

MICRONANO

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MMC Activities

MicroNano 2008 Report

MicroNano 2008 was held for four days Tuesday, July 29 through Friday, August 1, 2008 at the Tokyo International Exhibition Center (Tokyo Big Sight) and the Ariake Washington Hotel (Ariake, Koto-ku, Tokyo). The exhibition was a resounding success, and the sponsors would once again like to express their appreciation to all who attended.

This year, as last year, MicroNano 2008 featured both an international exhibition and a conference. The number of companies exhibiting at the exhibition came to 358 (in 483 booths). As in past years, the total number of visitors during the three days of the exhibition continues to increase: whereas last year's total attendance was 12,424, this year it was 14,075 – an increase of 13% over last year, and a new record. Attendance by overseas visitors was 2.7 times greater than the previous year. The increase was undoubtedly due to the fact that, in addition to the Micromachine / Nanotech Symposium, a variety of international conferences were held during MicroNano 2008, including the Japan-Germany Business Forum and the MIF Overseas Affiliate Workshop. At these and almost all of the other venues, attendance was so great that the handouts that had been prepared proved to be insufficient to meet the demand. The success of the event is a sure sign that MicroNano has become firmly established as a Tokyo Big Sight event, as well as a sign of the increased interest in micromachine and MEMS technology. Beginning last year, MicroNano has featured both micromachines and MEMS, with a full array of MEMS exhibits. No other exhibition, in Japan or even overseas, offers exhibits in the MEMS field on the scale of

MicroNano, and this appears to be one of the reasons that the event is held in such high regard.

Micromachines and MEMS devices are now key systems and devices that are essential for the manufacture of various products in the manufacturing industry. As the sole venue that combines together both the micromachine industry and the MEMS industry, the organizers of MicroNano feel both a sense of mission and an obligation to meet the high expectations placed on the event. Next year and in future years, they will continue to strive to increase the appeal of MicroNano and make it an event at which the achievements in these industries can be shared with visitors. Next year is particularly noteworthy in that the Exhibition Micromachine / MEMS will celebrate its 20th anniversary. The tentative dates and venue for MicroNano 2009 are shown below. The organizers hope that both exhibitors and visitors will once again attend and otherwise support the event.

MicroNano 2009 (tentative)
 - 20th Exhibition Micromachine / MEMS
 - Conference
 Wednesday, July 29 - Friday, July 31, 2009
 East Hall Nos. 5 & 6, Tokyo International Exhibition Center (Tokyo Big Sight), Ariake, Tokyo

19th Exhibition Micromachine / MEMS

The 19th Exhibition Micromachine / MEMS was held in the West Hall Nos. 1 & 2 at the Tokyo International Exhibition Center (Tokyo Big Sight) as one of the events in MicroNano 2008. Both the total number of exhibitors and the total number of attendees set a new record for the exhibition: 358 exhibitors and a total of 14,075 attendees over the three days of the exhibition.

The Micromachine Center booth featured both display panels and survey materials introducing the Center's activities, as well as exhibits of actual wafers and devices that enabled visitors to gain a thorough understanding of MEMS devices. The booth and its exhibits were very popular with attendees.



In addition, a separate MemsONE Consortium booth featured an explanation of the functions of the MemsONE software for MEMS design.

As the table below shows, the scale of the exhibition has been increased each year to accommodate the expansion of the MEMS industry. Next year, the 20th Exhibition Micromachine / MEMS is scheduled to be held July 29 - 31, 2009. The exhibition venue will remain the same – Tokyo International Exhibition Center (Tokyo Big Sight) – but the exhibition hall will change to the East Hall Nos. 5 & 6.

Year	Venue	Total No. of Attendees
19 th (2008)	Tokyo International Exhibition Center (Tokyo Big Sight)	14,075
18 th (2007)	Tokyo International Exhibition Center (Tokyo Big Sight)	12,424
17 th (2006)	Tokyo Forum	11,736
16 th (2005)	Science Museum	9,098

14th International Micromachine / Nanotech Symposium

On the first day of MicroNano 2008, July 29, 2008, the 14th International Micromachine / Nanotech Symposium was held at the Ariake Tokyo Bay Washington Hotel. As indicated by the symposium's subtitle ("Technology Convergence MEMS, LSI, Nano and Bio") the focus of this year's symposium was 2nd generation MEMS, for which integration with semiconductors is being pursued, as well as BEANS, the 3rd generation MEMS that are intended to integrate nano- and biotechnologies.

