEMS 4												
15:30	15:55	0:25	Improving the performance of intelligent MEMS motion sensors with ST's new Thelma Double technology	Mr.	Giorgio	Allegato	STMicroelectronics	15:30	15:55	23:30	2:30	8:30
15:55	16:20	0:25	Uncooled Infrared Focal Plane Arrays	Dr.	Masafumi	Kimata	Formerly with Ritsumeikan University	15:55	14:55	23:55	2:55	8:55
16:20	16:45	0:25	How context awareness can help to further extent battery lifetime in TWS	Dr.	Gunar	Lorenz	Infineon Technologies AG	16:20	16:45	0:20	3:20	9:20
16:45	16:55	0:10										
Session: Core Equipment Technology for MEMS												
16:55	17:20	0:25	Probe cards with MEMS probes	Ms.	Sachiko	Hattori	JAPAN ELECTRONIC MATERIALS CORPOI	16:55	15:55	0:55	3:55	9:55
17:20	17:45	0:25	Wafer bonding for 3D/Heterogeneous integration application	Mr.	Hiroshi	Yamamoto	EV Group Japan K.K.	17:20	16:20	1:20	4:20	10:20
17:45	18:10	0:25	Etch Challenges and Solutions for Highly Doped AlScN Films used in PiezoMEMS Applications	Mrs.	Joanne	Carpenter	SPTS Technologies Ltd.	17:45	16:45	1:45	4:45	10:45
18:10	18:15	0:05		Prof.	Ryo	Miyake	The University of Tokyo	18:10	17:10	2:10	5:10	11:10

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

9:20-10:25 Session: New Areas for MEMS Innovation 1 – Biomedical -

9:20- 10:00 Keynote speech:

Exponential Disruption of Medical Imaging

Dr. Janusz Bryzek, Co-Founder and
Executive Board Chairman
EXO, USA

<Abstract>

This keynote talk will cover the following themes:

- Introduction to medical imaging market and its disruption by personal ultrasound imagers.
- Cost disruptive innovations:
  - Silicon ultrasound transducers, cMUTs and PMUTs, including pMUT process evolution.
  - Universal imager replacing multiple legacy probes.
- Operator training elimination through AI to enable home use.
- Image interpretation by AI eliminating need for trained sonographers.
- Overview of disruptive applications for pMUTs.

<CV>

Serving as Exo's Co-Founder and Executive Board Chairman, Janusz is a pioneer in the fields of micro-mechanical integrated systems (MEMS) and sensors. He has co-founded 11 Silicon Valley MEMS companies with products including MEMS sensors (pressure, acceleration, gyro), MEMS microstructures (mirrors), sensor-based systems-on-chip (wireless pressure sensors, motion sensors with embedded sensor fusion) and systems (optical switches, medical ultrasound imagers). Janusz has performed due diligence for top-tier VC firms, including USVP (Irwin Federman), Mayfield, Benchmark, Morgenthaler, and Panorama. He also worked as an advisor or board member for 40+ startups.

Janusz has been the recipient of multiple awards, including "Entrepreneur of the Year" by Arthur Young in 1989, and Lifetime Achievement Awards in 1994 and 2003 by Sensors Magazine and MANCEF, respectively. In 2016, he was named Outstanding Polish Business Executive by the Polish Embassy in the United States and subsequently received the Industry Impact Award for Engineering Excellence from Sensors Expo in 2018.
He has published 250+ papers, wrote sections of four books, and has organized and chaired many international conferences. He is the author of 30 U.S. patents and multiple patent applications and has initiated several sensor standardization efforts.

Janusz earned his M.S. in Electrical Engineering and Ph.D. from Warsaw Technical University, Poland. He also completed the Executive Management Program at Stanford University.

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

9:20-10:25 Session: New Areas for MEMS Innovation 1 – Biomedical -

10:00-10:25 Invited Speech:

Commercialization of an AI-nanopore Platform to Revolutionize Inspection Systems

Prof. Masateru Taniguchi, Professor, SANKEN, Osaka University, Japan

検査システムを革新する AI ナノポアプラットフォームの事業化

大阪大学　産業科学研究所 教授　谷口 正輝氏

<Abstract>

Digital platforms are becoming increasingly popular in the clinical laboratory market for microbiological and biochemical tests. Digitized image and measurement data processing enable advanced analysis using artificial intelligence (AI), which is expected to improve test accuracy and speed. AI nanopore, a fusion of nanopore and AI, is a digital platform that can rapidly create microbiological testing systems by learning from bacterial and viral measurement data with AI. Nanopores are holes with diameters ranging from a few micrometers to a few hundred nanometers that are fabricated using semiconductor technology on a silicon substrate. Additionally, nanopores are integrated into flow channels made of plastic, resulting in the evolution of the current A4-sized measuring device into a palm-sized digital platform that can be connected to a smartphone via semiconductor and MEMS technology. New testing systems are currently being developed. I will introduce the journey toward commercializing AI nanopore by a university venture company and its future prospects.

<CV>

Masateru Taniguchi, Ph.D., is a Professor of Bionanotechnology at SANKEN, Osaka University. He obtained a Ph.D. from Kyoto University in 2001. He then became a postdoc at the Institute of Scientific and Industrial Research at Osaka University. In 2002, he became an assistant professor at Osaka University. In 2007, he became a researcher for PRESTO (Precursory Research for Embryonic Science and Technology), Japan Science and Technology Agency. He worked as an associate professor at Osaka University (2008–2011). His current research interests include single-molecule science and single-molecule technologies. In 2013, he founded Quantum Biosystems Inc. to commercialize single-molecule quantum sequencers and was a director of the company. In 2018, he also founded Aipore Inc. and serves on the board of the company to commercialize AI nanopores.

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

10:35-11:50 Session: Main Stream of MEMS 1

10:35-11:00 Invited Speech:

tinyML Solution for New Data Driven World

Dr. Evgeni Gousev, Senior Director,
Qualcomm AI Research
and Chairman, Board of Directors, tinyML Foundation,
USA

<Abstract>

The presentation covers the following points:

- tinyML Fundamentals
- tinyML Markets, Examples and Applications
- Qualcomm Always-On Computer Vision product
- How to get involved:
  - tinyML Foundation and its global ecosystem, projects and events, educational activities

<CV>

Evgeni Gousev is a Senior Director of Engineering in Qualcomm Research. He leads HW R&D org in the Silicon Valley Center and is also responsible for developing ultra low power embedded computing platform, including always on machine vision AI technology. He has been with Qualcomm Technologies, Inc. since 2005 after joining from IBM T.J. Watson Research Center where he drove projects in the field of advanced silicon technologies. From 1993 to 1998, Dr. Gousev held academic professorship appointments with Rutgers University and Hiroshima University (1997). Evgeni holds a M.S. degree in Applied Physics and a Ph.D. in Solid-State Physics. He has co-edited 24 books and published 163 papers and is an inventor on more than 60 issued and filed patents.

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MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

10:35-11:50 Session: Main Stream of MEMS 1

11:00-11:25 Invited Speech:

Near-infrared spectrometer using MOEMS technology

Ms. Anna Yoshida, Section Chief, MEMS, Solid state division

Hamamatsu Photonics K.K., Japan

MOEMS 技術を用いた近赤外分光器

浜松ホトニクス株式会社　固体事業部　MEMS 部　専任部員　吉田 杏奈氏

<Abstract>

Hamamatsu Photonics K.K. has developed and is producing a wide variety of optical sensors. By adding MOEMS technology to the opto-semiconductor devices, we have created new values of compact optical modules with superior performances.

The demand for near-infrared spectroscopic analysis is increasing. Hamamatsu's MOEMS spectrometers make near-infrared spectroscopy extremely accessible. With performance comparable to a laboratory equipment, our compact, affordable and a wide variety of near-infrared spectrometers can be integrated into handy instruments or manufacturing equipment for real-time measurement in the field.

In this presentation, ultra-compact SWNIR spectral sensor, FTIR engine, and MEMS-FPI (Fabry-Perot Interferometer) spectrum sensor will be presented.

<CV>

Yoshida Anna received her master’s degree in Materials and Manufacturing Science from the Osaka University. In 2007, Ms. Yoshida joined the Hamamatsu Photonics K.K, Hamamatsu, Shizuoka, Japan.

Since then, she has been engaged in the development and design of the MEMS technologies, especially miniature spectrometers, combined with CMOS sensors, based on diffraction gratings using nanoimprint technology.

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

10:35-11:50 Session: Main Stream of MEMS 1

11:25-11:50 Invited Speech:

Development of OCT products by using MEMS technology

Dr. Keiji Isamoto, Executive officer, President of OIS company
santec corporation, Japan
MEMS 技術を用いた OCT 技術の開発
Santec 株式会社　執行役員、OIS カンパニー長
諫本 圭史氏

<Abstract>
OCT is a non-invasive technology to observe cross section view of the object. It is used for variety of application, such as medical equipment or industrial inspection. Santec has been working for OCT for more than 15 years and will introduce latest results of OCT research by using MEMS technologies. One of the key technology for next generation OCT is MEMS based tunable VCSEL which enables deeper and faster imaging. Tunable VCSEL can also be used for FMCW-Lidar. We will introduce latest research results with some demonstration data in the presentation.

<CV>
Keiji Isamoto received his B.S. and M.S. degrees in Electrical and Engineering from Toyohashi University of Technology, Aichi, Japan, in 1994 and 1996, respectively. He joined Central R&D Laboratory of OMRON Co. in 1996 and was engaged in the development of micro optics. He joined Santec Corporation, Japan, in 2001, and worked on several subjects, including optical hybrid module, MEMS (microelectromechanical systems) based Variable Optical Attenuator and High Speed swept Laser for Optical Coherence Tomography. He received Ph.D. degree in electrical engineering from The University of Tokyo, Tokyo, Japan, in 2016. Since 2018, he has been a President of Optical Imaging and Sensing Company in Santec Corporation. His research interests include Optical MEMS and Optical Coherence Tomography for medical and Industrial application.

.MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

14:40-15:55 Session: Main Stream of MEMS 2

15:05-15:30 Invited Speech:

Bosch MEMS Foundry

Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

<Abstract>

The complexity of MEMS feedback loops process to product is higher than for ASICs. Additionally, the diversity in existing MEMS processes is tremendous. Therefore, MEMS foundry is based on specific process flows individually designed per customer. Ideally the customer-individual process is developed in a kind of partnership between customer and foundry, based on one hand on customer specific needs and on the other hand on foundry specific know-how, process- and tool-capabilities.

This MEMS specific approach drive other preconditions for a successful MEMS foundry:

1.) Flexible R+D willingness and capabilities.

2.) As much know-how in MEMS as possible, a broad tool park and numerous technology building blocks.

3.) Professional production capability with respect to quality, reliability, high volumes, and long-term delivery guarantee.

Bosch offers the broadest portfolio of MEMS technologies in the market. The available technologies are intensively tested, deeply understood, and proven for mass production. Bosch will increase its MEMS foundry activities and offers this existing MEMS portfolio in combination with the ability to develop new building blocks, specifically for future customers in long-term partnership.

This presentation highlights some of the key technologies and providing examples.

<CV>

Education

1983-1988	Master’s degree in Physics, University Paderborn, Germany
1988-1992	Ph.D. in Semiconductor Physics: Crystal Growth of (AlGa)Sb, University Freiburg, Germany

Professional Experience

1992- today	Robert-Bosch GmbH, Germany
1992-1995	Quality Assurance, Hybrid and Sensors
1995-1996	Development, MEMS-Sensors
1996-2000	Section Manager, Development MEMS Sensor Products
2000-2008	Director, Borsch MEMS-Production
2008-09/2012	Director, Bosch Corporate Research Microsystem-Technology
10/2012-today	Vice President, Bosch Engineering Sensors for External Customers and lead Product Area Sensors Automotive

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

14:40-15:55 Session: Main Stream of MEMS 2

15:30-15:55 Invited Speech:

MEMS Development and Fabrication During the Current Challenging Time

Dr. Rakesh Chand Tripathi, MTS-MEMS(TD)
Vanguard International Semiconductor Corporation, Singapore

<Abstract>
Although MEMS technology development uses the CMOS micro fabrication processes but developing and manufacturing the MEMS in CMOS fab is very challenging. This challenge is further compounded with the spread of COVD-19 and high rise in MEMS demand. To tackle this challenge VIS worked on reducing the development time of MEMS devices by developing and offering KEY MEMS technology platforms (IMU, PMUT, etc) and providing customer design guideline during the tape out phase. These both key changes lead to drastic reduction in the development time. Device fabrication technology can be now developed in less than 3 months (Mask in to wafer fab-out).

<CV>
He received. M.Tech. degree in Microelectronics from Indian Institute of Information Technology in 2010. And PhD (Eng.) in 2015 from Department of Bioengineering and Robotics, Tohoku University, Japan. He was research fellow at Micro System Integration Canter, Japan from April.2015 to Dec.2016. He joined VIS (formerly GF-Tampines) as Principle engineer (MEMS) in Jan.2017. He is currently working as Member of Technical Staff at VS1 (VIS-Singapore) MEMS-TD. He is a recipient of GATE Scholarship (Govt. of India) for pursuing masters in Microelectronics And Monbukagakusho (MEXT) Scholarship by Minister of Education, Culture, Sports, Science and Technology, Government of Japan, for pursuing research in engineering. His research interests include high temperature SiC devices, SiC sensors, power MEMS, RF MEMS, Acoustic devices and MEMS packaging.

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

17:15-18:30 Session: New Areas for MEMS Innovation 2

17:15-17:40 Invited Speech:

What is the fuel that will propel the MEMS market growth?

Dr. Dimtros Damianos, Senior Analyst, Photonics & Sensing Division, Yole Développement, France

<Abstract>

Two years into the pandemic, the semiconductor industry has felt the ups and downs of a crisis, leading eventually to chip shortages which in turn cause delays of electronic systems that incorporate them. Semiconductors have become a hot topic of paramount importance, being a strategic asset of sovereign caliber. Due to that, heavy investments are being poured into manufacturing capacities across all geographies.

MEMS devices, under the $500B+ semiconductor umbrella, are going through a growth period. While the market was stable at $12B between 2019 and 2020, with no significant effect felt from covid, in 2021 it grew by more than 11% reaching $13.4B due to rekindled consumer sentiment boosting end-system demand that incorporate a multitude of MEMS devices. In the next 4-5 years, we expect the market to reach north of $18B+ driven by various megatrends, such as audio sensing and voice HMI, including sensor-packed TWS hearables, environmental sensing, ADAS and AV, AR/VR, etc. Of course, all releted developments in the player landscape and the supply chain are not lacking. Join me in the presentation to learn about the latest MEMS developments.

<CV>

Dimitrios Damianos, Ph.D., is a Senior Technology & Market Analyst, part of the Photonics & Sensing division at Yole Développement (Yole).

Based on solid technical expertise in imaging, sensing, and photonics, Dimitrios oversees the day-to-day production of valuable technology & market reports and custom consulting projects.

He also plays a key role in the expansion of Yole's market & technical knowledge, supporting the development of strategic projects and maintaining long-term relationships with key accounts while ensuring their expectations are met.

Dimitrios regularly presents and delivers keynotes at international conferences and exhibitions. He has also authored and co-authored several technical & market reports as well as scientific papers in international peer-reviewed journals.

Dimitrios holds a BSc in Physics and an MSc in Photonics, both from the University of Patras (Greece), and a Ph.D. in Optics & Microelectronics from the University of Grenoble-Alpes (France).

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

17:15-18:30 Session: New Areas for MEMS Innovation 2

17:40-18:05 Invited Speech:

Large-Area Sensing Surfaces and Human Machine Interfaces Enabled by Hybrid Printed Electronics

Dr. Peter Zalar, HOLST Centre, The Netherlands

<Abstract>

Holst Centre is an applied research institute that has been focused for nearly two decades on the development of flexible and thin electronic systems using industrially relevant fabrication methods. The major goal is to make technological contributions toward the industrialization of printed electronics systems so that future visions can become a reality. The promise of implementing electronics into an ever increasing spectrum of form factors necessitates the development of systems that simultaneously bear the qualities of accuracy, conformability, ruggedness, and light weight. This is demanded in applications ranging from healthcare, automotive, and robotics. In these cases, traditional electronics based on rigid printed circuit boards (PCBs) can simply fall short of expectations or be completely unsuitable for a target application due to its rigidity.

In order to make progress toward this vision, Holst Centre has been active in the development of printable and flexible sensors that can be printed atop the complex surfaces found in the applications named earlier; thus realizing “Large-Area Sensing Surfaces”. In our vision, these surfaces largely consist of fully-printed circuitry and sensors on an elastomeric or thermoplastic carrier. This enables the conformal contact of the sensors to a surface, improving the reliability and quality of data gathered by them without being obtrusive. Additionally, in order to accommodate cases where a printed solution may not be available, integrating components such as integrated circuits, temperature sensors, pressure sensors, or accelerometers is also possible.

With this unique toolbox, a variety of novel systems can be manufactured that can meet a host of needs. In this presentation, we would like to introduce our approach and show how we have applied our expertise towards developing the aforementioned “Sensing Surfaces” for applications such as human machine interfaces and healthcare devices.

<CV>

Peter Zalar obtained his Ph.D. in chemistry from the University of California, Santa Barbara (UCSB) in 2014 under Prof. Thuc-Quyen Nguyen. His doctoral research focused on the characterization of the optical and electronic properties of novel π-conjugated polymers. He then joined the group of Prof. Takao Someya at The University of Tokyo as a project researcher. In that time, he worked on the development of optoelectronic devices based on organic semiconductors for electronic skins and medical monitoring. In 2017, he joined Holst Centre to continue his research in printed electronics. He is currently leading the “Large-Area Sensors” research program.

MEF 2022 Speakers

Wednesday, April 20, 2022 (JST, UTC+0900)

17:15-18:30 Session: New Areas for MEMS Innovation 2

18:05-18:30 Invited Speech:

MEMS technologies in an ever more demanding world

Dr. Samer Dagher, Research Engineer, Department of Silicon Components,
CEA-Leti, France

<Abstract>

The presentation covers the following items:

- MEMS: A Cornerstone of Tomorrow's World
- Inertial Sensors at Leti: A History of Innovation
- M&NEMS: Breakthrough Multi-Sensor Platform
  - High Performance Gyroscope
  - High Frequency Gyroscope
- NEMS Resonators for Mass Sensing
- Opto-Mechanics on Chip
  - Mass Sensors
  - Specific Biomarker Detection
  - An Emerging Ulti-Sensor Solution

<CV>

Samer Dagher is a Research Engineer at CEA-Leti. His research focuses on acoustic sensors, and nano-resonators for biological detection among others. He holds a PhD in Acoustics from Le Mans University, France during which he developed a new architecture for high-performance MEMS microphones with in-vacuum transduction. He also holds a Master's degree in Nano-Engineering from Ecole Centrale de Lyon, France and a Master's degree in History and Philosophy of Mathematics and Physics from Aix-Marseille University, France.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

08:45-09:50 Special Session: Environmental Technology

08:45-09:25 Special Lecture:

The climate neutral company - How Bosch has become carbon neutral by 2020 and where to go further

Mr. Klaus Meder
President and Representative Director
Bosch Corporation, Japan

<Abstract>

Since 2020, the Bosch Group with its more than 400 locations worldwide has been climate neutral (scopes 1 and 2). An independent auditing company has officially confirmed this. But that's not all: We want to shape climate action beyond our immediate sphere of influence and also systematically reduce upstream and downstream emissions (scope 3), which we aim to reduce by 15 percent by 2030.

