

for calibration and testing methods for bonding strength reflecting the results of round-robin tests currently being conducted at overseas research institutions are scheduled for submission to the IEC around June this year. The MMC has completed an analysis of results for round-robin tests conducted on micro-gyroscopes at research institutions in Japan, as well as a study on standardization items for electronic compasses.

(3) Standardization topics in FY 2009

Three topics were proposed for METT's 2009 collaborative research and development project for international standards: measuring methods and notation for MEMS shapes, bending test methods for micro-cantilever beams, and bulging test methods. Of these, measuring methods and notation for MEMS shapes was adopted and submitted for public review. This is a three-year project to research measuring methods and notation on parameters for shapes characteristic to MEMS devices, such as side wall shapes, angles, and aspect ratios in three-dimensional MEMS structures, and for writing up a draft proposal for an international standard on measuring shapes of MEMS devices, and submitting the draft proposal to the IEC. A written proposal was submitted jointly with Kobe University.

(4) Establishment of the SC 47F national committee in the IEC

While the MMC has been carrying out activities for the IEC

for some years, a national mirror committee corresponding to the IEC body was established at the MMC as the IEC assembly in charge of reviewing MEMS standardization was upgraded from a working group to a subcommittee (SC 47F). It was decided that the SC 47F national committee would be established in the IEC from 2009 based on the need for deliberating bodies to clarify national and international stances.



IEC SC 47F plenary meeting held in Tokyo

Recent Activities of the MEMS Industry Forum

The MEMS Industry Forum (MIF) was established with the goals of supporting the further development of MEMS industries and contributing to the international competitiveness of Japan's industry. Membership in the MIF is composed primarily of companies in MEMS-related industries. The MIF conducts various activities in collaboration with affiliated academies, regional centers, and overseas institutions to encourage exchange among and vitalization of MEMS-related industries. This article describes some of the recent activities at the MIF.

1. Initiation of MEMS Personnel Training Projects

The market for micro electro mechanical systems (MEMS) is expected to grow to 1.17 trillion yen in 2010 and to 2.4 trillion yen in 2015. In order to develop a sufficient number of skilled personnel to accommodate this expansion in the MEMS market, the MIF is examining ways to implement MEMS personnel training programs aimed at improving in-house personnel training at companies with the strategy of stepping up the number of MEMS skilled personnel in stages to meet expected industry needs, enhancing MEMS personnel training through industry-academia collaboration, and improving the environment to make MEMS fields more accessible to personnel wishing to transfer from other fields.

The MIF is currently helping out with a personnel training program spearheaded by the National Institute of Advanced Industrial Science and Technology (AIST) entitled "Personnel training program for pioneering new innovative projects related to micro/nano mass production and applied device fabrication." The MIF has also begun a study in concert with regional consortia on a tangible personnel project aimed at expanding practical personnel training with industry-academia collaboration and offering more MEMS lectures and training courses for working people, as well as launching a Web site for personnel training in MEMS fields. During 2009 the MIF plans to work with regional consortia, public research institutes, and universities to build the foundation for integrated course management with curricula structured around the local characteristics of each region.

2. The 12th MEMS Seminar

On February 6, the 12th MEMS Seminar organized by the MEMS Foundry Service Industry Committee (FSIC) of the MIF

(chair: Fumihiko Sato of Omron Corporation) was held at the Grand Hotel Hamamatsu in Hamamatsu, Japan. It was the first time held in the Tokai region. The seminar mainly targets beginners in MEMS field and middle class engineers of the member companies.



The 12th MEMS Seminar

Entitled "MEMS Design and Processing Techniques and Their Applications," the seminar was cosponsored by the Organization for Hamamatsu Technopolis and the Innovation and Joint Research Center of Shizuoka University and was held concurrently with Hamamatsu Messe 2009 organized by the Organization for Hamamatsu Technopolis.

The "MEMS Design and Processing Techniques and Their Applications" seminar covered a wide range of topics through academic lectures on advances in MEMS integration and fusion and expectations for the creation of new industries (Prof. Susumu Sugiyama of Ritsumeikan University) and MEMS design techniques using electric equivalent circuits (Prof. Gen Hashiguchi of Shizuoka University); a lecture on stealth dicing (a fully dry process) gaining popularity in MEMS mass production plants (Naoki Uchiyama of Hamamatsu Phototonics) as an introduction to technologies used in MEMS businesses in the Tokai region of Japan; lectures on MEMS devices, processes, and simulations developed by member companies of the FSIC; and talks on MEMS technology and trends, MEMS foundries, and the MEMS Open Network Engineering System of Design Tools (MemsONE).