In the morning keynote address entitled "MEMS Industrialization Perspective in Japan," Kyoto University Professor and NEDO Program Manager Hidetoshi Kotera gave an overview of the MEMS integration and fusing of different fields currently being promoted in Japan, covering such aspects as national government policy and industry-academic liaison efforts. Next, Roger T. Howe of Stanford University gave an absorbing presentation about integrated MEMS efforts in the United States and new efforts aimed at future MEMS development.

The afternoon sessions began with the MEMS LSI Integration session. Albert Chang of the Asia Pacific Microsystems (APM) foundry in Taiwan gave a presentation on CMOS / MEMS integration from a foundry perspective. Yoshiaki Toyoshima of Toshiba Corporation gave a presentation on cooperation and integration with regard to MEMS and CMOS. Wilbur Catabay of the Silicon Valley Technology Center spoke about deployment of the technology in 8" wafers in the MEMS integration process. In the final presentation in that session, Susumu Sugiyama of Ritsumeikan University spoke about the Fine MEMS project which will be completed this year. In these presentations, the speakers introduced MEMS integration efforts from a variety of perspectives and expressed a variety of opinions.

In the next session, entitled "MEMS Emerging Applications," Uwe Kleinkes of the iVAM Microtechnology

Network in Germany spoke about new applications for MicroSystems Technology (MST) at European companies. Yoshio Sekiguchi of Omron Corporation gave a presentation on MEMS microphones and deployment in 8" wafer manufacture. Ryo Ota of Olympus Corporation spoke about bio and medical applications for cantilever and mirror devices. Each of these presentations focused on the latest applications for MEMS technologies and the latest trends in commercial development.

The final session was entitled "Emerging Technology: BEANS" and focused on the integration of MEMS with nano- and bio technologies. Jouni Ahopelto of VTT spoke about the nanoimprinting technology currently being promoted in Europe and the nanopatterning technology expected to be promoted in the future. Ichiro Yamashita of Matsushita Electric Industrial gave a presentation on the nanopatterning technology that utilizes the self-organizing property of proteins and the application of this technology in device development. Finally, Associate Professor Koji Miyazaki of the Kyushu Institute of Technology spoke about the BEANS project, whose goal is to achieve high performance exceeding that of thermoelectric power generation through the control of nanostructures. In this session as well, there was spirited discussion of research trends, technological potential and so on.

The symposium was filled to capacity (200 persons) and was a resounding success, thanks not only to the outstanding presentations but also to the hard work of the Steering Committee and Program Committee and the international advisors, as well as to all who provided their assistance and cooperation in emceeing and coordinating operations on the day of the event.

The 15th International Micromachine / Nanotech Symposium will be held next year, once again as part of MicroNano 2009.



Professor Hidetoshi Kotera

Symposium venue

Albert Chang

Professor Roger T. Howe

Japanese-German Micro / Nano Business Forum

The Japanese-German Micro / Nano Business Forum was held on July 30 as part of MicroNano 2008. The forum was sponsored jointly by the Micromachine Center and the iVAM Microtechnology Network of Germany, a MEMS Industry Forum overseas affiliate.

In the opening ceremony, Peter Scholz, of the Industry and Energy Ministry in Germany's North Rhine-Westphalia (NRW) Province, and Keiichi Aoyagi, executive director of the Micromachine Center, spoke about the significance of the forum and their expectations for this year's event.

The sessions featured presentations from eight companies and research organizations from Germany and other parts of Europe that were also exhibitors at Exhibition Micromachine / MEMS. The presentations focused on MEMS packaging, auto-assembly, laser processing 3-dimensional measurement and other state-of-the-art technologies, as well as new product announcements. Presentations from Japan included a discussion of the injection molding of metallic powder by Taisei Kogyo Co., Ltd. (an iVAM Microtechnology Network member), a presentation by Matsushita Electric Works, a MEMS Industry Forum member, on its proprietary MID technology (MIPTECH), and a presentation by Olympus Corporation on the latest cantilever technologies and their application in business activities. The Micromachine Center also gave a presentation on efforts to promote industrial applications for MEMS in Japan

through industry-government-academic cooperation. The final presentation, by Professor Masayoshi Esashi of Tohoku University (a MEMS Industry Forum advisor), focused on business development through open collaboration on the part of industry and academia.

Moreover, on Thursday, July 31, an International Affiliate Workshop was held at a special venue set up at MicroNano 2008. The workshop featured presentations on the activities of affiliates in Korea, Brazil and Singapore.