Climate neutrality refers to the energy we generate ourselves and the volume we purchase for manufacturing, development, and administration (scopes 1 and 2 of the Greenhouse Gas Protocol, GHG). This is where we can directly influence the reduction of greenhouse gases and make a big impact in a short time.

Upstream emissions in the Bosch value chain primarily concern purchased goods and services as well as logistics. Downstream emissions are mainly caused by the use of our products.

The presentation shows the status and the future targets. Several examples how to reach the target will be shown.

<CV>

Klaus Meder has various and long experiences in engineering in Bosch. One of his noteworthy experiences is that he resided in Japan for 5 years, when he was Vice President in charge of Engineering, Quality and Manufacturing of Automotive Electronics Japan from 1996 until 2000. After various positions with the division Chassis Systems, he became President of Automotive Electronics of Robert Bosch GmbH in January 2012. Since July 2017 he has been President and Representative Director of Bosch Corporation in Japan.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

08:45-09:50 Special Session: Environmental Technology

09:25-09:50 Invited Speech:
Application of Sensing Technology in Small-scale Decentralized Water Recycling System
Mr. Shohei Okudera, Director,
WOTA CORP., Japan
小規模分散型水循環システムにおけるセンシング技術の活用
WOTA 株式会社　取締役
奥寺 昇平氏

<Abstract>
WOTA Corp. is a startup company and seeks "Structural Solutions to the World’s Water Crisis". WOTA has developed a "small-scale decentralized water recycling system" and has commercialized several products such as "WOSH," a water recycling handwashing stand, and "BOX," a portable water recycling plant. In this presentation, we will talk about the use of sensing technology to support the "Small-Scale Decentralized Water Recycling System".

<CV>
Shohei Okudera studied computer science at Tokyo Institute of Technology and the University of Tokyo, where he researched technologies for building distributed processing platforms for big data. He was a member of Director Kitsuregawa's laboratory at the Institute of Industrial Science. In 2014, he co-founded Hotaru Corporation, the predecessor of WOTA.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

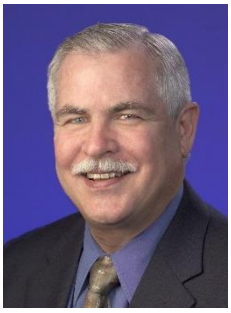
10:00-11:05 Session: New Areas for MEMS Innovation

10:00- 10:40 Keynote Address:

The Impact of Key New Technologies and Capabilities on the Future of MEMS

Dr. Kurt Petersen

Silicon Valley Band of Angels



<Abstract>

Over the past 5 years or so, a number of novel, advanced process capabilities related to MEMS have become commercially available. These newly developed processes are poised to have enormous impact on new MEMS devices and on the future of the MEMS industry. Some of the technologies we will discuss are: glass-processing, including through-glass-vias and glass wafer bonding; processing of ultra-thin substrates, thinner than 50 μm; recently-commercialized deposition and etching of AlN and PZT; DRIE etch-rates of over 25 μm/min; the epi-seal process. And, more ! Examples of how these new capabilities are impacting the development of novel, state-of-the-art MEMS products will be presented, as well as implications for the future of MEMS.

<CV>

Kurt Petersen received his BS degree cum laude in EE from UC Berkeley in 1970. In 1975, he received a PhD in EE from the Massachusetts Institute of Technology. Dr. Petersen established a micromachining research group at IBM from 1975 to 1982, during which he wrote the review paper "Silicon as a Mechanical Material," published in the IEEE Proceedings (May 1982). This paper is the most frequently referenced work in the field of micromachining and micro-electro-mechanical systems (MEMS).

Since 1982, Dr. Petersen has co-founded six companies in MEMS technology, Transensory Devices Inc. in 1982, NovaSensor in 1985 (now owned by Amphenol), Cepheid in 1996 (acquired by Danaher in 2016), SiTime in 2004 (now listed as SITM on NASDAQ), Profusa in 2008 (still private), and Verreon in 2009 (acquired by Qualcomm).

In 2011, Dr. Petersen joined the Silicon Valley Band of Angels, where he now co-chairs the HardTech group. The Band is an angel investment group which mentors and invests in early stage, high-tech, start-up companies. Today, he spends most of his time helping and mentoring such companies.

Dr. Petersen has published over 100 papers, and has been granted over 35 patents in the field of MEMS. He was awarded the prestigious IEEE Medal of Honor in 2019 as well as the IEEE Simon Ramo Medal in 2001 for his contributions to MEMS. Dr. Petersen is a member of the National Academy of Engineering and is a Life Fellow of the IEEE in recognition of his contributions to "the commercialization of MEMS technology".

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

10:00-11:05 Session: New Areas for MEMS Innovation

10:40-11:05 Invited Speech:
Lessons Learned from 10+ Years of Epi-Seal Fabrication Runs at Stanford.
Prof. Thomas Kenny, Professor, Stanford University, USA

<Abstract>
TBA

<CV>
Kenny's group is researching fundamental issues and applications of micromechanical structures. These devices are usually fabricated from silicon wafers using integrated circuit fabrication tools. Using these techniques, the group builds sensitive accelerometers, infrared detectors, and force-sensing cantilevers. This research has many applications, including integrated packaging, inertial navigation, fundamental force measurements, experiments on bio-molecules, device cooling, bio-analytical instruments, and small robots. Because this research field is multidisciplinary in nature, work in this group is characterized by strong collaborations with other departments, as well as with local industry.

MEF 2022 Moderator for Panel Discussion

<u>Thursday, April 21, 2022 (JST, UTC+0900)</u>
11:05-12:05 The Grand Panel Discussion,
"What are the New areas for MEMS Innovation and New MEMS Products?"
MEMS イノベーションのための新しい領域と新しい **MEMS** 製品は何か？

Moderator: Mr. Susumu Kaminaga, Executive Senior Advisor
SPP Technologies Co., Ltd., Japan
SPP テクノロジーズ株式会社
エグゼグティブシニアアドバイザー
神永 晉氏

<Abstract>
To discuss the New Areas for MEMS Innovation and New MEMS Products from the point of view of expected contribution of MEMS to the society, Smart City. Amazing ideas from the various aspects to be discussed by the distinguished visionary panelists based on their unique knowledge and experience.

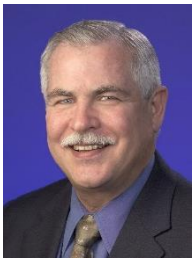
<CV>
Susumu Kaminaga studied Mechanical Engineering at the University of Tokyo and graduated in 1969. He joined Sumitomo Precision Products Co., Ltd. (SPP) and was President of the company from 2004 to 2012. He is currently Executive Senior Adviser at SPP Technologies Co., Ltd. as well as Representative Director & Chief Executive at SK Global Advisers Co., Ltd. He lived in Germany in the 1980s and U.K. in 1990s. Having been involved with MEMS activities since 1988, he played a major role to develop and commercialize Deep Reactive Ion Etching (DRIE) technology based on Robert Bosch patented switching process at Surface Technology Systems (STS), UK, subsidiary of SPP. STS under his initiative introduced the world first DRIE equipment into the market in 1995. The DRIE has enabled MEMS world to expand rapidly in the last decades since then. The DRIE and its associated processing technologies to support MEMS development have been contributing to such emerging markets like smart phones, IoT, 5G, DX, CASE and MaaS. Following his achievement to establish MEMS business with the processing technologies, gyroscopes and wireless sensor network systems, he became a member of the organizing committee of Trillion Sensors (TSensors) Summit to drive TSensors Initiative. He is Fellow of JSME (The Japan Society of Mechanical Engineers) and a member of JSAP (The Japan Society of Applied Physics), IEE (The Institute of Electrical Engineers of Japan) and IEEE (The Institute of Electrical and Electronic Engineers).

MEF 2022 Panelists

<u>Thursday, April 21, 2022 (JST, UTC+0900)</u>

11:05-12:05 The Grand Panel Discussion,

"What are the New areas for MEMS Innovation and New MEMS Products?"



Dr. Kurt Petersen, Silicon Valley Band of Angels, USA

Prof. Thomas Kenny, Professor, Stanford University, USA

Prof. Weileun Fang, NTHU Chair Professor/Power Mech. Eng. Department, National Tsing Hua University, Taiwan

<CV>

Prof. Fang has been working in the MEMS field for more than 20 years. He received his Ph.D. degree from Carnegie Mellon University (Pittsburgh, PA) in 1995. He joined the National Tsing Hua University (Taiwan) in 1996, where he is now a Chair Professor. He became the IEEE Fellow in 2015 to recognize his contribution in MEMS area. Prof. Fang has published ~500 refereed papers and granted ~120 patents. He is now the Chief Editor of JMM, the Board Member of IEEE TDMR and Sensors and Materials, and the Associate Editor of IEEE Sensors J. He served as the General Chair or Program Chair for many important international conferences: the World Micromachine Summit 2012, IEEE Sensors 2012, and Transducers 2017. He also served as the chair of International Steering Committee of Transducers during 2017-2019. Moreover, he served as the Technical Program committee of IEEE MEMS and Transducers for many years. So far more than 50 PhD and 70 Master students have graduated from Prof. Fang's group. Most of them are working in the MEMS and micro sensors related companies. Thus, Prof. Fang has close relation with MEMS industries, and is now the VP of MEMS and Sensors Committee of SEMI Taiwan.

Mr. Klaus Meder, President and Representative Director
Bosch Corporation, Japan

Dr. Georg Bischopink, Vice President, Product Area Sensors and Sensor Development, Robert Bosch GmbH, Germany

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

12:50-13:30 Session: Medical Robotics

12:50-13:30 ***Special lecture: Integration of Bio-Mechatronics, Biomedical Instrumentation, and Bioscience for Minimally Invasive Therapies***

Prof. Ichiro Sakuma, Director, Research Institute for Biomedical Science and Engineering, Professor, Medical Device Development and Regulation Research Center, Department of Bioengineering, Department of Precision Engineering. School of Engineering, The University of Tokyo

低侵襲治療のためのバイオメカトロニクス，生体計測，生命科学の統合

東京大学　臨床生命医工学連携機構 機構長、大学院工学系研究科

医療福祉工学開発評価研究センター　教授　佐久間 一郎氏

<Abstract>

Minimally invasive therapy such as endoscopic surgery and catheter based intervention are being spread in many surgical intervention fields. Invasiveness of the procedures has been reduced resulting in better outcomes such as improved survival, less complications, and early discharge. The application of minimally invasive procedure requires new technologies for dexterity enhancement and sensing augmentation. Engineering assistance is important to realize safe and effective minimally invasive therapy. Computer Assisted Surgical guidance such as surgical navigation is a representative technology. It is expected that application of bio-mechatronic technology to minimally invasive surgery will provide the following functions: (1) Precise manipulation of biological tissues and surgical instruments in narrow and confined surgical field. (2) Precise and accurate localization and control of therapeutic devices using various pre and intra-operative medical information. Fusion of medical bio-mechatronics, biomedical instrumentation, bioscience is required for realizing these functions. Information technologies such as signal processing, image processing, and pattern recognition (artificial intelligence) are also important for extraction of clinically significant information from acquired biological data. Bioengineering, an interdisciplinary field of engineering and biomedical sciences, will contribute to integrate pre-, intra- and post-operative multi-dimensional anatomical and physiological information for optimization of surgical/interventional procedures.

<CV>

Ichiro Sakuma graduated from Department of Precision Engineering, faculty of Engineering, and Graduate School of Engineering, The University of Tokyo in 1982 and 1984 respectively. He received PhD in Engineering from The University of Tokyo in 1989. He worked as a research associate in The university of Tokyo from 1984 to1987, and worked in Tokyo Denki University from 1987 to 1998. Since 1998, he has been serving as a faculty member of the University of Tokyo since 1998. He became professor in Graduate School of Frontier Sciences in 2001, and professor in School of Engineering in 2006. He is currently professor of the Medical Device Development and Regulation Research Center, Department of Bioengineering, and Department of Precision Engineering, School of Engineering, and the Director, Research Institute for Biomedical Science and Engineering, The University of Tokyo. He served as Deputy Director for Medical Devices, Center for Product Evaluation Pharmaceuticals and Medical Devices Agency (PMDA) from 2012 to 2017, and president of Japanese Society for Medical and Biological Engineering from 2014 to 2016.

His research interests include medical devices, medical imaging, computer aided surgery, medical robotics, and regulatory sciences. He is a fellow of the International Academy of Medical and Biological Engineering.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

13:30-13:55 Session: Main Stream of MEMS 3

13:30-13:55 Invited Speech:

AI Enabled Touch User Interface for Smart Surfaces

Mr. Mo Maghoudnia, Founder/CEO,
UltraSense Systems Inc., USA

<Abstract>
UltraSense is ushering a new touch user interface technology that enables smart surfaces. We have created the world's smallest ultrasound system-on-a-chip that can be used as technology platform for delivering our touch user interface in the smartphones, consumer electronics, IoT, home appliances, medical and automotive markets. Our technology can sense through almost any material and virtually any material thickness to cost-effectively turn any surface into a gesture. Metals, glass, plastic, wood can easily be turned into smart surfaces.
Everywhere we look, objects and materials are becoming increasingly interactive. We believe that we are only at the beginning of an evolution that will have a huge impact on our day-to-day life. And the advent of smart surfaces will unquestionably speed up this evolution.
We have a disruptive touch sensing technology platform that will enable the onset of smart objects/surfaces easier and more cost effectively across myriad of use cases. It allows for detection of intended vs accidental touch using Machine Learning. Not to mention that it is shipping today!

<CV>
Mo Maghsoudnia serves as Founder & CEO of ULTRASENSE Systems. Prior to ULTRASENSE, Mo was the Vice President of Technology & Manufacturing at InvenSense where he was responsible for all worldwide operations and Process Technology development. Previous to InvenSense, Mo was Vice President of Manufacturing at NetLogic MicroSystems where he successfully managed the manufacturing operations of the company from a single product line to a highly diversified product portfolio. Mo holds MS in EE from Santa Clara University. He Holds 10 patents and has filed numerous papers.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

15:30-16:45 Session: Main Stream of MEMS 4

15:30-15:55 Invited Speech:

Improving the performance of intelligent MEMS motion sensors with ST's new Thelma Double technology

Mr. Giorgio Allegato, Technology Development Manager, Analog, MEMS & Sensors Group, STMicroelectronics, Italy

<Abstract>

In today's “onlife” world, the need for intelligent sensors with higher levels of integration is growing along with the demand for higher performance and improved reliability.
To overcome these challenges, ST's new generation of its Thelma technology platform, Thelma Double, shrinks the footprint of inertial sensors and improves their performance without compromising mechanical robustness.
Discover how this new technology can help improve your designs while offering significant cost and size benefits.

<CV>

After joining ST in 2004 as a Technology Engineer, Giorgio led the way to new technology development and industrialization activities for several MEMS products including motion and environmental sensors and actuators. The author of several technological papers and patents in the field of micromachining, characterization, and design, Giorgio enjoys helping to advance MEMS technologies.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

15:30-16:45 Session: Main Stream of MEMS 4

15:55-16:20 Invited Speech:

Uncooled Infrared Focal Plane Arrays

Dr. Masafumi Kimata, Formerly Ritsumeikan University, Japan

非冷却赤外線イメージセンサ

元立命館大学 木股 雅章氏

<Abstract>

The uncooled infrared focal plane array (IRFPA) is one of the most successful integrated MEMS devices. MEMS technology, which enables the manufacture of low thermal conductance structures, has been contributing to uncooled IRFPA development by increasing the sensitivity. As a result of active research and development, the uncooled IRFPA technology has reached a plateau level, in which the pixel pitch is reduced to less than 12 μm and the array format is increased to a level compatible with HDTV. The cost of uncooled IRFAPs has also been reduced. Reflecting this situation, the interest in infrared imaging is shifting from technology to business. In this talk, the current state of uncooled IRFPA technology and some of the hottest applications that have been gaining attention lately will be discussed.

<CV>

Masafumi Kimata received the B.S. and M.S. degrees in electronic engineering from Nagoya University in 1974 and 1976, respectively, and received the Ph. D. degree in faculty of engineering science from Osaka University in 1992. He joined Mitsubishi Electric Corporation in 1976, where he was involved in research and development of silicon-based infrared focal plane arrays, including Schottky-barrier cooled infrared focal plane arrays and SOI diode uncooled focal plane arrays. In 2004, he left Mitsubishi Electric, and became a professor of Ritsumeikai University, where he continues his research on MEMS-based uncooled infrared focal plane arrays and type-II superlattice infrared focal plane arrays. He retired from Ritsumeikan University in March 2022. He also served as a visiting researcher of JAXA (Japan Aerospace Exploration Agency) by 2021. He was awarded the Prime Minister Prize of the Japan National Invention Awards in 1993 for invention of high-resolution Schottky-barrier infrared focal plane arrays. He is a fellow of SPIE.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

15:30-16:45 Session: Main Stream of MEMS 4

16:20-16:45 Invited Speech:

How context awareness can help to further extent battery lifetime in TWS

Dr. Gunar Lorenz, Senior Director, Technical Marketing Sensor
Infineon Technologies AG, Germany

<Abstract>

In the past years, the industry has managed a huge increase in the MEMS microphone performance to a point where it starts to rival studio microphone quality. At the same time, current consumption has been reduced with each new generation paving the way towards new audio use-cases such as noise cancelling earbuds (TWS) and audio-enabled wristbands. This trend will continue and require new strategies to feed the hunger towards always higher performance at lower power. Intelligent performance management emerges as a viable path to continue the trend. In a new world of “context awareness”, system components will only take the minimum amount of power needed to perform a given task. The question is: which performance level is needed and when? Who manages and who gets managed? Or in other words: “How can context awareness help to extend the battery lifetime of TWS?”

<CV>

Dr. Gunar Lorenz is currently heading the technical marketing and application engineering for consumer sensors at Infineon Technologies. Gunar joined Infineon in 2016 as system project manager responsible for Infineon's first open market MEMS microphone. Prior joining to Infineon he worked as director of system-level simulation at Coventor, where he and his group invented and developed Coventor's MEMS/IC co-simulation design environment MEMS+. The original ideas for MEMS+ are embodied in his PhD carried out at Robert Bosch R&D Center in 1999. Gunar graduated in mechanical engineering at the TU Braunschweig in Germany and received his PHD in electrical engineering from the TU Bremen in 1999.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

16:55-18:15 Session: Core Equipment Technology for MEMS

16:55-17:20 Invited Speech:
Probe cards with MEMS probes
Ms. Sawako Hattori
Senior Specialist, MEMS Division
JAPAN ELECTRONIC MATERIALS CORPORATION, Japan
MEMS プローブカード
シニアスペシャリスト、MEMS 統括
日本電子材料株式会社 服部 佐知子氏

<Abstract>
The probe card using the MEMS probe is effective for the miniaturization of the electrode pad of the semiconductor chip and supports the production of many semiconductor devices including the most tip. The MEMS probe cards will be discussed. And how the MEMS probe movement & various electrical and mechanical tests will be discussed.