3. The 17th MEMS Advanced Technology Forum

The forum was established to encourage the exchange of ideas among industry and academia and to disseminate information and raise awareness on micro/nano technologies. It mainly targets skilled researchers and engineers of the member companies. Held three times annually, the forum invites experts from universities, the AIST, and other organizations to give lectures on cutting-edge technologies in the micro/nano and MEMS fields.

The 17th MEMS Advanced Technology Forum was held on February 17 (Tuesday) at the MMC Techno Salon, where the

MIF had the privilege of welcoming Prof. Shuichi Shoji of Waseda University's Faculty of Science and Engineering and Associate Prof. Yoshio Mita of the University of Tokyo's Graduate School of Engineering.

Prof. Shoji introduced a case study entitled "MEMS devices designed for cell function analysis" on applied MEMS devices that enable a cell culture system, cell disruption, and biomolecular separation and analysis for analyzing the functions of specific cells. Associate Prof. Mita introduced an innovative MEMS technology in his lecture entitled "Study on MEMS integrated through an autonomous distributed micro-robot." As an example, he described a MEMS device that moves autonomously over a water surface according to low-voltage



Prof. Shuichi Shoji of Waseda University

Associate Prof. Yoshio Mita of the University of Tokyo

electrowetting-on-dielectrics (EWOD) droplet propulsion employing a three-dimensional photodiode structure having a depth of 10 μ m and a width of 150 nm.

Dissemination and Publicity Projects

The Micromachine Center (MMC) publishes newsletters, holds exhibitions, and distributes information on its Web site as a means of disseminating information on micromachines and MEMS to educate the general public and of making information on its activities widely available. This article will describe some of the MMC's recent activities.

1. Expansion of Participants in the MEMS Mall

The MEMS Mall was launched on October 1, 2008 on the MMC Web site to provide information on products and technologies developed by MEMS-related companies. While participation in the mall was limited last year to members of the MEMS Industry Forum (MIF), this year we have relaxed the requirements to include non-member companies.

In the past, a person wishing to collect information on MEMS products had to access each company's Web site individually. The MEMS Mall is a site that brings all MEMS product information together and provides online visitors a method of accessing information, much like visiting booths at the MMC-sponsored Exhibition Micromachine/MEMS. To participate in the MEMS Mall, please visit the following Web site.

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

2. MemsONE Sales and Distribution

Sales and distribution of the MEMS design and analysis software MemsONE began in February this year. The software was developed under the project entitled the MEMS Open Network Engineering System of Design Tools and has been receiving glowing reviews. An academic version of the software for universities and public research institutions is distributed by the MMC, while an enterprise version designed for general company use is sold through software vendors.

See the table below for the schedule of MemsONE training courses to be held in Tokyo and Osaka. For more information on the training courses and features of the MemsONE software, please visit the following Web site.

<http://mmc.la.coocan.jp/mems-one/>

Schedule of training courses

Tokyo	Osaka
5/19 (Tue) : Basic operations	5/22 (Fri) : Basic operations
6/22 (Mon) : Analysis	7/17 (Fri) : Analysis
9/18 (Fri) : Applications	
10/21 (Wed) : Basic operations	
11/18 (Wed) : Analysis	
1/20 (Wed) : Applications	

3. Micro/Nano 2009

The general exhibition Micro/Nano 2009 provides a venue for businesses in the micromachine and MEMS industries to showcase their leading-edge products and materials and to

present their latest research findings. Details of the event are given below.

(1) 20th Exhibition Micromachine/MEMS

The world's largest exhibition covering both the micromachine and MEMS industries, the 20th Exhibition Micromachine/MEMS will be held July 29–31, 2009. At Tokyo Big Sight (Tokyo International Exhibition Center), East Hall. Some special exhibits are planned for the event to commemorate its 20th anniversary.

(2) Seminars and symposiums

This year, two special conference areas A and B will be set up at the venue of Exhibition Micromachine/MEMS for holding various presentations on micro/nano-related research activities. The following table shows the schedule of events for these conference areas.

	Conference area A	Conference area B
7/29 (Wed)	10:25–16:45 The International Micromachine/Nanotech Symposium – MEMS World –	11:00–12:20 MEMS Industry Forum Workshop on Industry-Academia Collaboration 13:00–15:50 MEMS Packaging Forum
7/30 (Thu)	Japanese-German Micro/Nano Business Forum	11:00–12:20 MEMS Industry Forum Workshop on Industry-Academia Collaboration 13:15–17:00 BEANS Project Seminar
7/31 (Fri)	10:30–16:15 MIF Forum	10:30–16:45 Presentation of Results from the Fine MEMS Project

For more information on the exhibition and visitor registration, visit the Web site (<http://www.micromachine.jp>).

The 19th Exhibition Micromachine/MEMS held in 2008