MEMS Forum

The MEMS Forum was held on August 1, 2008 at a special venue set up within Exhibition Micromachine / MEMS. The purpose of the MEMS Forum is to offer information about the activities of the MEMS Industry Forum, a special project committee of the Micromachine Center, and to provide a forum for the exchange of views regarding MEMS, in order to achieve a deeper common recognition of issues involved in the growth and expansion of MEMS-related industries.

This year's MEMS Forum began with an overview of MEMS Industry Forum activities by Keiichi Aoyagi, director of the MEMS Industry Forum secretariat. Session 1 focused on current issues relating to the establishment of a MEMS industry infrastructure. Session 2 featured presentations on the activities of MEMS Industry Forum academy affiliates. Session 3 focused on the status of specific activities relating to issues in the development of the MEMS industry, including international standardization, personnel training, support for MEMS-related research and development at the MEMS foundry experimental research institutions established and operated by local governments, and the infrastructure for MEMS design. Below is a list of the presentation titles and the names of the presenters for each session in this year's MEMS Forum.

Session 1 Advancement of MEMS Industries and Technologies

- (1) Strengthening of MEMS industry infrastructure**
Isao Shimoyama, The University of Tokyo
- (2) Toward MEMS market expansion:
1st generation MEMS - 3rd generation MEMS (BEANS)**
Junji Adachi, Micromachine Center

(3) Technical strategy roadmap for the MEMS field

Hideaki Watanabe, New Energy and Industrial Technology Development Organization (NEDO)

Session 2 Industry-Academic Collaboration

Session 2 was a session on industry-academic collaboration, organized and chaired by Professor Kazuo Sato of the School of Graduate Studies at Nagoya University. Presentations in this session were from the perspective of industry-academic collaboration, which supports the activities of the MEMS Industry Forum, and were conducted by the following MEMS Industry Forum academy affiliates.

- (1) Remarks at the beginning of the industry-academic collaboration session**
Kazuo Sato, Nagoya University
- (2) Wearable microsensors: an advanced general sensing technology for achieving a safe and secure society**
Kazusuke Maenaka, University of Hyogo
- (3) Mass production of next-generation optical elements through ultra-precision micro three-dimensional machine processing**
Eiji Shamoto, Nagoya University
- (4) Introduction to the Micro Energy Research Council, Micro / Nano Optical Specialist Forum, Japan Society of Mechanical Engineers**
Hiroki Kuwano, Tohoku University

Session 3 Issues for MEMS Industry Development

Session 3 focused on the committee activities of the MEMS Industry Forum in the Micromachine Center, comprising

international standardization efforts in the MEMS field, issues relating to the strengthening of the MEMS foundry infrastructure, an example of a micro/nano manufacturing personnel training program (a topic currently being pursued by MEMS Industry Forum affiliate organizations), and the current state of research and development assistance to local companies.

(1) International standardization trends in MEMS fields

Professor Kuniki Ohwada, Teikyo University

(2) AIST training of micro / nano manufacturing personnel, focusing on industry-academic personnel training partnership projects

Ryutaro Maeda, National Institute of Advanced Industrial Science and Technology (AIST)

(3) Strengthening of MEMS foundry infrastructure

Susumu Sugiyama, Ritsumeikan University

(4) Activities for the establishment of a MEMS Foundry Network

Fumihiko Sato, Omron Corporation and Chair, Foundry Service Industry Committee, MEMS Foundry Network

(5) Case studies of the use of MEMS technologies in research and development assistance by the Kanagawa Industrial Technology Center

Manabu Yasui, Kanagawa Industrial Technology Center
(6) MemsONE functions and future plans (MEMS design and analysis support system) Ver. 1.1

Yukihisa Maeda, MemsONE Consortium, Nihon Unisys Excelutions

This year, as last year, the MEMS Forum was held at a special venue that had been set up within Exhibition Micromachine / MEMS. On the day of the forum, the attendance exceeded the capacity of the special venue (400 persons). The MEMS Forum featured exhibits of new technologies and products. The Forum also facilitated participation in conferences on MEMS-related technical trends and industry trends, and provided an overview of the current state of MEMS business and MEMS technologies and the prospects for both, and it was well-received by attendees.

The MEMS Industry Forum makes every effort to ensure that the content of the MEMS Forum provides the opportunity to enhance the common recognition of issues relating to the growth of MEMS-related industries. We hope that visitors will continue to attend and benefit from the MEMS Forum in future years as well.