<CV>
Sachiko Hattori received the B.S. and M.S. degrees in applied fine chemistry from Osaka University, in 1984, 1986, respectively.
She joined Mitsubishi Electric Corporation in 1986.She was engaged in lithography material and process development and lithography integration including optical proximity correction of memory, logic and sensor devices (0.8μm-90nm process).
Since the establishment of Renesas Technology Corporation and Renesas Electronics Corporation, she was engaged in the same work (90-28nm process).
She joined JAPAN ELECTRONIC MATERIALS CORPORATION in 2014.She was engaged in the process development of spacetransformer, and now she is responsible for probes and spacetransformer development as a senior specialist after a chief manager in MEMS Division.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

16:55-18:15 Session: Core Equipment Technology for MEMS

17:20-17:45 Invited Speech:

Wafer bonding for 3D/Heterogeneous integration application

Mr. Hiroshi Yamamoto, Representative Director
EV Group Japan K.K., Japan

最新接合技術による 3D およびヘテロ集積化

イーヴィグループジャパン株式会社

代表取締役 山本 宏氏

<Abstract>

As traditional 2D silicon scaling reaches its cost limits, the semiconductor industry is turning to heterogeneous integration — the manufacturing, assembly and packaging of multiple different components or dies with different feature sizes and materials onto a single device or package in order to increase performance on new device generations. Wafer bonding, which involves stacking and electrically connecting wafers from different product lines, is a central process in 3D / heterogeneous integration, and is of growing importance to chipmakers and system companies for new kind of designs and manufacturing flexibility. Here we present EV Group's novel wafer and die level bonding technologies deliver improvements in chip performance, cost, and time-to-market.

<CV>

Hiroshi Yamamoto has over 25 years of experience in semiconductor manufacturing equipment and process engineering. He joined in field service engineering at EV Group Japan in 2002 and took up a post as EV Group's Customer Support Director Asia in 2010. He has been serving as Representative Director of EV Group Japan since 2012.

MEF 2022 Speakers

Thursday, April 21, 2022 (JST, UTC+0900)

16:55-18:15 Session: Core Equipment Technology for MEMS

17:45-18:10 Invited Speech:

Etch Challenges and Solutions for Highly Doped AlScN Films used in PiezoMEMS Applications

Mrs. Joanne Carpenter,
Senior Product Manager - Etch
SPTS Technologies Ltd., U.K.

<Abstract>
In piezoMEMS devices, the coupling coefficient is of utmost importance to device performance, and manufacturers look to maximize the coupling coefficient as much as possible. In recent years, device manufacturers have been adding Sc to AlN as it has been shown that AlScN films with up to 43at% Sc may have ~400% higher piezoelectric coupling coefficient than AlN [1].
Unfortunately, increasing the Sc makes dry etching more problematic because of the low volatility of scandium halides relative to those of Al and N.
This presentation focuses on the challenges faced when etching both AlN and AlScN and presents solutions based on the use of an innovative high density plasma etch module. Etch data will include performance comparisons with more mainstream ICP type reactors, and various Sc levels.

<CV>
Joanne Carpenter is a Senior Product Manager for Etch Products at SPTS and has over 18 years' experience in the semiconductor and electronics manufacturing industries.
Joanne joined Surface Technology Systems (STS) in 2007 as an Etch Process Engineer. When STS and Aviza merged in 2009 to form SPTS, she became a Senior Etch Engineer, specializing in development of innovative etch process solutions and supporting SPTS customers on critical advanced packaging technologies in China, Taiwan and North America. Joanne was also closely involved in the development of SPTS's plasma dicing technology, before joining the Etch Product Management team in 2016, and is now responsible for the etch product solutions used in Piezo device applications.

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AD-25	ポリテックジャパン株式会社	Polytec Japan
AD-26	（一財）マイクロマシンセンター	Micromachine Center
AD-27	株式会社クレステック	Crestec Corportaion
AD-28	Coventor, A Lam Research Company	Coventor, A Lam Research Company
AD-29	アユミ工業株式会社	AYUMI INDUSTRY CO.,LTD
AD-30	電気学会センサ・マイクロマシン部門	IEEJ Sensors and Micromachines
AD-31	東北大学マイクロシステム融合研究開発センター (μSIC)	Tohoku University - Micro System Integration Center
AD-32	MEMS パークコンソーシアム(MEMS PC)	MEMS PARK CONSORTIUM
AD-33	東北大学 田中（秀）研究室	Tohoku University Tanaka Shuji Laboratory

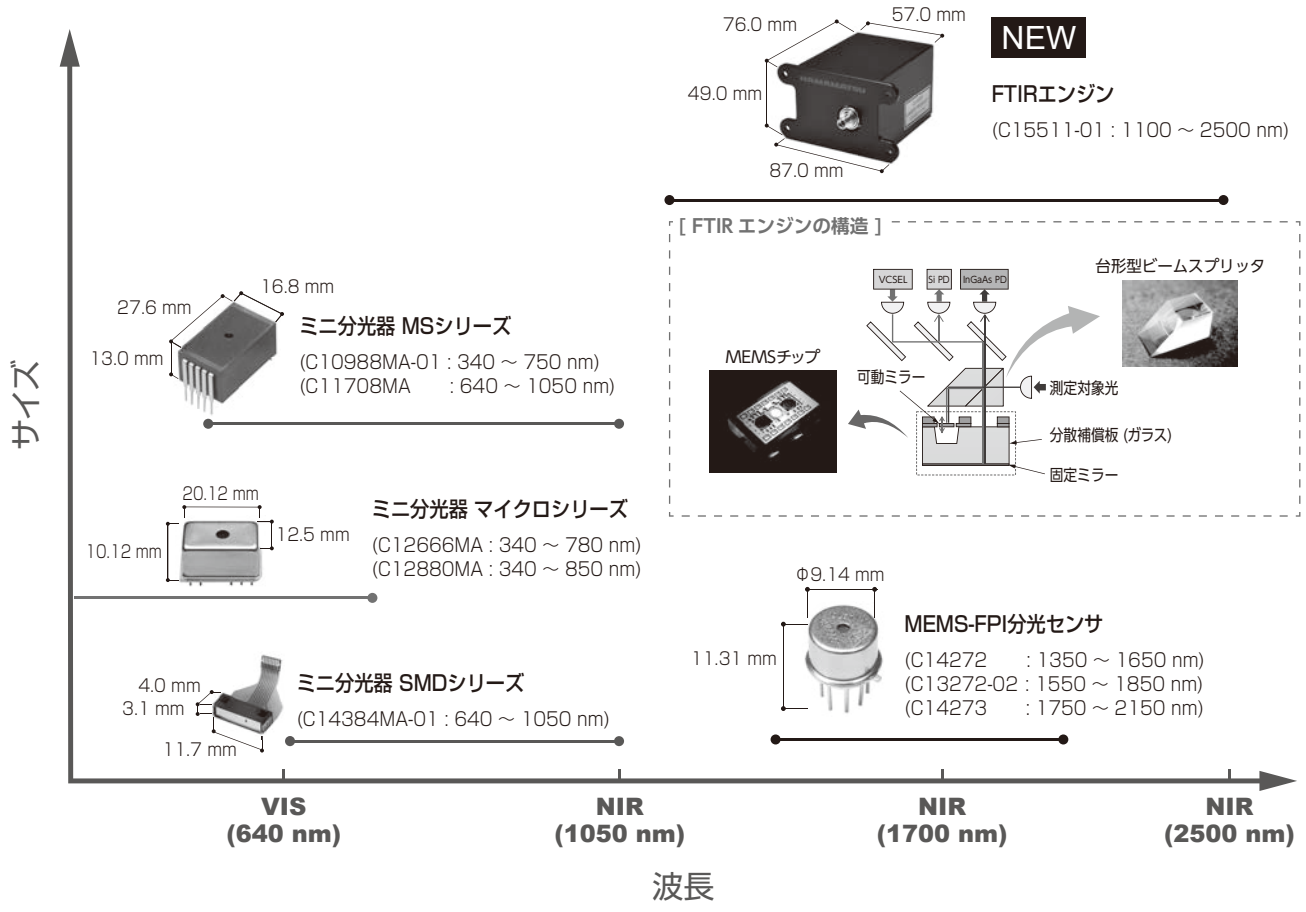
AD-34	日清紡マイクロデバイス株式会社	Nisshinbo Micro Devices Inc.
AD-35	興研株式会社	KOKEN LTD
AD-36	TDK 株式会社	TDK
AD-37	横河電機株式会社	Yokogawa Electric Corporation
AD-38	Adeia (Xperi)	Adeia (Xperi)
AD-39	株式会社メムス・コア	MEMS CORE CO.,Ltd
AD-40	長瀬産業株式会社	NAGASE & Co., Ltd.
AD-41	マイクロ化学技研株式会社	Institute of Microchemical Technology
AD-42	株式会社 KOKUSAI ELECTRIC	KOKUSAI ELECTRIC CORPORATION
AD-43	長野計器株式会社	NAGANOKEIKI CO.,LTD.
AD-44	株式会社フルヤ金属	Furuya Metal Co., Ltd.
AD-45	新光電気工業株式会社	SHINKO ELECTRIC INDUSTRIES CO., LTD.
AD-46	ハイソル株式会社	HiSOL, Inc.
AD-47	SK グローバルアドバイザーズ株式会社	SK Global Advisers Co., Ltd.

HAMAMATSU
PHOTON IS OUR BUSINESS

携帯型簡易分析向け分光器・分光センサ

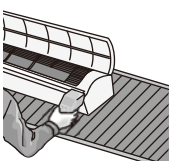
環境計測機器・色計測機器・生産ラインなど、さまざまな機器に組み込み、
現場でのリアルタイム計測を可能とした分光器/分光センサをラインアップしています。

浜松ホトニクスの携帯型簡易分析向け分光器・分光センサの位置付け



用途 (現場でのリアルタイム測定)

- インフラ診断 (トンネルなど)
- 繊維分別 (古着リサイクルなど)



- プラスチック選別 (リサイクル工場など)
- 色分析 (車の塗装状態など)

- 畜産検査 (乳牛の乳房炎など)
- 材料受入検査

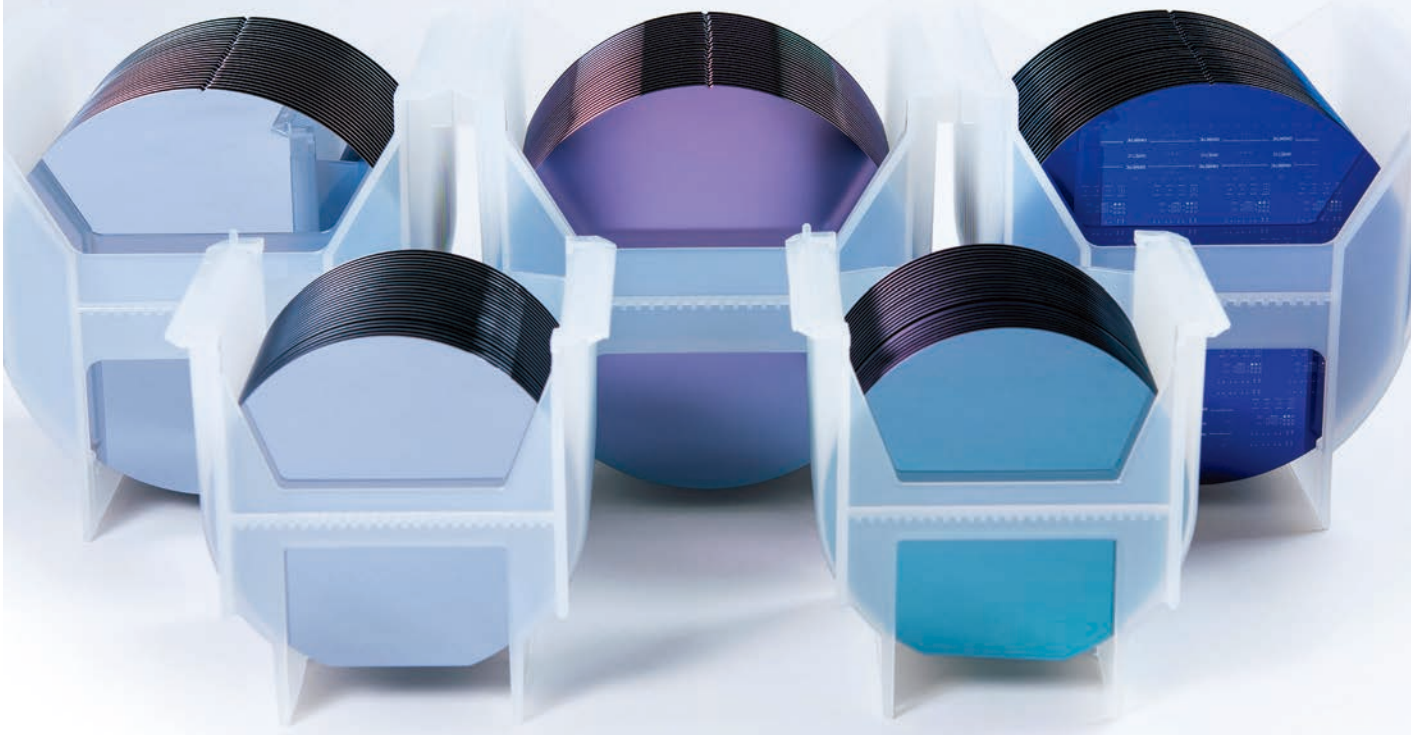
- 農産物検査 (糖分など)
- 土壌測定 (圃場)

浜松ホトニクス株式会社 www.hamamatsu.com

固体営業推進部 〒435-8558 浜松市東区市野町1126-1 TEL (053) 434-3311 FAX (053) 434-5184

OKMETIC

ADVANCED SILICON WAFERS SINCE 1985



WORLD'S LEADING SUPPLIER OF ADVANCED SILICON WAFERS FOR MEMS AND RF MARKETS

Okmetic, founded in 1985, is the leading supplier of advanced, high value-added silicon wafers for the manufacture of MEMS, sensor, RF and power devices. Okmetic has the most extensive 150 to 200mm wafer portfolio in the market comprising of comprehensive lines of Silicon-On-Insulator (SOI) wafers and High Resistivity RFSi® wafers as well as Patterned wafers, SSP and DSP wafers, TSV wafers, Wafers for Power devices and Wafers for GaN-on-Si applications.

Okmetic's headquarters is located in Finland, where the majority of the company's silicon wafers is manufactured. Worldwide sales organization and technical support ensure quick local service, rapid prototyping and highly optimized wafer solutions meeting your device and process needs. Okmetic K.K. has been serving Japanese customers since 2006.

WWW.OKMETIC.COM

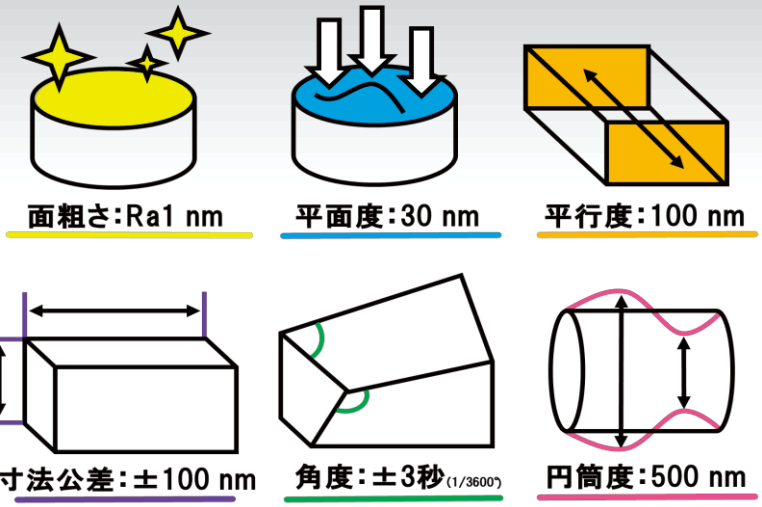
丁寧なものづくりで 喜びと、感動を

超精密研磨加工

超精密ラップ加工技術により各種ご希望精度を実現

金属、セラミックス、ガラス、半導体、新素材などあらゆる材質に対応

切削、研削、研磨、ポリッシュ等の加工を組み合わせる事により
お客様のご要望に総合的なソリューションを提供します



株式会社ティ・ディ・シー

https://www.mirror-polish.com
tdc@mirror-polish.com

本社・工場
〒981-0113
宮城県宮城郡利府町飯土井字長者前24-15
TEL 022-356-3131 FAX 022-356-3578

Fine Polish TDC

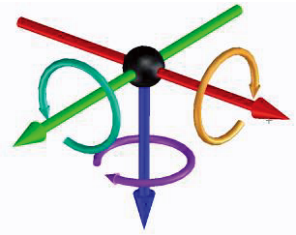
MEMS触覚センサシリーズ
ショッカクチップ＆ショッカクプローブ

Touchence

薄型・小型のMEMS６軸センサ
ショッカクチップ

オールインワンで指先サイズを実現した
世界最小の多軸触覚センサ

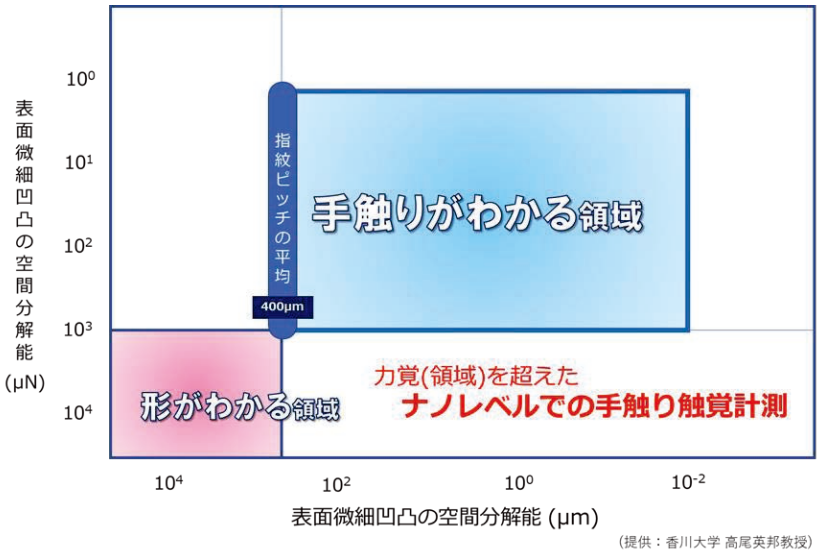
圧縮方向の力(Fz)とせん断力(Fx/Fy)の3軸力に加え
各軸のモーメント(Mx/My/Mz)を合わせた6軸力を同時計測



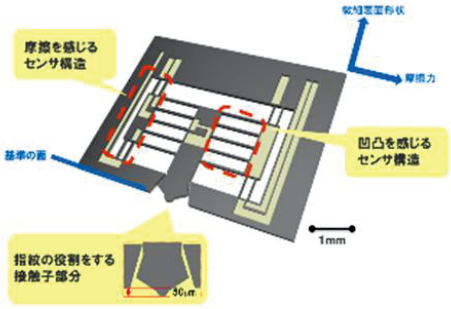
手触り感検出に特化した触覚センサ
ショッカクプローブ

世界初、『手触り』を計測する触覚センサ

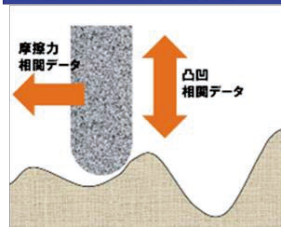
人の指紋に近い構造で手触りの数値化を実現
表面微細凹凸と摩擦力変化を同時検出可能