Fine MEMS Project Interim Achievements Meeting

As part of MicroNano 2008, a meeting was held to announce the interim achievements of the Highly Integrated and Complex MEMS Manufacturing Technology Development Project (Fine MEMS Project) commissioned and subsidized by the New Energy and Industrial Technology Development Organization (NEDO). The meeting was held on Thursday, July 31, 2008 at the Tokyo International Exhibition Center (Tokyo Big Sight) and was hosted by the NEDO and the Fine MEMS Project Promotion Committee of the Micromachine Center, with support from the Ministry of Economy, Trade and Industry (METI).

At the opening ceremony, Akira Uehara, Executive director of NEDO, delivered an address of welcome to the attendees on behalf of the organizers. Next, Motoki Korenaga, deputy director of the Manufacturing Industries Bureau of the Ministry of Economy, Trade and Industry, an invited guest, gave a presentation entitled "MEMS Industry Strategies and Expectations for the Fine MEMS Project." Isao Shimoyama, Dean of the Graduate School of Information Science and Technology of The University of Tokyo and the leader of the Fine MEMS Project, gave a presentation entitled "Overview of Fine MEMS Project" in which he presented an the outline of the project's achievements including grant projects. After these presentations, there were detailed reports on the latest

achievements in nine consignment projects from the heads of development in each area, followed by a lively discussion.

Even from the viewpoint of attendance, the meeting was a resounding success. For this year's meeting, 250 seats – more than twice the number of last year's interim achievements meeting – had been prepared. However, by the time the meeting began, these seats were filled and that there were a lot of standing audience, and all 400 copies of the meeting material prepared in advance had been handed out. Similarly, there were many visitors to the NEDO Fine MEMS Project booth within the exhibition venue, and this booth soon became a site of a lively discussion on the details of the interim achievements of the Fine MEMS project and other issues. Judging from the air of excitement that pervaded both the meeting and the exhibition venue from start to finish, expectations for this project are extremely high, and both the meeting and the Fine MEMS Project booth were deemed as a outstanding success about publicizing the development efforts for highly integrated and complex MEMS manufacturing technologies. The responses from a questionnaire survey conducted for meeting attendees and exhibition booth visitors will be analyzed and used the questionnaire data to rapidly achieve practical applications for the manufacturing technologies developed as part of the Fine MEMS Project.



BEANS Project Promotion Organization

Atsushi Yusa, BEANS Project Leader

The previous issue of MICRONANO featured an overview of the Project to Develop Next-generation Device Manufacturing Technologies that Fuse Different Fields (otherwise known as the BEANS Project). This issue will present the features and implementing organization for promoting the BEANS Project. As you know, there are two types of implementing organizations for national research and development projects: a centralized research framework, in which all of the organizations participating in the project are grouped at one location, and the distributed research framework, in which the organizations are distributed in separate locations for each research topic. In the centralized research framework, the researchers, instruments and equipment are centralized at a single location (a university, national research center or company) and all research activities are conducted at that location. With this system, the research budget and scale of research for the project are large, but the research can be managed efficiently. In the distributed framework, the participating institutions take the issues back to their own departments and conduct research there. For this reason, in Japan this framework is also known as “take-home research.” With this system, research is limited to individual issues, so there is a clear organization of responsibilities, but on the other hand it is difficult to efficiently manage the project as a whole. In this way, each system has its advantages and disadvantages. Although naturally it depends on the nature of the project, in general the distributed system has been used for projects that are promoted for short-term topics and for the practical application of technologies, while the centralized system has been used for long-term topics and key technology research and other major projects that are considered to be national strategies.

Both approaches are being employed to implement the BEANS project. The implementing organization is a centralized framework, but an active effort is being made to incorporate the advantages of the distributed approach, for example by distributing research activities among multiple research institutions. In the background of this approach lies the fact that the research topics for the BEANS project encompass a wide range of areas (MEMS, biotechnology, organic research and nanotechnology), and instead of centralizing the research centers at a single location, it would be more efficient to distribute them to universities and national research institutes to utilize existing research resources. On the other hand, good organization, close cooperation and common management will be needed in to organically link these wide-ranging research topics and pursue research and development that will enable the project's goal of integrating different fields to be achieved. For this reason, it was decided to establish the management organization for the BEANS project at a different location from the research centers in an effort to accelerate and improve the efficiency of research promotion. Accordingly, university researchers, company engineers and post-doctoral researchers have been assembled at research centers (national research institutes and universities that have outstanding research resources) to conduct research activities based on cooperation among industry, government and academia. Meanwhile, a separate research center that serves as the head office for the project has been established at the BEANS Laboratory to enable effective project management. For the purposes of the BEANS project, the research centers and the project management organization are collectively referred to as the “BEANS research initiative.” The following diagram shows the details of the BEANS research initiative.