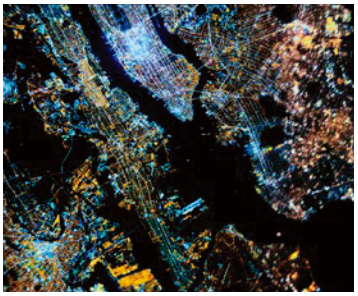
（提供：香川大学 高尾英邦教授）



プローブ先端拡大図

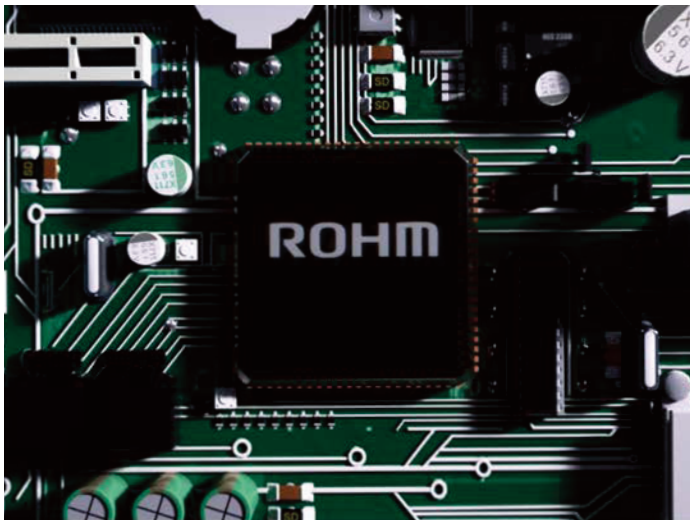


タッチエンス株式会社
〒110-0014 東京都台東区北上野2-21-10　TEL. 03-3847-9551　FAX. 03-3847-9552

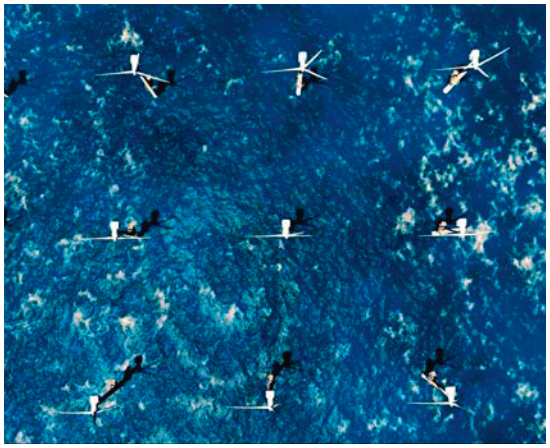



エレクトロニクスの技術で、美しい未来を。

Electronics for the Future







ROHM SEMICONDUCTOR

ローム株式会社

ロームWebサイトはこちら

Japanese English

アルプスアルパインは人と地球に喜ばれる
新たな価値を創造します。

Electronic Components

Touchless Display

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ALPSALPINE
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EVG®

invent innovate implement

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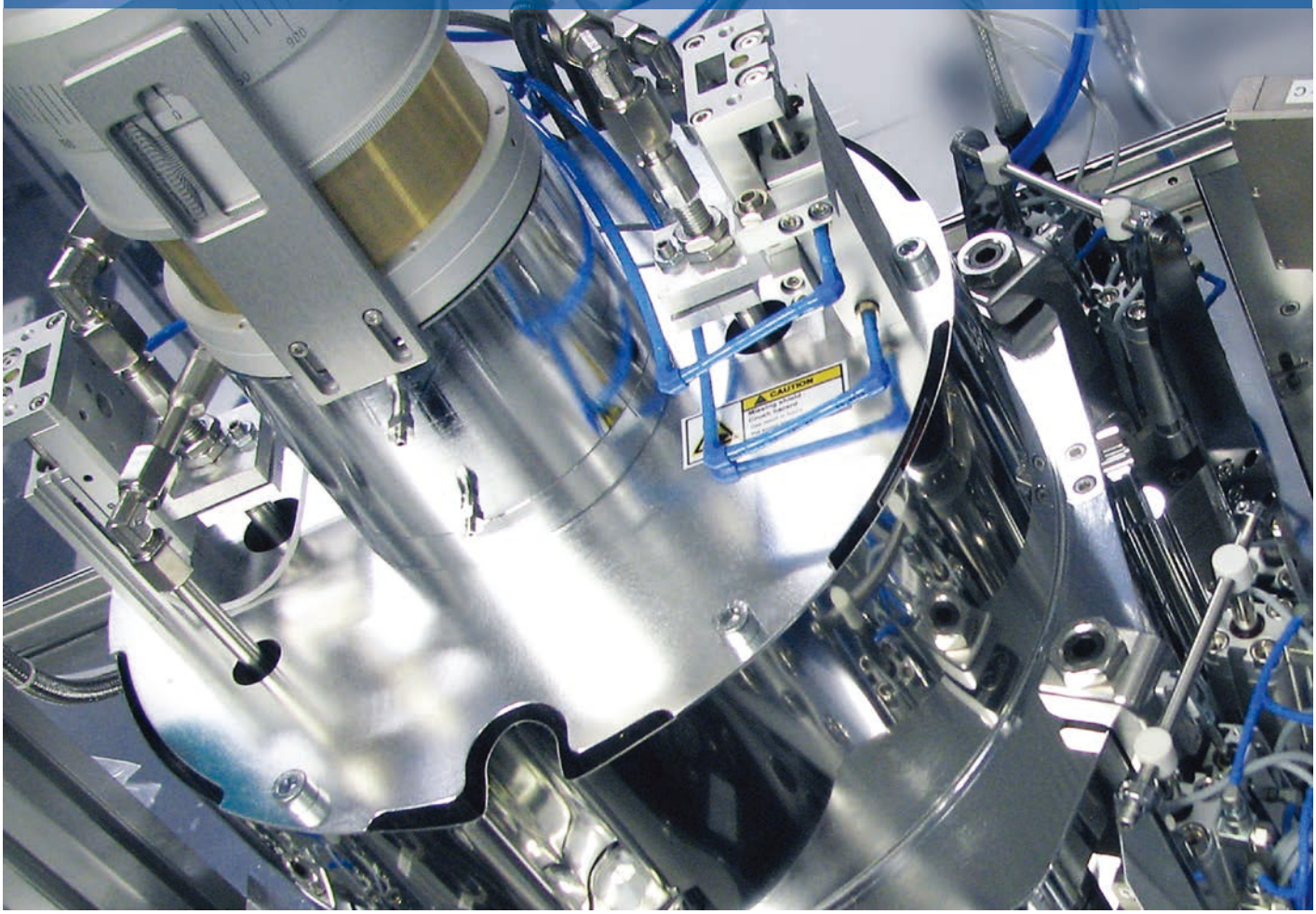
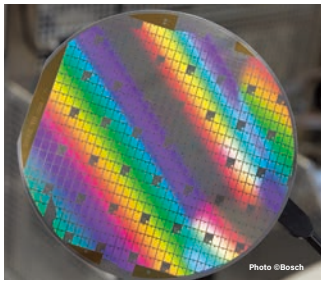
SOLUTIONS FOR MEMS PROCESSES





EVG is the first semiconductor equipment supplier ever to receive Preferred Supplier status by Bosch. According to Bosch, the most efficient suppliers to the company are appointed as preferred suppliers. These suppliers participate to a greater extent in new projects and are involved in development projects at an early stage. EVG received this accolade for its equipment as well as its comprehensive customer support.

EV Group Japan K.K.
Marketing+CommunicationsJapan@EVGroup.com
TEL: 045-348-0665

www.EVGroup.com

開発報告

業界きっての技術力を持つ

住友精密工業が開発した

ノースファインダー™
姿勢方位基準装置 (AHRS)
GCAH-12

概要

- MEMS技術により、小型・高耐久・低価格を実現
- GPSなしでリアルタイム姿勢方位を出力
- 初期静定は簡単、コマンドひとつだけ
- 慣性センサ出力をもとに自動演算

住友精密工業株式会社

詳細はこちら www.spp.co.jp/mems

JAB MS CM014

JMA QMS REGISTRATION CENTER JMAQA-

MIRISE TECHNOLOGIES

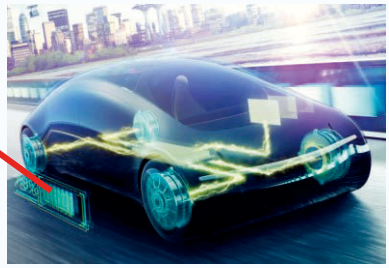
Mobility Innovative Research Institute for SEmiconductor Technologies

ミライズテクノロジーズは車載半導体を強化するために、デンソーとトヨタの半導体研究部門を集結して2020年4月に設立されました。パワーエレクトロニクス、センサ、SoCを主な研究領域として、CASE(※)などの自動車の技術革新に貢献していきます。

※ CASE：Connected, Autonomous, Shared, Electric

パワーエレクトロニクス

電動モビリティ社会を切り開く
高効率パワーエレクトロニクス

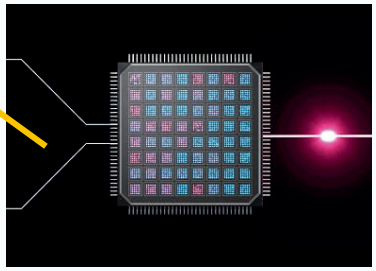


センサ

交通事故ゼロを可能にする
高精度センサ

System on a Chip

高度な自動運転を実現する
高集積、高速SoC



ミライズテクノロジーズは企業、大学、研究機関との連携を積極的に進めています。
私たちと車載半導体のイノベーションで豊かなモビリティ社会を実現しましょう

連絡先　ホームページの「CONTACT/問い合わせ先」を参照ください
https://www.mirise-techs.com

IntelliSense

MEMS 用統合解析ソフトウェア

IntelliSuite®

新機能リリース

MEMS 専用ソフトによる MEMS 最適設計

Total MEMS Solutions™

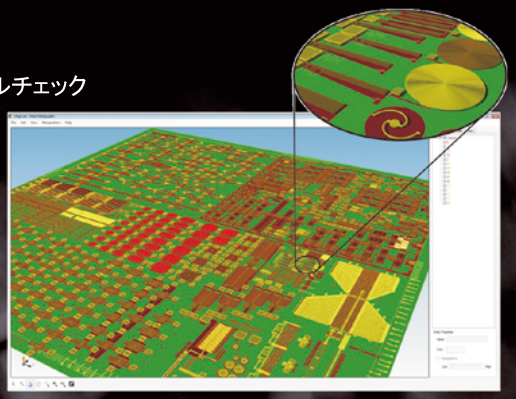
専門技術間のシームレスなデータ連携を実現するソフトウェア設計環境

MEMS概略設計

等価回路要素による高速設計機能
MEMS,電気,論理,デジタル回路要素による混成モデルに対応
3Dモデル,他に出力対応

マスク、プロセス設計

MEMS構造設計者向けデザインルールチェック
Dry,Wetエッチングシミュレーション
プロセスフロー設計
各種マスクデータ形式に対応

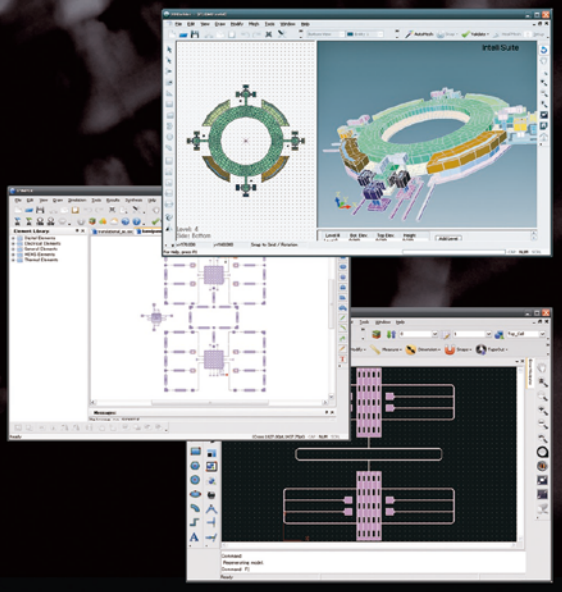


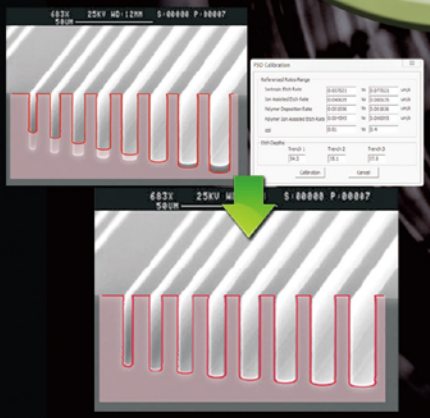
デバイス設計

Optical,Piezo,Sensor,RF,Bio,他の各種MEMSに対応
3次元、複合物理場によるデバイス性能設計機能
構造, 電場, 静電場,流体,流体減衰効果,
熱弾性減衰効果, 溶質,インピーダンス,
電磁駆動,他に対応

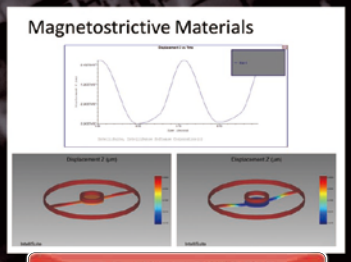
システム解析

ASIC設計との連携機能
ユーザー設計環境に対応





DEEP-RIEシミュレーションでの
マイクローディング効果の反映

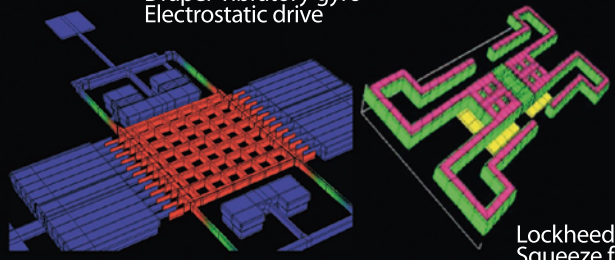


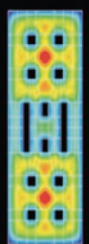
v9.0追加機能

- PZTデバイスマクロモデル解析の拡張
- エッチング解析のサファイア/InP対応
- Dryエッチング解析/Cariblation機能の改良

Rotary ring gyro
Rate/Coriolis analysis

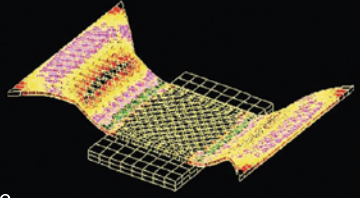
Draper vibratory gyro
Electrostatic drive





Lockheed inertial device
Squeeze film analysis

Raytheon/TIRF switch
Non-linear contact analysis



ADTECH 株式会社アドバンストテクノロジー URL http://www.ad-tech.co.jp/
〒141-0022 東京都品川区東五反田1-8-13 TEL:03-5475-1540 FAX:03-5475-1541 E-mail:sales@ad-tech.co.jp

AAC TECHNOLOGIES

Introduction to AAC MEMS

AAC is a major and global supplier of advanced MEMS microphones, MEMS sensors and RF products. The MEMS business unit has strong capabilities in R&D, manufacturing and global sales for the high performance MEMS microphone and also MEMS speakers, RF products for better user experience.

Microphone Shipments
Top 3 Globally

Total Shipment of AAC MEMS microphones
5,024,000,000+

R&D

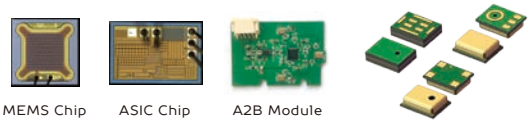
8	100+	900+
R&D centres Shenzhen, Wuhan, Hong Kong, Taipei, Singapore, Edinburgh Nanjing, Irvine	Ph.D and master degrees	Patents

Manufacturing

3	18,100M^2	150M /month	Class 100 and Class 1000
Production bases Shenzhen, Nanning, Johor	Plant area	Production Capacity	cleanrooms

MEMS Microphone

AAC's digital and analog MEMS microphone with high SNR (up to 70dB) and very low distortion for consumer bring a studio-quality experience. We now also offer high performance ultrasonic microphone, VPU microphone, smart microphone and A2B microphone module for applications in consumer, industrial and automotive markets.



MEMS Chip | ASIC Chip | A2B Module

MEMS Speaker

AAC owns IP and technologies on key MEMS chip development, and also AAC has very deep accumulation on packaging and testing. AAC provides an advanced solution of speaker with full-range Hi-Fi sound quality for wearable devices such as TWS, smart glasses, etc.

MEMS speaker

- Size: Φ6mm X 1mm;
- SPL : ≥105dB @6kHz~20kHz;
- THD : ≤5% @6kHz~20kHz;
- Loudness consistency : ±0.5dB;
- Power consumption : 10mW(MEMS+IC);

Speaker Module(TWS)

- Dynamic Speaker (Customizable) • MEMS speaker (Customizable)
- Size: Φ11mm X 3.6mm

MEMS RF

AAC will start from RF MEMS technologies and expand to all RF front-end devices based on our own IP and technologies, international R&D team and local implementation capability. AAC device and solution could apply on consumer electronics, wearable, IoT devices and other wide application scenarios.

MEMS Switch & Tuner

FOM =12 /
Revolutionary improvement of IL and ISO

- MEMS switches – Own IP
- Extremely low FOM, revolutionary improvement of IL and ISO
- Reliability lifetime up to 1b, high reliability

FBAR Filter

High Q, Low insertion loss High roll-off / small size

- FBAR filter design – Own IP
- Stable MP process
- High Q, low insertion loss, high roll-off, small size

RF SOI Device

Low insertion loss, High isolation, High power handling, High linearity

- Advanced Process of RF SOI
- Small size, low insertion loss, high pressure resistance, high linearity
- Comprehensive RFFE product roadmap

MEMS Inertial Devices

The Integration of independent design capabilities, precision manufacturing capabilities, and testing& calibration capabilities help achieve high-precision and high-reliability for vibration monitoring, attitude detection and dead reckoning in various application scenarios. Our goal is to provide a complete solution from inertial chip level to module level.

IMU Module for Automotive navigation

>L3 self-driving inertial module

High precision, providing more accurate navigation position information;
High robustness, module output being environmental vibration immune;

Inertial chips

~0.1°/hr high performance Gyro MEMS chip

High precision, providing more reliable vibration monitoring, posture detection, and dead reckoning ;
Completely localized supply chain, with independent and controllable design, packaging and testing capabilities;

		Consumer	Automotive
Gyro	BI	~5 °/hr	~0.1°/hr
	Noise	0.005 °/s/rtHz	0.002 °/s/rtHz
	TCO	±0.05 °/s	±0.004 °/s
Accel	BI	30ug	10ug
	Noise	90ug/rtHz	110ug/rtHz
	TCO	±0.5mg/C	±0.5mg/C

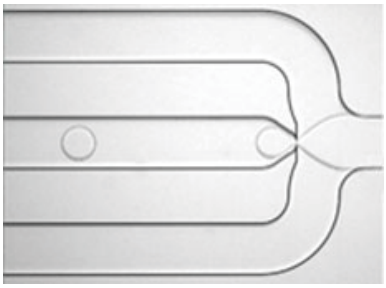
About AAC Technologies

Founded in 1993 and listed on the Hong Kong Stock Exchange in 2005 (Ticker Symbol: HK2018), AAC Technologies is a world-leading solution provider for smart devices. The company boasts the cutting-edge technologies in material R&D, simulation, algorithm, design, automation and manufacturing process development, which enables us to provide most advanced miniature technological solutions in fields like acoustics, optics, EM Drives, Precision Processing, MEMs, Wireless RF and antenna. For more information, please visit our official website: www.aactechnologies.com

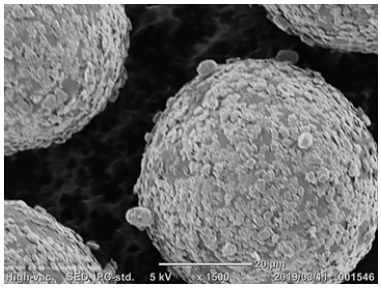
MEMS Prototyping Foundry

We support customers R & D and trial production with a consignment wafer processing service for medium volume productionfrom 1 to 100 pieces and from a single process to full process.