Many research entities are participating in the BEANS research initiative. At present, these comprise 18 companies, 12 universities, two independent research institutes and two foundations. These entities include four organizations that have been contracted by the Ministry of Economy, Trade and Industry

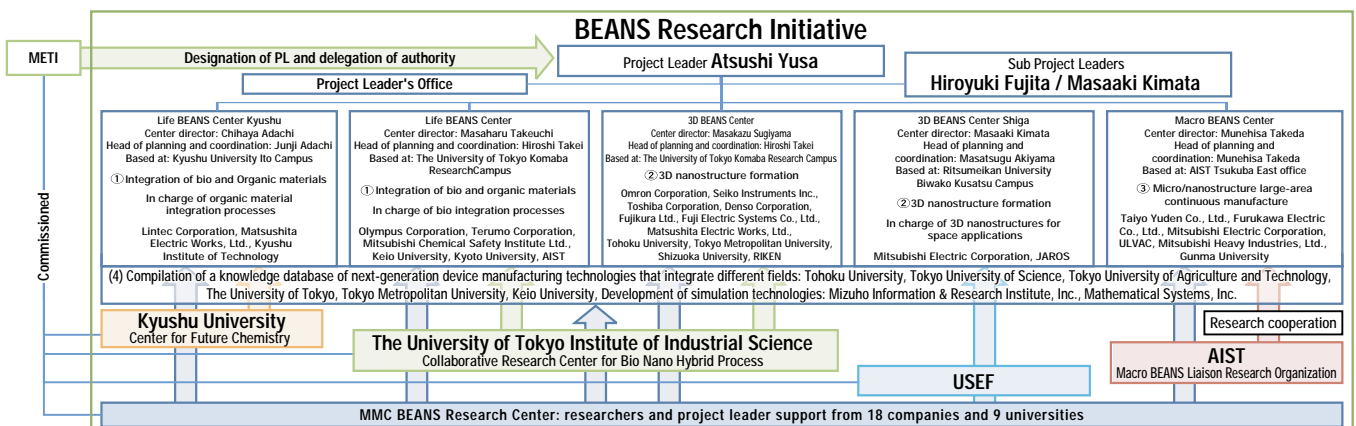
to conduct research: the Micromachine Center, the Institute for Unmanned Space Experiment Free Flyer Foundation (USEF), The University of Tokyo and Kyushu University. The remaining participating organizations are places to which research has been re-consigned or companies from which employees have been transferred to the aforementioned four entities to conduct research. Currently a total of 108 researchers and engineers are engaged in project research. These include university faculty members, temporarily transferred company employees, post-doctoral researchers, interns and exchange researchers.

For the purposes of this project, research activities are organized into three areas (Life BEANS, 3D BEANS and Macro BEANS) according to research and development topic, and research is being conducted at five research centers. At present, the Life BEANS Center comprises two locations: the Ito Campus of Kyushu University and the University of Tokyo's Komaba Research Campus. The 3D BEANS Center also comprises two locations: the University of Tokyo's Komaba Research Campus and the Biwako Kusatsu Campus of Ritsumeikan University. The Macro BEANS Center is located at the Tsukuba East office of the National Institute of Advanced Industrial Science and Technology (AIST). As a result, in geographical terms the BEANS research network is a nationwide one, with centers in the Kanto and Kansai regions of Honshu and on Kyushu.

In terms of the management scheme, the BEANS Centers are placed under a project leader. Each BEANS Center has a director and a head of planning and coordination. The Center directors are outstanding research leaders 30 to 40 years of age at the universities and independent research institutes that are the driving force behind research promotion. The heads of planning and coordination are the three assistant directors of the BEANS Laboratory, individuals who have experience in research management. In this way, the research and management functions are completely separate but are designed to complement one another. This gives researchers a sense of mission and an appropriate level of intensity, enabling Center operations to be both speedy and efficient.

Overall project management is conducted by the project leader with support from the sub project leader and the office of the project leader. The office of the project leader handles daily tasks relating to research planning and management and so on, while at the same time administering the Project Promotion Committee, Intellectual Property Committee and various other committees. Particularly with regard to the Project Promotion Committee that plays a central role in project promotion, the office of the project leader periodically ascertains the progress of each research and development topic, comparing project progress with project planning and evaluating the results and then expeditiously making determinations as needed with regard to whether the project should be accelerated, downscaled, terminated or otherwise revised. The Intellectual Property Committee establishes mechanisms that enable batch sub-licensing of the patents and other intellectual property rights achieved by the project to participating institutions, in order to enable project achievements to make wide-ranging contributions to the creation of new industries and provide increased added value to existing manufacturing operations.