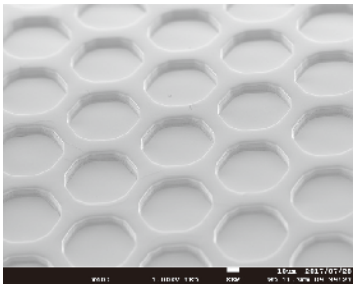
- Substrate, Deposition, Photolithography/Nanoimprinting, Etching, Ion Implantation, CMP/Wafer bonding, Others.
- Microfluidics chip (Standard chip/holder, Custom chip)
- Particle Coating, The uniform coating on the surface of fine particles can be done.
- Thin film membrane, Additional Nanopore processing, Thermocouple membrane.



Microfluidics chip



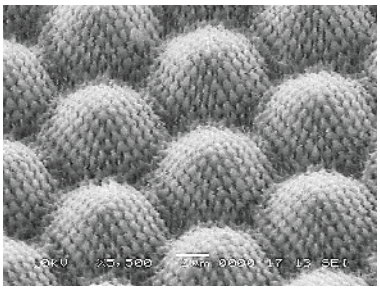
Particle Coating



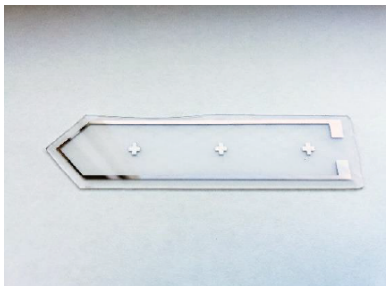
Thin film membrane

Polymer MEMS Development

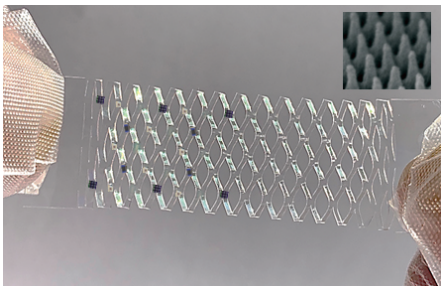
In the future Trillion Sensor era, High mass productivity, Cost merit, Durability Is required in the MEMS Sensor. We propose a Polymer MEMS solution by combining NIL know-how and silicon process know-how.



Optical sensor element with moth-eye structure



Thermocouple element formation on plastic film



Sensor with moth-eye structure mounted on elastic film (under consideration)

KYODO INTERNATIONAL INC. Electronics Dept.
2-10-9 Miyazaki, Miyamae-ku, Kawasaki-shi, Kanagawa-ken, 216-0033, Japan
TEL : +81-044-852-7575 FAX : +81-044-854-1979
E-MAIL : denshi@kyodo-inc.co.jp

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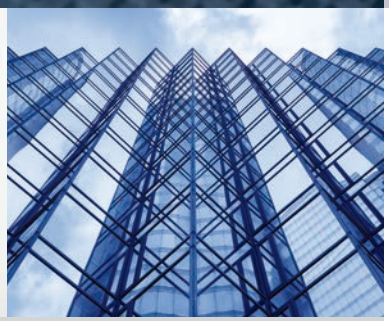
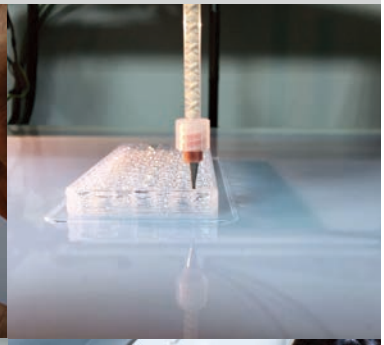
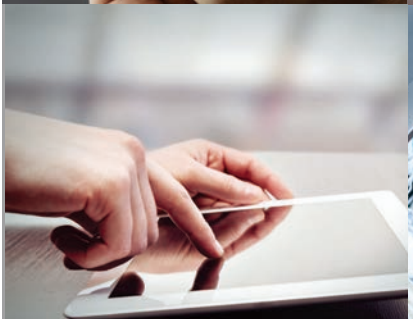


ダウのパーパス（存在意義）は

素材科学の専門知識とパートナーとのコラボレーションを通じて、世界のためにサステナブルな未来を築くことです。





シリコーン 技術でサステナブルな社会に貢献

ダウグループの一員として、化学の可能性を無限に広げ、イノベーティブなシリコーン技術と製品をベースにお客様のニーズや業界が抱える課題解決に貢献するダウ・東レ。

ホーム・アンド・パーソナルケア用途、エレクトロニクス、商業建築や高機能建築、消費財、シリコーンエラストマーや化学業界などにおける、ソリューションや原料を提供します。

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東北大学 金森義明教授・産総研・（一社）ミニマルファブ推進機構との共同開発
水素アニール技術を基盤とした新技術を搭載

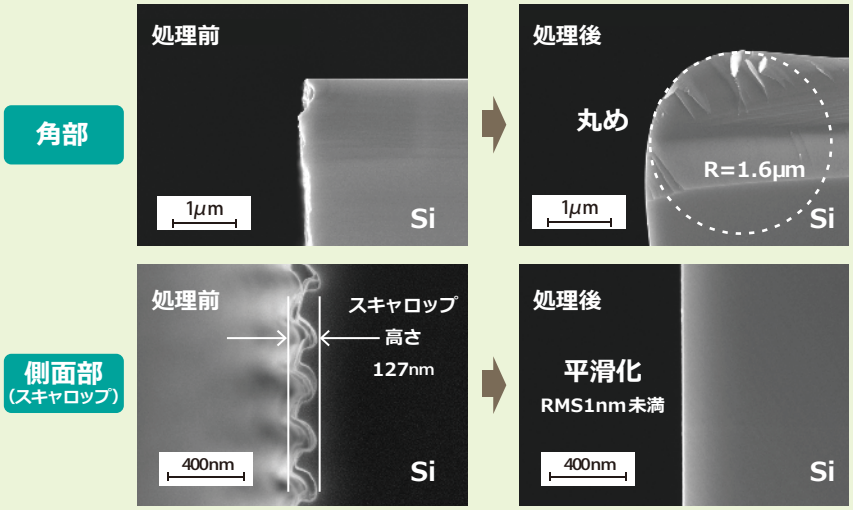
坂口電熱

原子レベルアンチエイリアス熱処理ミニマル装置
（ミニマルレーザ水素アニール装置）

平成 30 年度
～令和 2 年度
戦略的基盤技術
高度化支援事業
（サポイン事業）

シリコン微細構造の原子レベルでの平滑化と丸め制御により、
様々な分野・用途における MEMS デバイスの高性能・高信頼性を実現

シリコン微細構造断面（レーザ水素アニール処理）



特長

- ✓ φ12.5mm ウェハ（枚葉処理）
- ✓ コンパクトな筐体（幅約 30cm）
- ✓ クリーンルーム不要
- ✓ 低消費電力（定格 AC100V 10A）
- ✓ クリーン水素処理を可能とする超高真空対応（5×10^{-5} Pa以下）
- ✓ 急速昇降温（1100℃まで 2.5 秒）
- ✓ 安定した温度制御（1100℃±0.5℃）
- ✓ 均一温度分布（ばらつき 0.5％）（σ/Ave.）

用途例：【MEMS ミラー】
・自動車用 LiDAR のセンシング範囲の拡大
・スマホ用の至近距離・広角プロジェクタとしての活用 など

加熱試験のご相談も承ります

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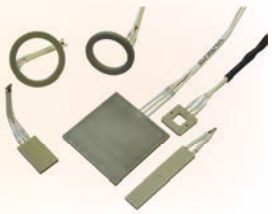

温調器 SCR-SHQ-A2

超高速・高精度・高性能。超高速サンプリング 10ms（0.01 秒）を実現しました。持ち運びができ、移動用としてもお使いいただけます。幅広い温度管理に最適です。

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エックス・レーザー・ライト

超高速な昇温降温が可能なレーザー平面瞬間加熱装置。0.5 インチ基板を 1 ショットで均一に加熱します。雰囲気を加熱しないため省エネです。プロセスに合った温度制御が可能です。真空度・ウェハサイズ・導入ガス等カスタマイズも承ります。

お問い合わせ先：
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VPG+ 1400

ULTRA

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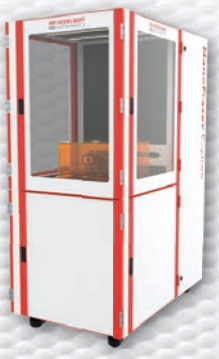
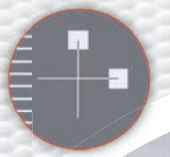
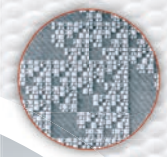
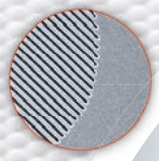


Explore







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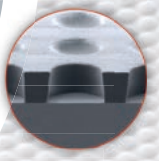
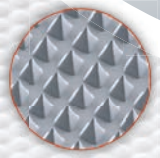


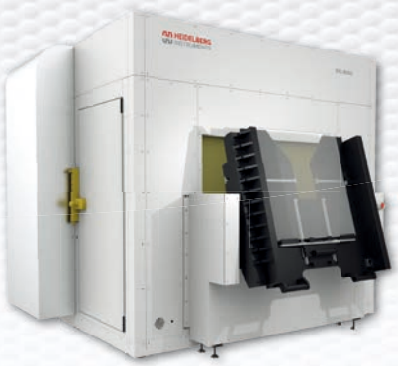


DWL

MLA

DWL 66+

MLA300



DWL 8000

DWL 2000

μMLA

MLA150

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神奈川県横浜市緑区白山1－18－2　ジャーマンインダストリーパーク
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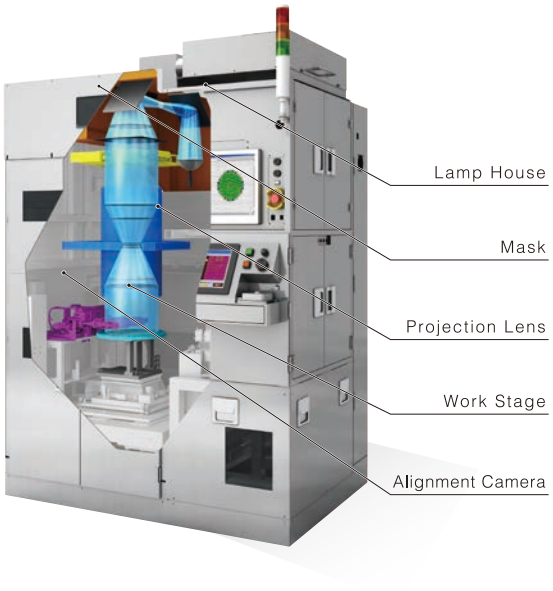
USHIO

Full-Field Projection Aligner

UX-4



Resolution	2μm L/S～
Overlay	Top Side : ±1μm, Back Side : ±1.5μm
Throughput	120wph
Wafer Size	Φ100mm / 150mm / 200mm Si, Saffire, GaN, GaAs, SiC, Glass
Wafer Transfer	Cassette to Cassette Automatic

Advantage of Full-Field Projection Lithography

	UX-4 (Full-Field Projection)	Others
Mask Damage Free	No mask-wafer contact throughout the process.	Proximity/Contact Aligner — Damaged
High Productivity	1 Shot — Productivity : Stepper < Full-Field Projection	Stepper — Multiple Shots
3D Lithography	Large Depth of Focus. High resolution on both top and bottom of step.	Proximity/Contact Aligner, Stepper
Thick Resist Process	No mask-wafer sticking problem with thick-sticky resist.	Proximity/Contact Aligner — Stuck
TTL (Through the Lens) Alignment	TTL Alignment Procedure 1. Mask mark is illuminated with UV light, and the image is captured by CCD Camera. 2. Save mask mark image on the tool. 3. Work mark is illuminated with non-UV light, and the image is captured by CCD Camera. 4. Align mask mark image and work mark image by adjusting work stage position.	
Mask Compatibility	OK — Use your own contact aligner mask. No special mask needed.	

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SPTS A KLA Company

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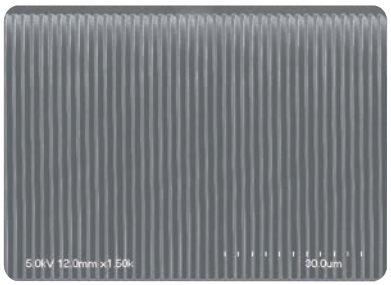
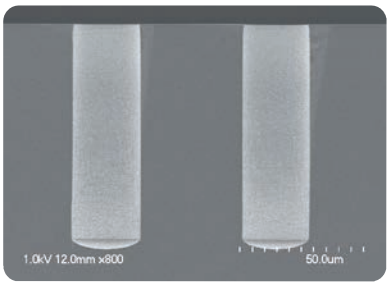
Deep Silicon Etcher

Predeus, Proxion and Pegasus represent a market leading Deep Reactive Ion Etch (DRIE) processing system, providing production customers the fastest etch rates with exacting feature profile control and excellent uniformity for substrate sizes up to 200mm. This combination of benefits further reduces the manufacturing cost in volume applications such as MEMS and Advanced Packaging concepts in silicon using ASE processing technology.



High Aspect Ratio (AR) etching



Through Silicon Via (TSV) etching

Deep silicon etcher

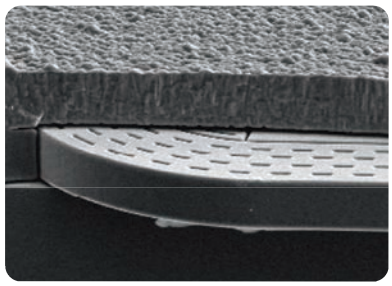
CPX Predeus

Sacrificial Layer Etcher for Silicon Oxide

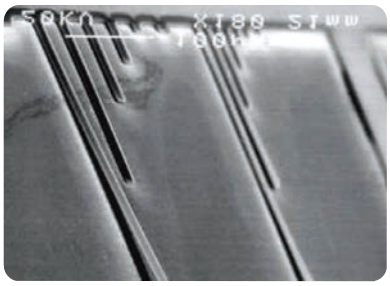
Sacrificial layer etcher for SiO_2

MLT Vetelgeuse

The Vetelgeuse, designed specifically for stiction-free sacrificial layer etch of silicon dioxide (SiO_2) for MEMS, also offers significant improvements compared to conventional wet etch processing by increasing compatibility with a wide range of materials including aluminum, copper and gold.



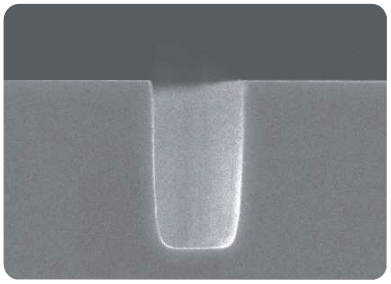
Silicon resonator (provided by SiTime)



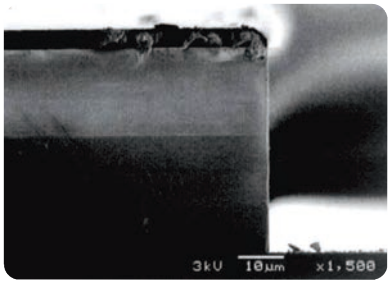
Cantilever

SiC, Oxide & Compound Semiconductor Etcher

The APS series, designed originally for deep etching of SiO_2 and Silicon Carbide (SiC), also offers significant improvements compared to conventional RIE and ICP processing for a wider range of materials such as lithium niobate and quartz.



SiC etching (bottom; round shape)



SiO_2 waveguide

SiC, oxide & compound semiconductor etcher

DPX Sirius

製造業の常識を打ち破る!

超精密水準を実現する3Dプリンターシステム

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超高解像度
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2μm 3Dプリンター

10μm 3Dプリンター

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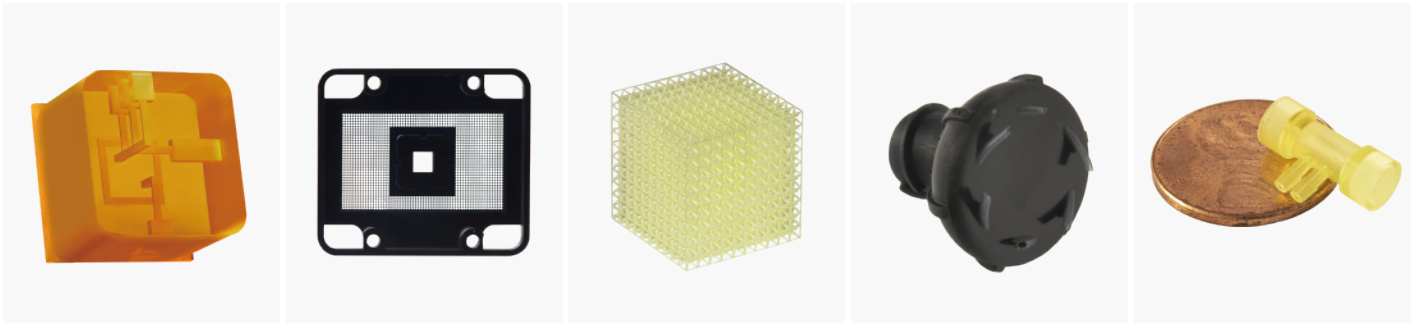
BMFが得意とする構造

独自のPμSL技術による造形事例



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・縦型、横型、螺旋状のチャンネル
・表面/内部チャンネル構造
・一体成型, 組立不要

射出成形/CNC加工では難しい部品

・密集配列の微細穴
・大面積の薄壁
・中空構造

マイクロアレイ

・Gyroid/他の類似構造
・微細格子ロッド
・最小3D部材サイズは僅か数十ミクロン

マイクロ針

・異なる種類のマイクロ針が可能
・密集配列
・針先をミクロン単位まで細くすることが可能

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・交差：±10μm/±25μm
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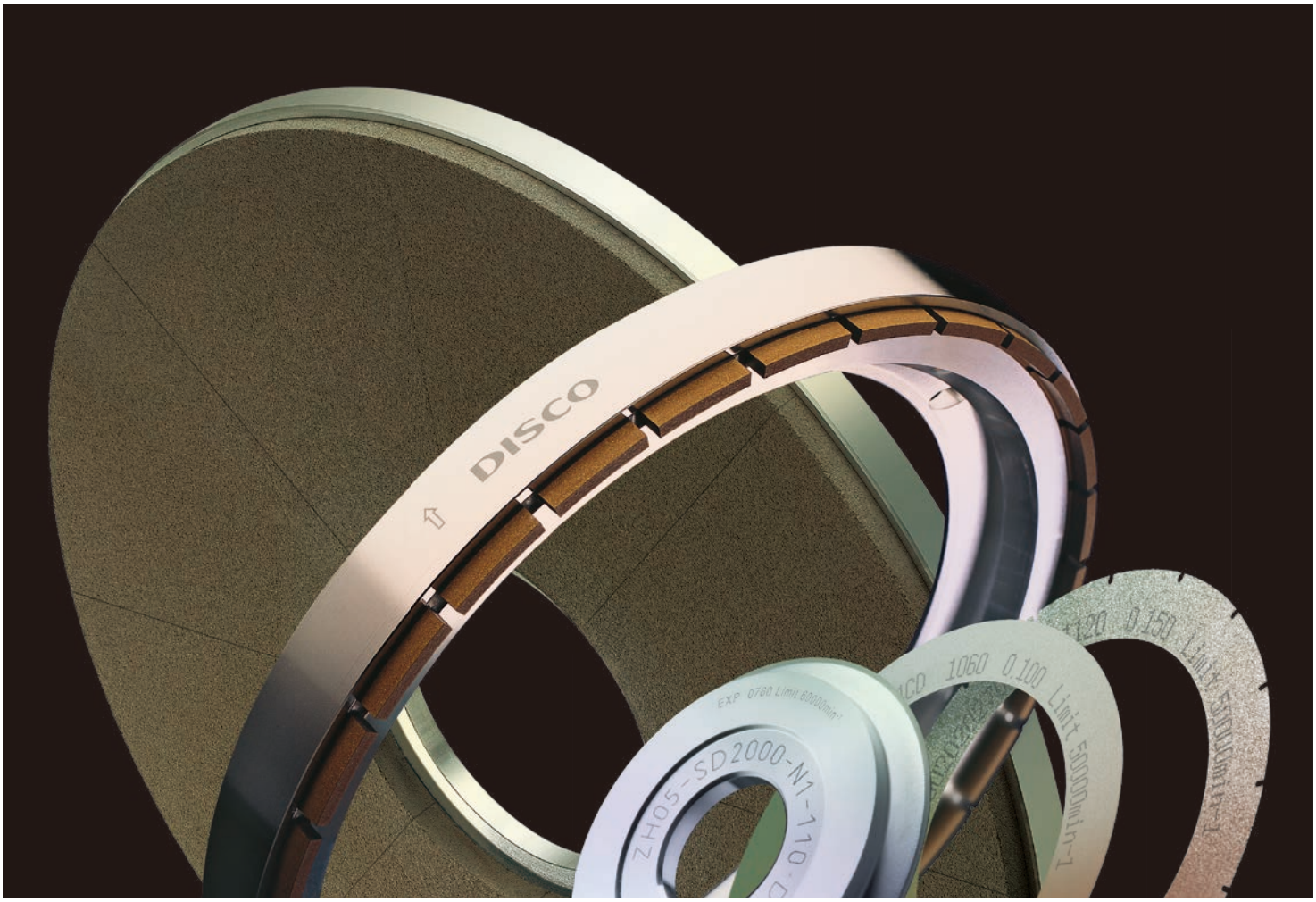

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表面活性化技術による低温(常温)接合
接合材料により最適な表面活性化方法を使い分け

常温接合プロセス

超高真空中でのArボンバードメントによる表面活性化技術により、常温にて異種材料を直接接合します。量産対応も可能です。

低温・低圧化プロセス

超高真空を使わず、低温・低圧接合を実現します。接合材料によっては大気中での接合も可能です。

独自の高精度アライメント(位置決め)
サブミクロンオーダーでの高精度接合を実現

WOW
(Wafer-on-Wafer)

研究開発から量産まで対応する
装置ラインナップ

COW
(Chip-on-Wafer)

COC
(Chip-on-Chip)

熱/UV　8" ウエハ対応

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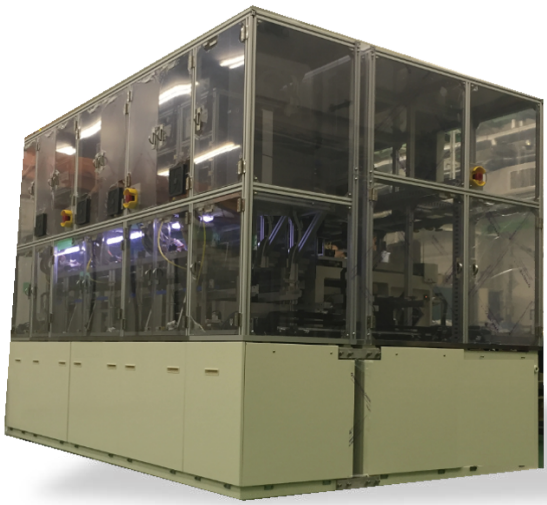

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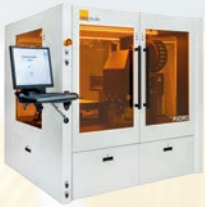

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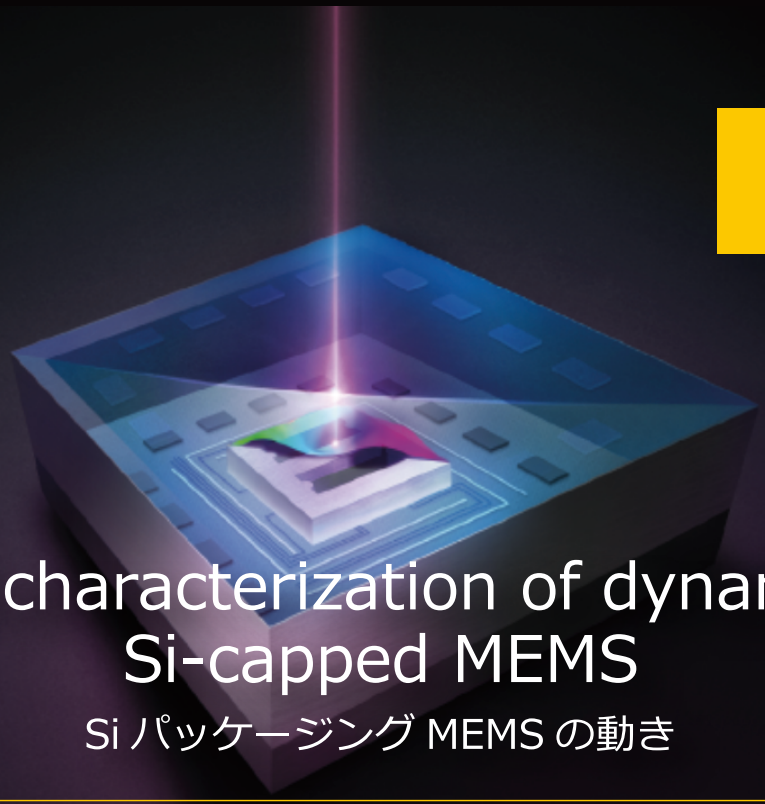
Polytec



Optical characterization of dynamics on Si-capped MEMS

Si パッケージング MEMS の動き

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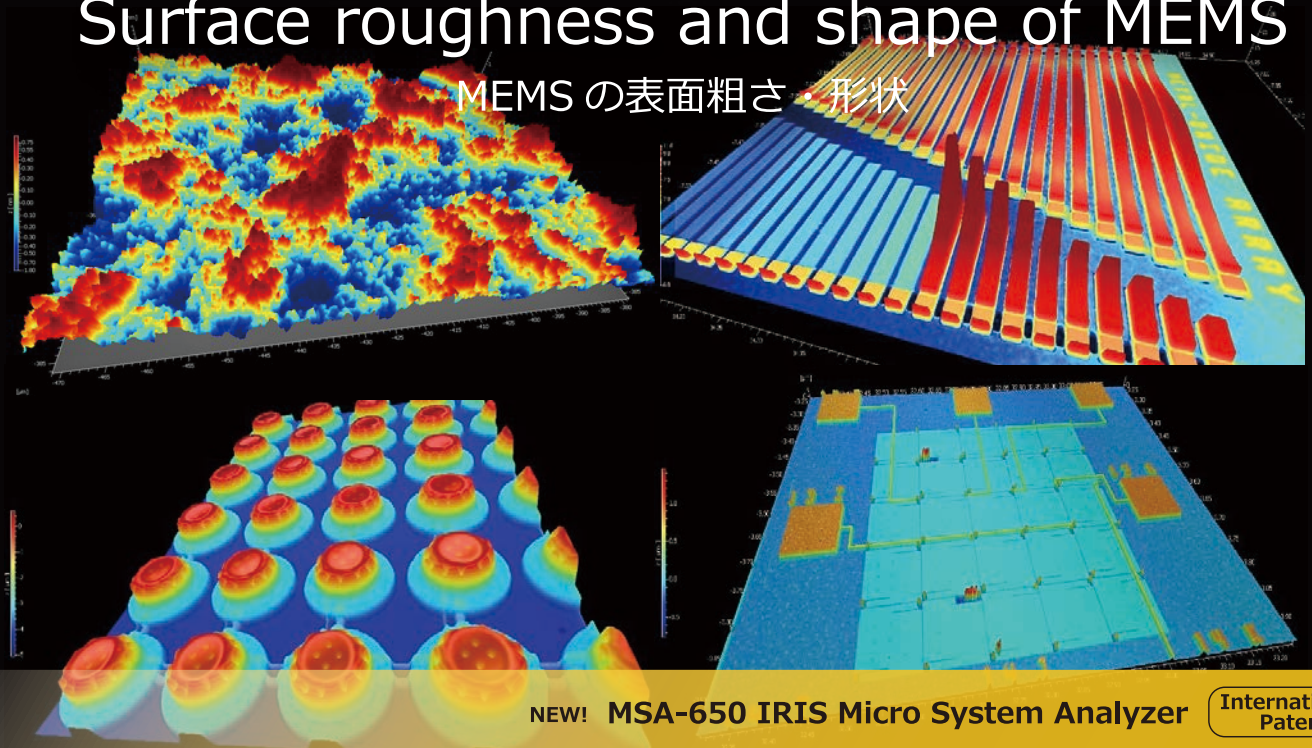
Surface roughness and shape of MEMS

MEMS の表面粗さ・形状



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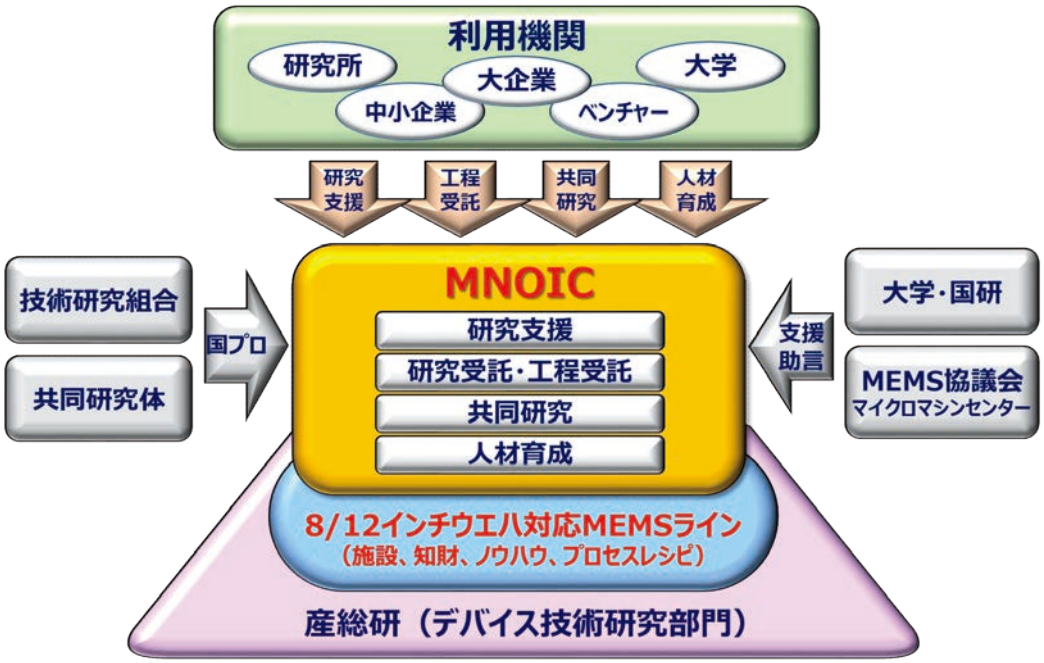
MNOIC: MicroNano Open Innovation Center

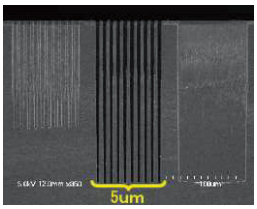
最先端MEMSラインによる研究支援・工程受託サービス

MNOICでは、産総研が蓄積した最先端MEMSの研究成果と、産業界から日本を代表する半導体、MEMSの製造企業出身の技術者による応用技術を合体させ、幅広いニーズに応える研究開発支援や工程受託などの多様なサービスを提供します。

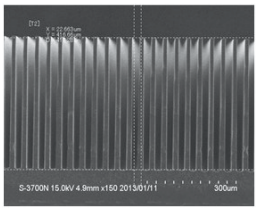


MNOIC微細加工事例

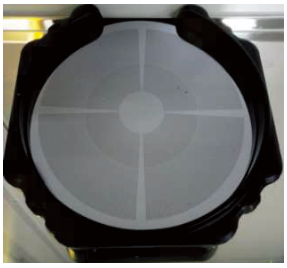
Si深掘エッチャ
（12”）



深溝加工
（幅：5μm, 深さ：200μm）



深溝加工
（幅：20μm, 深さ：400μm）



12”SiウェハX線ミラー加工例

【お問合せ先】
一般財団法人マイクロマシンセンター
MNOIC研究企画部　Tel. 03-5835-1870
MNOIC開発センター（産総研つくば東事業所内）　Tel. 029-886-3471
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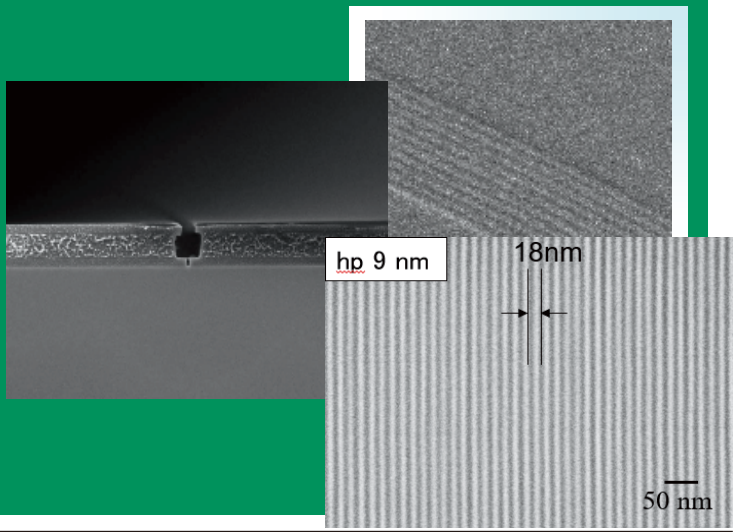
- nano-devices
- Sub 5nm gaps



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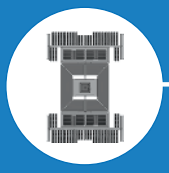
Layout



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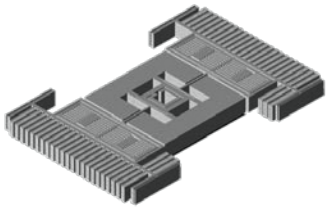

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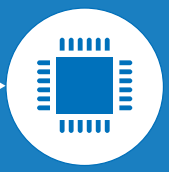
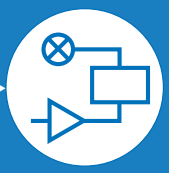


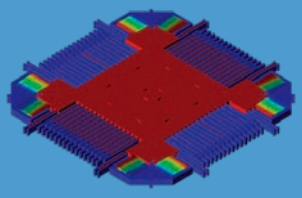
Device Level



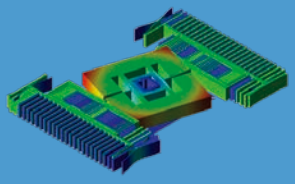
System Level

Circuit Level

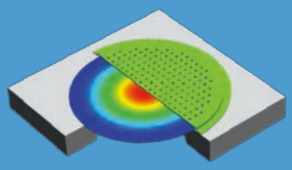
Accelerometers



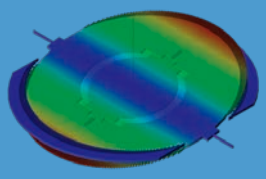
Gyroscopes



Microphones



Micro Mirrors



And many more MEMS devices...

MEMS+ and CoventorWare work seamlessly together in the Coventor*MP* framework. They provide a design platform that enables MEMS designers to simulate critical end-product performance specs such as sensitivity, linearity, frequency response, signal-to-noise ratio, temperature stability or actuation time. These software tools are ideal for MEMS devices that employ mechanical, electrostatic, piezo-electric, piezo-resistive, or thermal effects for sensing or actuation.

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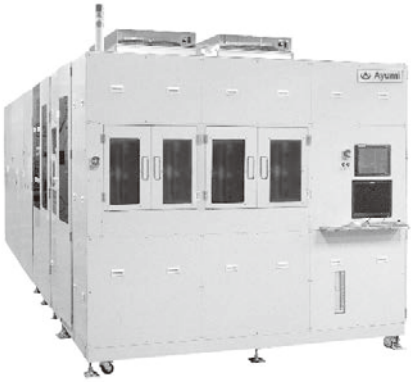
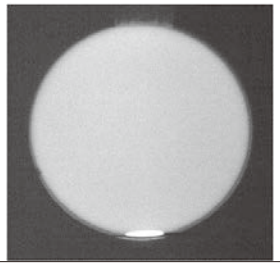


Si-Si RT Bonding

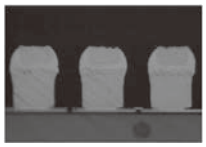
※Measured by IR light



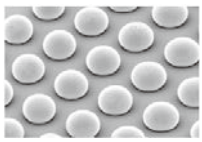
No Void Bonding

Flux-free Reflow System

Void free reflow and solder connection is available with flux-free reflow system for power electronics, LED, high density solder connection.
Formic acid can remove oxidation layer from metal surface.