The innovative research and development conducted as part of the BEANS Project involves the integration of different fields on an unprecedented scale. The project organizers believe that a key factor in the success of the project will be a promotion scheme that is commensurate with the innovative nature of the project. While it may be necessary to change or revise the promotion scheme to match the progress of research efforts, in such cases this will be accommodated through a flexible approach that is not constrained by the existing scheme.



MEMS Mall Now Open

MEMS Mall (Japanese only) became available on the MMC website starting October 1, 2008

More than 14,000 visitors attended the Exhibition Micromachine / MEMS held at the Tokyo International Exhibition Center (Tokyo Big Sight) in July. 358 MEMS-related organizations participated in the exhibition. The exhibition is a valuable opportunity to obtain information about micromachines and MEMS, which in Japan have been called, so to speak, the "beans" of industry (providing nutriment to the semiconductors that are the key element or "rice" of industry). The fact that attendance has increased each year is a sure sign of the enthusiastic expectations of industry for these fields. However, as the exhibition is only held once a year in a single location, up until now it has not been possible to obtain such information whenever and wherever it is needed.

For this reason, MIF (the MEMS Industry Forum) has been studying ways to create a "virtual exhibition" online. The results of the efforts of MIF became the establishment of MEMS on the MMC website, which is available starting October 1, 2008.

MEMS MALL is the virtual mall which provides information on products and new technologies developed by MEMS-related companies, with content provided by the 15 member companies of MIF. The list of the companies and their products is linked to the each company page that introduces information on the products and new technologies for each company, as well as to the individual company websites.

Clicking the MEMS Mall button on the MMC website displays the top page for the MEMS Mall.

MEMSモールは、各企業が最新MEMS関連製品・技術を紹介するサイトです。
(株)マイクロマシンセンター・MEMS協賛会が運営しています。MEMSモールに記事
を希望される方は、最前までご連絡下さい。

出展企業名をクリックしてください。

出展企業名	MEMS製品・技術
MEMS協賛会 正メンバー (五十五社)	
オムロン(株)	RF-MEMS、センサMEMS、MEMSファンドライバサービス
オリンパス(株)	光MEMS、アクチュエータMEMS、その他MEMS、MEMSファンドライバサービス、評価・計測装置
HDA(株)	MEMS製造関連装置・材料/その他材料
(株)新理システム	MEMS設計ツール
セイコーインスツル(株)	センサMEMS、流注MEMS、MEMS製造装置・加工装置、評価・計測装置
日本ユニシス・エクスソリューションズ(株)	MEMS設計ツール
パナソニック電工(株)	センサMEMS、MEMSファンドライバサービス
(株)ツカサ	センサMEMS、MEMSファンドライバサービス
富士電機システムズ(株)	光MEMS、RF-MEMS、MEMSファンドライバサービス
みずほ情報産研(株)	MEMS設計ツール
三菱電機(株)	センサMEMS、MEMS製造装置・加工装置
MEMS協賛会 アソシエイトメンバー (五十名)	
住友精密工業(株)	センサMEMS、MEMS製造装置・加工装置
住友電気工業(株)	光MEMS、アクチュエータMEMS
三菱マテリアル(株)	その他材料
リソコ・マイクロシステム(株)	マイクロマシン/MEMS装置

Clicking the name of an exhibiting company in the list of exhibitors displays the company page with information on the MEMS products and new technologies of that company.

MEMSモール > オリンパス(株)

オリンパス株式会社

オリンパスのMEMS事業/技術紹介

→ 会社情報ページ

オリンパスは、蓄積された経験と多岐にわたる技術・最先端の設備や充実した生産ラインを基盤として、お客様のニーズに的確にお応えします。
競争力の高い製品の開発や新しい分野の製造開発をサポートするためにMEMSの設計から量産まで一貫したサービスを提供します。

オリンパスの製品紹介

●ミラースキャナ(光MEMS)

- ・特徴: MEMS加工技術で小型軽量化を実現した電磁駆動型1次元レーザスキャナ。当社の高精度非接触レーザ計測機のLSシリーズに搭載されました。
- ・仕様: ・共振周波数 4kHz
・光学径 9mm 16mm
・スキャン距離 224mm以下
・連続動作時間 1万時間

写真:

In some cases, you can go directly to the company's website that provide information on those products and technologies from the each company page on MEMS MALL.