Narrow pitch solder connection

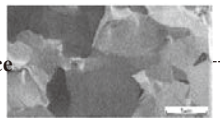


High density bump reflow

Metal bonding

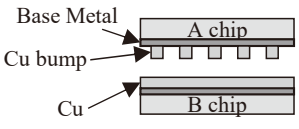
Low temperature metal bonding can be processed by using formic acid treatment

Cu-Cu bonding cut view

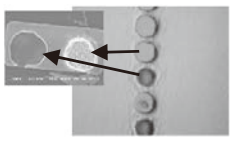


Cristal grows through bonding surface

Cu bonding strength



Pealing test after bonding



Break at UBM, Bonding surface is strong

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一般社団法人
電気学会

センサ・マイクロマシン部門（E 部門）

電気学会とは

電気学会は，1888 年に創設された学者技術者で構成される会員組織の学術法人です。すでに 1 世紀以上の歴史を有する伝統ある学会ですが，絶えず革新を求め，事業活動の活性化に努めています。第一線の研究者・技術者から，学生に至るまで幅広い方々の参加・支持を得ています。
https://www.iee.jp

センサ・マイクロマシン部門（E 部門）とは

電気学会センサ・マイクロマシン部門（E 部門）は，1995 年に設立された最も新しい部門です。これまでの電気学会の枠にとらわれず，計測工学・物性工学・精密工学・情報科学・ライフサイエンスなど，センサとマイクロマシンに関連する分野の技術者や研究者の参画を広く得て，21 世紀の新たな基盤技術を作り出すために，協同・協力して研究開発をすすめる交流の場となることを目指しています。
https://www.iee.jp/smas

部門大会「センサ・マイクロマシンと応用システム」シンポジウム

部門大会である「センサ・マイクロマシンと応用システム」シンポジウムは，センサ，マイクロマシン，MEMS などに関する我が国最大の講演会です。今年は Future Technologies from TOKUSHIMA として，合同シンポジウムを開催します。センサ，マイクロマシン技術のさらなる発展を目標に，学協会を超えた研究グループ間の情報交換，研究成果およびアイデアの討議の場として開催されます。

発表申込締切
2022 年 6 月 15 日（水） 正午

同時開催シンポジウム
第 13 回「マイクロ・ナノ工学シンポジウム」
第 14 回「集積化 MEMS シンポジウム」
化学とマイクロ・ナノシステム学会　第 46 回研究会

総合研究会

本会は，センサ・マイクロマシン部門にあるマイクロマシン・センサシステム，ケミカルセンサ，バイオマイクロシステムの各分野を軸として，本部門における研究会を総合的に行うものであり，部門内の交流，若手の育成，発展に寄与することを開催趣旨としています。
本年は，2022 年 6 月 7 ～ 8 日に金沢商工会議所にて開催します。皆さまの積極的なご参加をお願いいたします。
発表申込締切　2022 年 4 月 8 日（金）
https://www.iee.jp/blog/esoken2022/

電気学会論文誌 E

電気学会論文誌 E（センサ・マイクロマシン部門誌，E 部門誌）は国内唯一のセンサ・マイクロマシン専門誌として 20 年以上の歴史を持っています。一般論文に加え解説，特集号，研究室紹介，国際会議報告，特別記事，座談会など魅力的なコンテンツを掲載しています。皆さまの投稿をお待ちしています。
https://www.iee.jp/smas/publication/magazine/

試 東北大学 作コインランドリ

Hands-On-Access Fabrication Facility

TOHOKU UNIVERSITY

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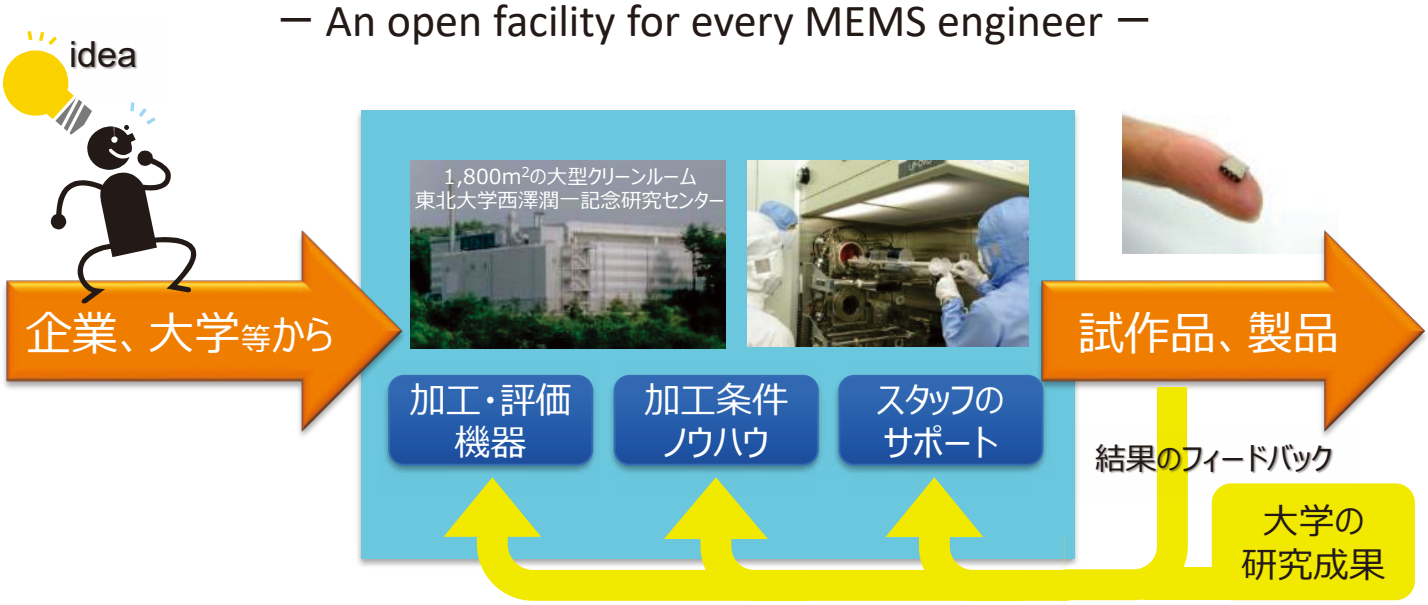
－ An open facility for every MEMS engineer －



- 100台以上の微細加工・評価機器をご利用いただけます。
- 単工程からセンサなどのデバイスの試作開発まで可能です。
- 大学に蓄積された技術、ノウハウをご利用いただけます。
- 15名の専属スタッフが設計から試作、評価まで支援します。
- 機器、技術支援は時間単位でご利用可能で、1時間あたり1,000円～25,000円程度です。
- 一定の条件のもとで製品の製作も可能です。また、機器利用だけでなく、共同研究など多様な使い方も可能です。
- 2010年の開始以降、これまでに約300社が利用しています。年間10,000件以上の機器利用の実績があります。
- 圧力センサ、波長可変光源、血液分析チップなどの製品化事例があります。





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MEMS
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MEMSパークコンソーシアム

産学官の連携により、国内外の企業、研究機関、支援組織等とのネットワークを構築し、MEMSを中心としたマイクロデバイス分野の研究開発・産業化促進を行っています。

■第20回MEMS集中講義 in 香川

日時：2022年8月8日(月) ～ 8月10日(水)
場所 8日、9日　かがわ国際会議場（YouTubeライブ配信あり）
　　10日　香川大学 創造工学部3101教室（YouTubeライブ配信あり）
主催：東北大学マイクロシステム融合研究開発センター、MEMSパークコンソーシアム、
　　香川大学微細構造デバイス統合研究センター
参加無料。プログラム等の詳細を、MEMSパークコンソーシアムHPに後日掲載します。

■International Contest of InnovAtioN (iCAN)

MEMS等のデバイスを活用して、役立つアプリケーションを製作し、発表する学生向けのコンテストです。MEMSパークコンソーシアムが日本予選を毎年開催し、上位チームを世界大会に派遣しています。オムロン、日本信号、アルプスアルパインからMEMSデバイスを提供いただいています。

第5回世界大会（仙台） 2014年7月


2014 世界1位　郡山北工業高　防災・防犯ロボット
第6回ものづくり日本大賞（内閣総理大臣賞）
2015.11


2011 世界第1位　京都大
指文字翻訳機


2016 国内第2位　郡山北工業高
尿糖値センサ


2017 世界第1位　東北学院大/東北大　スマホ・PC操作時の姿勢矯正

2015年1月　ラスベガス CESに出展


2015 世界1位：NPO natural science、東北大、
大阪大　茶道のお点前点数化


2009 世界第2位　京都大
LEDアレイを搭載したブーメラン


2016 国内第3位　郡山北工業高
赤ちゃんのうつぶせ寝検知


2017 国内第1位　東北大
リハビリを補助するけん玉

iCANに協賛いただける企業を募集しています。

■人材育成事業

MEMSの試作を通じて、設計・加工・評価のノウハウを提供します！

受講される方が、作りたいデバイスを東北大学試作コインランドリに持ち込んでいただく「オーダーメード型」です。MEMSは標準化が困難で、デバイス毎に形状や作製プロセスが異なるので、多くのノウハウを習得する必要があります。そのため、とくに初めてMEMSに取り組まれる場合、実際にデバイスを試作しながら技術を学んでいただくことが最も効果的と考えています。

受講者の募集：随時（通年）。
事前相談：御希望に応じた受講内容を相談、提案いたします。
実習内容：企画、設計、試作、評価まで1～3か月で実施します。設計のみ等、柔軟に対応します。

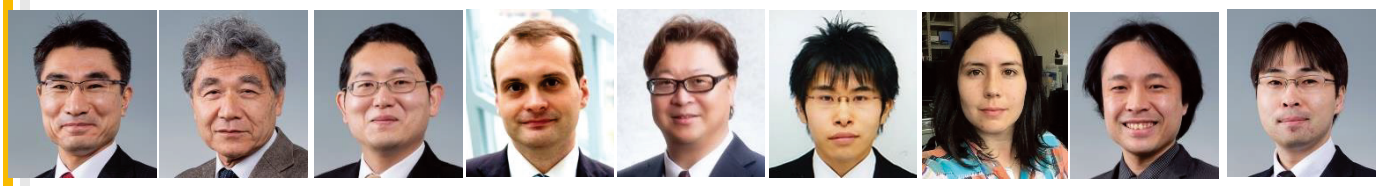
MEMSパークコンソーシアムでは入会を随時受け付けております。http://www.memspc.jp/

東北大学　大学院工学研究科　ロボティクス専攻

田中(秀)研究室

ナノシステム講座　スマートシステム集積学分野
http://www.mems.mech.tohoku.ac.jp/index.html

Micro Electro Mechanical Systems Lab
Tanaka Shuji Laboratory



教 授 田中 秀治
シニアリサーチフェロー 門田 道雄
准教授 塚本 貴城
准教授（μSIC） Jörg Frömel
講師（μSIC） 鈴木 裕輝夫
助教 山田 駿介
助教 Andrea Vergara
客員准教授 室山 真徳
客員准教授 吉田 慎哉

材料からシステムまで、MEMS・マイクロシステムの研究開発

MEMS（Micro Electro Mechanical Systems）は人間と機械との間をつなぐ入出力システムとして広く利用されていますが、それを発展させた新しいマイクロシステムを創出しています。たとえば、ロボットやVRシステムに用いられる高性能ジャイロスコープや触覚センサ、情報通信や無線センサの要となる周波数選択・制御デバイス、安心・安全、健康、あるいは省エネルギーのための各種センサなどがあります。これらのマイクロシステムは、これまでにない機能や性能を発揮するために、集積回路との一体化、機能性材料の利用、新しいパッケージングなどを必要とします。そのため、異種要素をウェハレベルで集積化するヘテロ集積化技術、ウェハレベル・パッケージング技術、機能性材料の成膜技術などの基盤技術も開発しています。また、企業との共同研究、技術支援、研究機器の公開、および国際連携にも力を入れています。

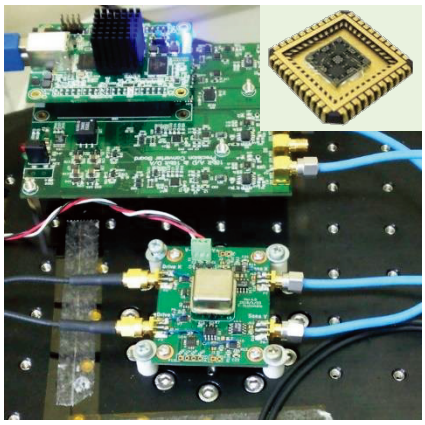


図1　システムレベル・デバイスレベルで高性能化したMEMSジャイロスコープ

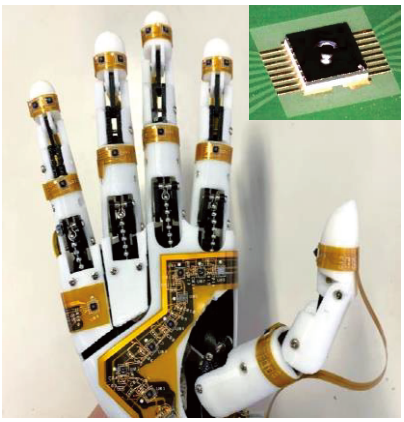


図2　ロボットハンド*に実装した集積化触覚センサ
*東京都立産業技術高等専門学校 深谷直樹准教授提供

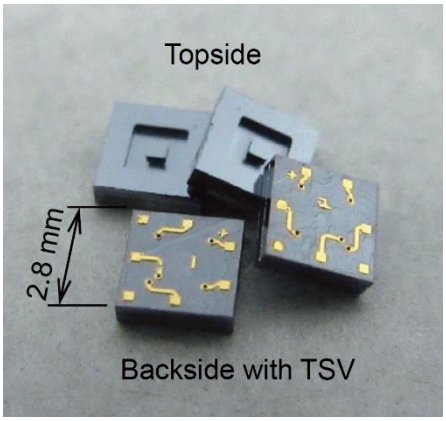


図3　MEMS-LSI集積化プラットフォーム（TSV付きLSIによる気密封止）

ロボット，自動運転車，スマートフォン，ヘルスケア機器などのための高性能センサー

自動運転やロボット制御のため、従来のMEMSジャイロスコープを格段に高性能する研究を行っています（図1）。ロボットの体表を覆うバスネットワーク型触覚センサーを、力センサーと信号処理・通信用集積回路が一体化された形で開発しています（図2）。また、ジェスチャー認識や位置制御のための超音波レンジファインダー、光素子の制御に用いるマイクロアクチュエーターなども開発しています。

ウェハレベル・パッケージング／集積化技術

MEMSとLSIに代表される異要素の集積化技術、MEMSをウェハーレベルで真空封止するためのパッケージング技術などを開発しています（図3）。これらは、マイクロデバイスの小形化や高機能化に必要な共通基盤技術であると同時に、多くのノウハウを必要とする差別化技術でもあります。また、原子層堆積（ALD）装置、ウェハーボンダーなどのプロセスツールも開発しています。

無線通信をつながりやすく、高速にするための周波数選択・制御デバイス

スマートフォンに代表される携帯情報端末の普及とコンテンツの充実によって、周波数資源がひっ迫しています。無線通信の根幹を担う周波数制御機能は、実は機械的に振動するマイクロデバイスによって実現されています。通信のさらなる高密度化と高周波化に対応するために、Q値と温度安定の高い弾性波デバイス（SAW・BAWデバイス）、集積化高周波MEMSスイッチなどを開発しています。また、圧電薄膜材料や圧電デバイスの開発にも力を入れています。

【お問合せ先】
東北大学　大学院工学研究科　ロボティクス専攻
教授　田中　秀治
TEL: 022-795-6934
E-mail: tanaka@mems.mech.tohoku.ac.jp
※いつでも技術相談を受け付けています。

日清紡マイクロデバイスのセンサ技術

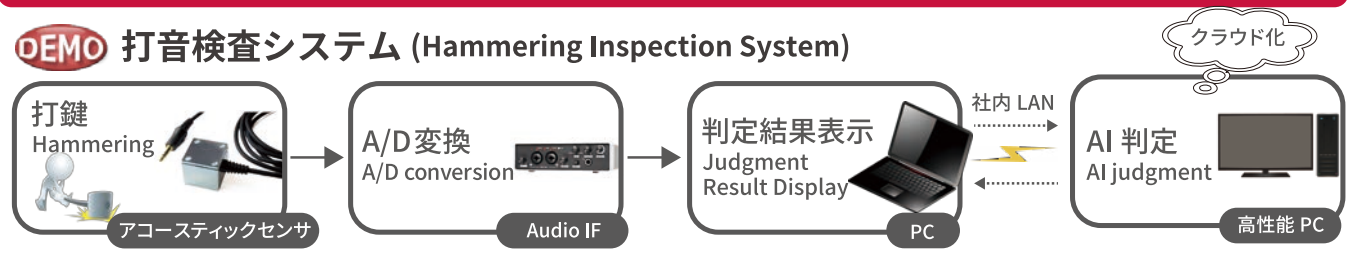
アコースティックセンサ
Acoustic Sensor

- 耐環境産業用途向け超音波センサ
- 100kHzまでの超音波を検知
- 防塵防水 IP67 対応可能
- 周囲ノイズを抑制する接触設置タイプ

・For environmentally resistant industrial applications
・Detects ultrasonic waves up to 100 kHz
・Dustproof and waterproof IP67 compatible
・Contact installation type to suppress ambient noise

Application Example

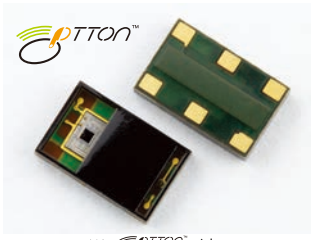
DEMO 打音検査システム (Hammering Inspection System)



光学式タッチレスセンサ
Optical Touchless Sensor

- 小型・薄型パッケージ
- 隣接するセンサ同士の干渉防止機能内蔵
- 外乱光に強い

・Miniature, thin package
・Built-in interference prevention for adjoining sensors
・Resistant to ambient light



※ OPTTON™ は、
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Target Application

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Vending machine

飲料サーバー
Beverage stat

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世界最上級の清浄度を数十秒で形成

清浄度が不安定なせいで失敗したことはありませんか。
オープンクリーンシステム KOACH（コーチ）が形成する清浄空間は世界最上級の**ISOクラス1**です。
高い清浄度を必要とする作業にも短時間でレスポンス良く対応できます。

囲わないから作業がしやすい

手元だけでなく上部や奥側を囲うことなく清浄空間を形成します。
オープンなので物を出し入れする動きにも干渉しません。顕微鏡の観察作業も楽に行えます。
囲わないことにより**コンタミナントを素早く排出**できるので清浄度の維持管理も簡単です。

使いたい場所でスーパークリーンを形成

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移動もでき、使わない時は片付けられるのでスペースを有効活用できます。

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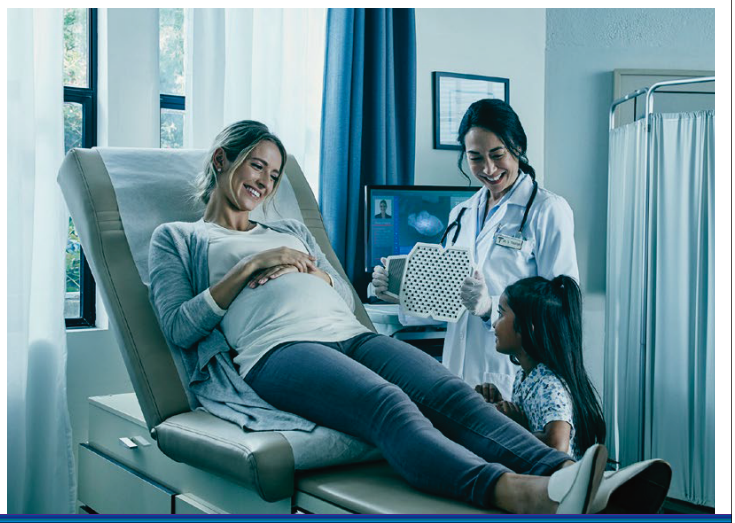
KOACH　検索

IoTを、万能にする。

5Gに、限りない可能性を。

モビリティを、夢見た先へ。



先端医療を、革新する。

再生エネルギーを、あたりまえに。

人とロボットを、もっと近くに。

未体験の感覚を、より多くの人に。

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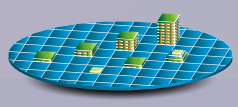

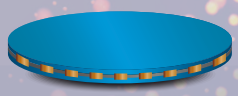

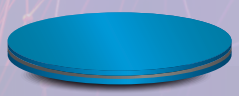

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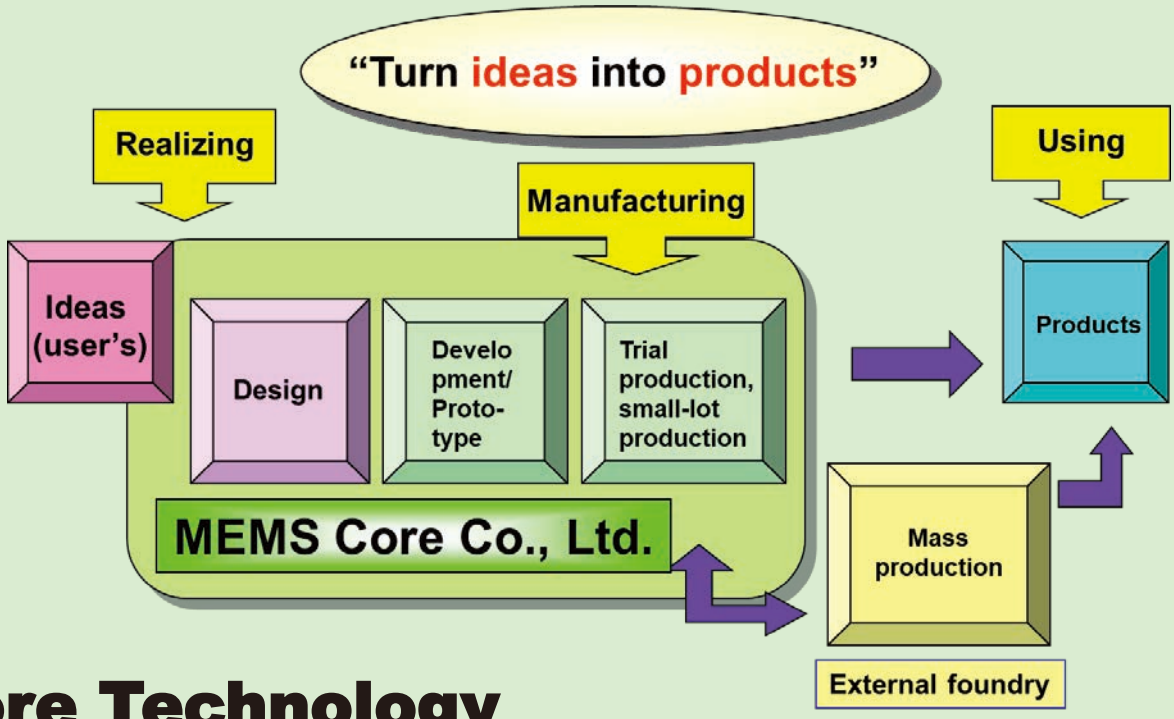

Core Technology

◆ Si DEEP RIE

◆ Patterning

Depth 300 μm、100um:L/S

◆ Feed Through

◆ Sacrificial layer etching

◆ Thermopile

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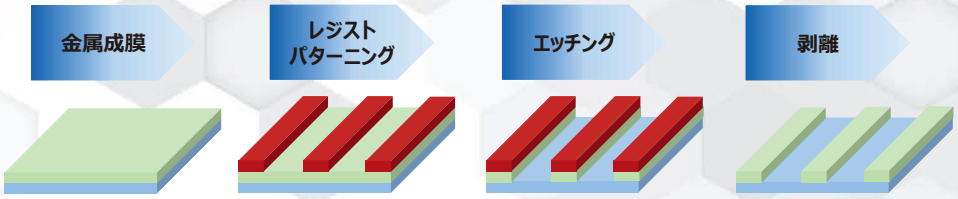
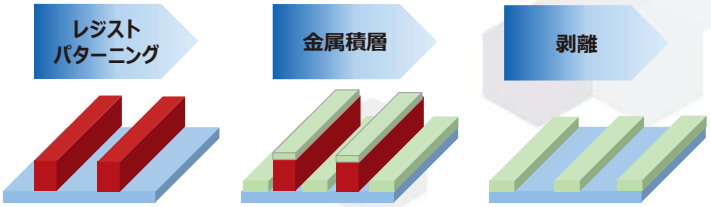


4 steps

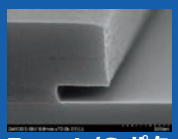
リフトオフプロセス



3 steps

製品ラインナップ

リフトオフプロセス用2層レジスト
BLX シリーズ

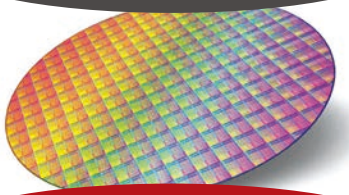


1.5um L/S パターン

2.5D 露光用レジスト
GDX シリーズ

5um 直径パターン

Profile Control

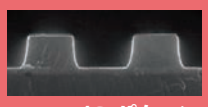


Durability

リフトオフプロセス用単層レジスト
UCZ シリーズ

10um L/S パターン

ウェットエッチング用レジスト
GRX シリーズ



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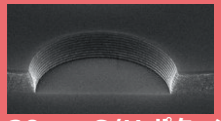

20um C/H パターン

Nagase ChemteX
NAGASE Group

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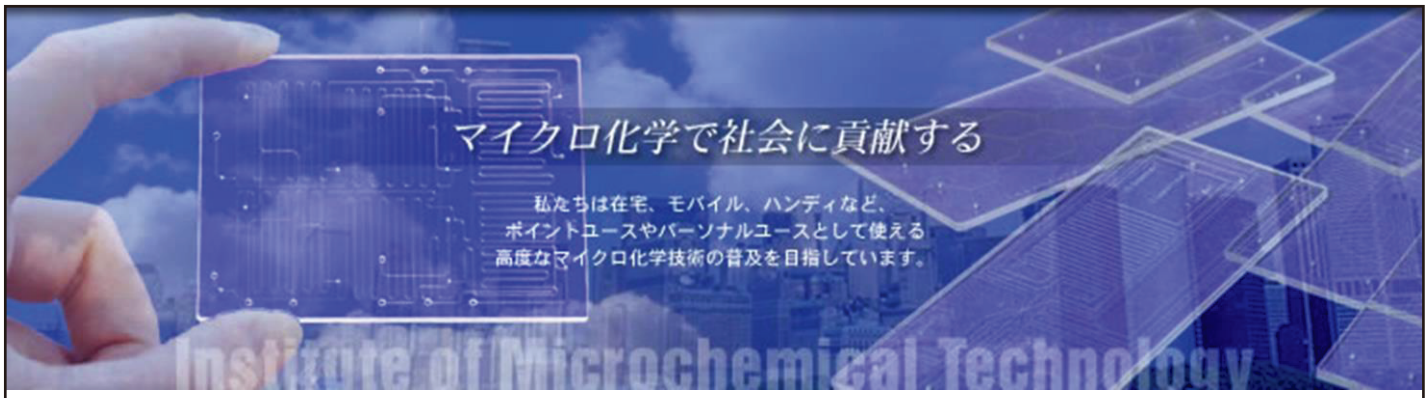
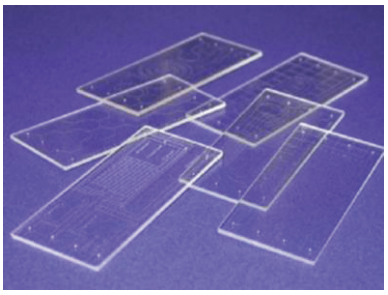


カスタムメイドマイクロ化学チップ



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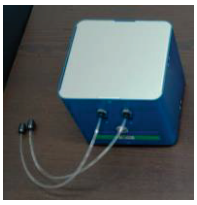

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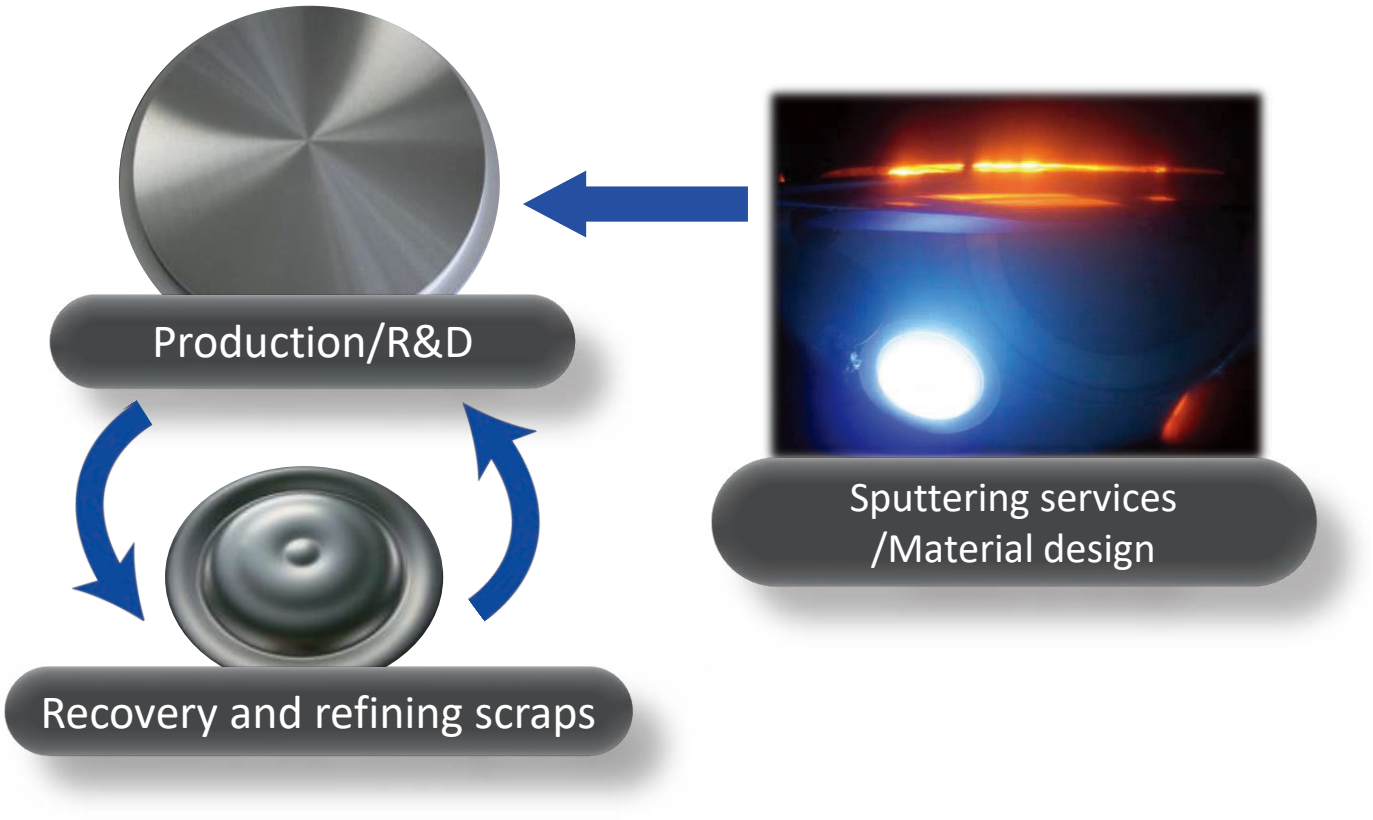


■ Applications

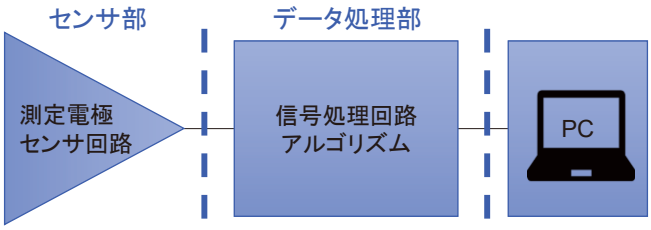
Ir	MEMS、MRAM、ReRAM、FeRAM、etc.
Ru	HDD、Interconnectors、Magnetic devices, EUV Mask blanks.
Pt	MEMS、MRAM、etc.
APC	MEMS mirror、LED、OLED、Quartz crystal unit、IGBT、etc.
Al alloy	AlSc、AlMgX

Sensing Edge Device(SED)

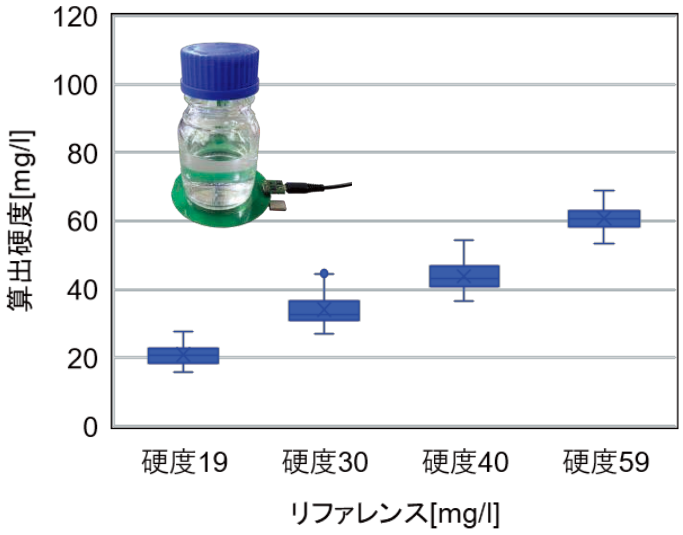
Liquid Concentration Sensor

ロ非接触式液体濃度センサモジュール

■センサを最適化することで、様々な液体濃度測定に対応
■リアルタイム(1回/1秒)データ取得が可能
■温度変化による濃度補正アルゴリズムを搭載



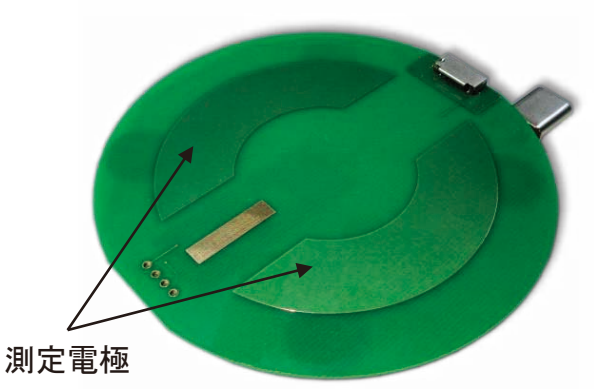
ブロック図



水の硬度測定

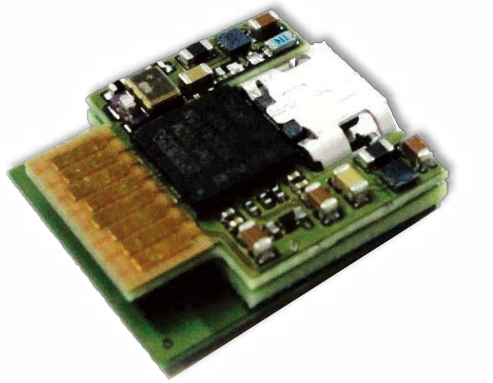
センサ部

サイズ [mm]	Φ87 × t11.3
重量 [g]	18.6
機能	液体濃度センサ 温度センサ
通信方法 (センサ - データ処理部間)	カスタム通信



データ処理部

サイズ [mm]	17 × 15 × t5
重量 [g]	1.5
部品数	54個
機能	信号処理 温度補正アルゴリズム
通信方法 (データ処理部 - PC間)	USB接続(UART)



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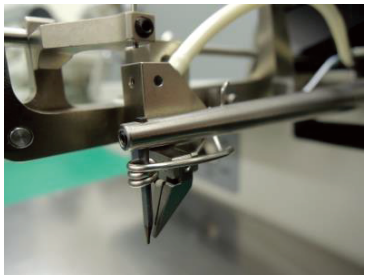
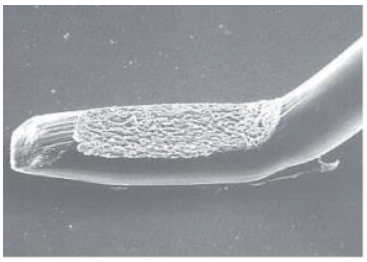
モデル 7200CR　エポキシダイボンダー

X-Y-Z　3軸マニピュレーターを標準装備
□0.1mmのチップ、Φ0.06mmのハンダボール、Φ0.015mmのワイヤーなどを
容易にハンドリングすることが可能です。
ペースト配線、スタンピング、ケガキなどに対応した高精度マニュピレーターです。

モデル 7400D　ウエッジワイヤーボンダー

金線、アルミ線、銅線、Pt線等のワイヤーボンディングが可能
金ブロック実装と組み合わせることで、MEMSデバイスを含めた
様々なデバイスに対して、容易にボンディングを行うことが可能です。





SK Global Advisers

Company Information / 会社概要

SK Global Advisers Co., Ltd.
Representative Director & Chief Executive
Susumu Kaminaga
Founded 10 October 2012
Business
Consulting, Planning, Proposal-making and Hands-on Work for
- Business Management
- New Business Development
- Mergers & Acquisitions (M&A)
- New Products Marketing
- Business Promotion, Marketing, Technology Assessment

SKグローバルアドバイザーズ株式会社
代表取締役　神永　晉
設立　2012年10月10日
事業内容
下記に関する助言、企画、立案および関連業務受託
- 事業経営
- 新規事業開設
- 企業の買収、合併 (M&A)
- 新製品等の拡大販売
- 事業推進、市場調査、技術動向調査

Biography of Chief Executive / 代表者略歴

1995 Surface Technology Systems (STS), Director
2000 STS, Non-Executive Director
2004 Sumitomo Precision Products (SPP), President
2009 SPP Process Technology Systems (SPTS), Chairman
2011 SPP Technologies (SPT), Chairman
2012 SPT, Executive Senior Adviser

1995 STS取締役
2000 STS社外取締役
2004 住友精密工業社長
2009 SPTS会長
2011 SPT会長
2012 SPTエグゼキュティブシニアアドバイザー

Positions of Chief Executive / 代表者役職

JSME, Fellow
Technology and Management Professional
Royal Aeronautical Society, Fellow FRAeS

日本機械学会　フェロー
技術同友会認定　技術経営士
英国王立航空協会　フェロー　FRAeS

Susumu Kaminaga: His own involvement with MEMS activities started in 1988 and he has played a major role to develop and commercialize Deep Reactive Ion Etching (DRIE) technology which, as widely perceived, has enabled MEMS world to expand rapidly in the last decades. During the course of his initial work of developing technology and business for MEMS, he was instrumental to run Surface Technology Systems (STS), UK, a subsidiary of SPP, since the acquisition in 1995 until 1999. Under his management, STS pioneered development and commercialization of the DRIE technology based on Robert Bosch patented switching process. The technology was enhanced as Advanced Silicon Etch (ASE) technology to satisfy customers' demand to develop various new devices. He was further involved as the main driver to establish SPP Process Technology Systems (SPTS) in 2009 to integrate STS and the newly acquired Aviza business, which is now SPTS Technologies with local management after MBO in 2011. At the same time, SPT was formed as a joint venture of SPP and SPTS for Japanese market. SPT USA was established in San Jose in 2015 with the business unit bought back from SPTS. All these actions have been made under his strong initiative. He is a member of JSME (The Japan Society of Mechanical Engineers), JSAP (The Japan Society of Applied Physics), IEE (The Institute of Electrical Engineers of Japan) and IEEE (The Institute of Electrical and Electronic Engineers).

SK Global Advisers Co., Ltd.

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The University of Tokyo - Miyake Lab
μSIC
Micro Electro Mechanical Systems Lab Tanaka Shuji Laboratory

ANNOUCEMENT of Future MEF

The 14th

MEMS Engineer Forum (MEF) 2023

Wednesday, April 19, 2023

&

Thursday, April 20, 2023

Contact:
MEMS Engineer Forum (MEF) Secretariat
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mef_2022@semiconportal.com
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