The MEMS Mall is designed to provide online the visitors with the same experience, as if they visited different booths at Exhibition Micromachine / MEMS. You can easily access the information about MEMS products and technologies.

MEMS products and technologies are categorized as follows:

- Devices (optical, RF, sensor, fluid, actuator, bio / chemical, power, etc.)
- Products that incorporate MEMS (micromachine, biotechnology, medical)
- Manufacturing equipment and materials (foundry service, design tool, manufacturing and processing equipment, materials, evaluation and measurement equipment)

We expect that MEMS Mall will enhance the interchange between MEMS-related companies and individuals. If you would like to be a MEMS Mall exhibitor, please contact the MMC Secretariat.

MEMS Mall

<http://www.mmc.or.jp/mall/>

(Note: the MEMS Mall is available in Japanese only.)

4th Japan-Korea-China MEMS Standardization Workshop

Efforts to promote international standardization of Micro-Electro-Mechanical Systems (MEMS) have up to now resulted in the publication of three international standards originating in Japan: "Terms and definitions," "Tensile testing method of thin film materials" and "Thin film standard test piece for tensile testing." Another proposed standard, "Thin film fatigue test methods," is currently under review as a Committee Draft Version (CDV). Recently efforts to achieve international standardization have become active in South Korea as well. Five draft standards have been proposed and are currently under review.

Against this backdrop, the Japan-Korea-China MEMS Standardization Workshop has been held as a forum to promote cooperation and the exchange of information relating to MEMS standardization among Japan, Korea and China.



Workshop venue

The 1st workshop was held in 2005 in Tokyo. The 2nd workshop was held in 2006 in Gyeongju, South Korea. The 3rd workshop was held in Beijing, China. After having been held in all three countries, for the 4th workshop the venue returned to Japan once again, and the workshop was held on Friday, June 20, 2008 in Tokyo to coincide with the IEC TC47 WG4 Tokyo Meeting. Although at this year's workshop there were only four presentations (two each from Japan and South Korea), as China had been forced to cancel its participation as a result of the Sichuan Earthquake, the presentations sparked a lively discussion.

The following is an overview of the presentations.

Following the opening address by Chairman Naotake Oyama of the Micromachine Center's Standardization Project Committee, the following four presentations were given on the topic of MEMS standardization.

- (1) Professor Park of Kyunpook National University in South Korea gave a presentation on the current status of MEMS / NEMS standardization and the approach to standardization research in South Korea. He spoke about standardization in the MEMS field (IEC TC47 / WG4) and the state of international standardization in the area of nanotechnology (IEC TC229), as well as future approaches in the MEMS field (in terms of the evaluation of packages, sensor devices and flexible devices and standardization topics for which reliability is a chief concern).



- (2) Associate Professor Tsuchiya of Kyoto University gave a presentation on "The Accelerated Life Test for MEMS Device Structures," one of the standardization projects currently being promoted in Japan. Dr. Tsuchiya began by giving an overview of the material evaluation



type standardization projects that have been implemented in Japan up to now and the current state of international standardization. Subsequently, he reported on progress in the accelerated life test standardization project currently being implemented. He also discussed a draft standard that is currently under study.

- (3) Dr. Nak Kyu Lee of the Korea Institute of Industrial Technology gave a presentation on the Forming Limit Diagram (FLD) Test for evaluating the ductility of nanoimprint materials. In this test, a thin film is fastened in place and a semispherical jig is used to compress the film, after which the deformation of the film is evaluated. In the presentation, he discussed the measurement principle and introduced a deformation measurement technique that utilizes a CCD camera to measure the grids formed on the test specimen. Plans call for this test method to be proposed to the IEC as an international standard.



- (4) Professor Higo of Tokyo Institute of Technology gave a presentation on the development of standard materials used for calibrating thin film material test equipment, entitled "Bending specimen for calibrating materials testing machine." He proposed metallic glass materials as materials that are stable, uniform, strong and have a low modulus of elasticity, and noted that these materials have been confirmed to possess stable elastic properties. He also reported on studies of the significant impact of machining on these standard materials, as well as on the shape of the test specimens used for calibration.



The conference ended with Keiichi Aoyagi, Executive Director of the Micromachine Center, expressing his hopes for standardization in the MEMS field.

Although it was unfortunate that China was unable to participate, it was a valuable workshop, with an active exchange of information between Japan and South Korea and participants from many companies in attendance. Prior to this 4th workshop, the workshop had been held in each of the participating countries – Japan, South Korea and China – and so this workshop also marked the beginning of the second round of workshops held in each country. The major achievement of the Workshop has been its role in providing a forum for the exchange of information regarding the current state of MEMS standardization and future prospects in each country, as well as in enhancing the common recognition in these three countries. It is crucial that these achievements be utilized in MEMS standardization strategies in Japan.

The 5th Japan-Korea-China MEMS Standardization Workshop will be held in South Korea in 2009.

Members' Profiles

Kyocera Corporation

Established in 1959, Kyocera is a manufacturer specializing in fine ceramics. Over the years, the company has expanded its applications of fine ceramics into a wide range of industries and has developed diverse enterprises, from the production of fine ceramic materials and ceramic components, such as industrial machinery parts, electronic components, and semiconductor packages, to solar power generating systems, cutting tools, jewelry, medical products, mobile phones, and document imaging equipment, as well as network systems and other services.

Kyocera began with twenty-eight employees nearly half a century ago. Today, the company has expanded its operations into more than thirty countries worldwide, with more than 180 affiliate companies. The Kyocera Group has grown into a global corporation with some 68,000 employees and a trillion yen in annual sales.

Kyocera has espoused the managerial philosophy of enabling each employee to pursue material and spiritual happiness, by which we hope to contribute to the advancement of society and humankind. Our goal is to grow continually as a creative-based company, honing a competitive edge in each business division. To accomplish this, we practice our own management system, called Amoeba Management, based on our corporate philosophy, and continuously strive to develop new technologies and new quality high-performance products for our customers.

Kyocera also aggressively engages in environmental activities. Recognizing that our business activities can impact the global environment and human life, we have adopted a clear vision for environmental preservation, promoting "green management" aimed at finding a balance between eco-friendly practices and economic development to assure sustainable growth within the company. As a leader of green management, it is our social responsibility as a manufacturer to reduce the impact our activities have on the environment. Even during the early years, the company has rigorously practiced environmental management, establishing stricter internal standards than public regulations.

Kyocera adheres to the tenet that the customer comes first, with the aim of supplying products and services at a price and quality that our customers have come to expect, while continuously delivering new value to the global market.

Electronic Components and Devices

Kyocera produces a wide variety of electronic components using fine ceramic technologies, including multilayer ceramic capacitors and EMI filters formed of dielectric ceramic materials. The smallest of the multilayer ceramic capacitors is currently a mere 0.4x0.2 mm, and the trend toward miniaturization is expected to continue. To manufacture such miniature components, innovative micromachining techniques are required in material formation, printing, laminating, and other steps of the process. EMI filters designed for reducing noise are another component produced by laminating sheets of dielectric material. Reducing electromagnetic noise is a

major issue in today's electronic devices, and the demand for noise reduction components is likely to increase.

AVX Corporation, which is part of the Kyocera Group, is one of the largest manufacturers of capacitors in the world, particularly tantalum capacitors. AVX also produces ceramic capacitors, electric double-layer capacitors, film capacitors, and numerous others for diverse applications.

The production of RF modules is also an essential business today, and Kyocera specializes in modules formed of multilayer substrates fired at low temperatures. We supply miniature low-profile Bluetooth modules and RF modules for mobile telephones. The modules have filters and other functions built into the multilayer substrates.

The piezoelectric property of fine ceramics is also applied to a product lineup including oscillators, shock sensors, and piezo buzzers. Piezoelectric ceramics convert electric signals into mechanical vibrations, or vice versa. This property has been applied to acoustic components, actuators, and power generating elements, with more applications anticipated. SAW (surface acoustic wave) devices also employ this piezoelectric property. SAW filters, commonly used in mobile devices, have comb electrodes formed on the surface of a monocrystalline material that convert mechanical vibrations propagating across the surface of the crystal into electric signals.

Kyocera Elco supplies numerous connectors for electronic equipment to meet the demands for higher circuit density, lower profiles, smaller footprints, and greater functionality.

Our product lineup includes numerous other high-performance electronic devices, such as thermal print heads produced with thin film technology, LCDs for industrial use, and amorphous silicon photoreceptor drums.

Kyocera Kinseki produces various timing devices and other crystal products that utilize the piezoelectric property of crystals, such as crystal units and oscillators. As mobile phones and other electronic products become increasingly smaller in size, there is continuous demand to reduce the size of components. For example, temperature compensated crystal oscillators (TCXO), which are considered the heart of mobile phones, are now 1/150th the size of those produced fifteen years ago. To produce such compact oscillators, the ceramic packages and crystal units had to be greatly reduced in size. We are now

exploring ultraprecision micromachining based on MEMS technology in order to achieve even greater miniaturization and manufacturing precision, particularly with crystal units.



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