

A Survey of China's Research Trends in Micro / Nanosystems

We conducted a survey on Chinese research trends in micro- and nanosystems by attending the International Conference on Integration and Commercialization of Micro and Nanosystems (Micro/Nano China 2007) held in Sanya, China on January 10-13, 2007. The conference was co-organized by the American Society of Mechanical Engineers (ASME) and the Chinese Mechanical Engineering Society (CMES). This academic conference on the integration of nanosystems has been held by the ASME Nanotechnology Institute in the United States since 2001. This year for the first time the conference was held outside of the United States—in Sanya, China—and was cosponsored by ASME with CMES and MANCEF. In addition to the cosponsorship by mechanical engineering societies from both countries, the conference was likely held in China because of the increased activity in MEMS-related R&D in China and the focus on Chinese MEMS researchers active in America.

We participated in this conference at the request of our overseas affiliate in MEMS conferences, MANCEF, to present the state of Japan's MEMS development and industrialization as a guest speaker, but we also participated with the following objectives.

- To study trends in MEMS R&D and industrialization in China, where such R&D has become more active in recent years and will likely influence Japan's MEMS industry in the future
- To study the condition of Sino-American research collaboration

The conference was held in the relatively new resort of Sanya, located at the southern tip of Hainan Island. Presentations given at the conference consisted of 108 oral and 260 poster presentations. **Tables 1 and 2** below give a breakdown of the topics in the oral and poster sessions and the countries that participated in each.

The following information was obtained based on the content of presentations and discourse at the conference.

- Based on the oral presentations and the exchange of information among participants at the conference, it is

apparent that China, Taiwan, South Korea, and other Asian countries recognize the high quality and substantial accomplishments Japan has made in MEMS industrialization through collaboration among industry, government, and academia.

• Overall picture of research trends in China

• Trends in MEMS-related research

- Total number of groups conducting MEMS-related research: 140 (researchers: 3,000)
- Groups focusing on MEMS research: 50 (researchers: 1,452)
- North China: Tsinghua University, Peking University, CAS, and CETC (13 locations)
- East China: SIMIT, and Shanghai Jiao Tong University
- Northeast China: Dalian University of Technology, and Harbin Institute of Technology
- Other regions: Chongqing University, Xi'an Jiaotong University, and China University of Technology

• Micro and nano fields are a focus in long-term strategies for R&D in 2006-2020

• Trends in Industrialization

- MEMS commercialization has begun in Beijing, Shenyang, Taiyuan, Hangzhou, Wuxi, Chongqing, and others
- There is no movement at present to establish a system for supporting industrialization

• Sino-American research collaboration

- The NSF is playing a central role in promoting Sino-American research collaboration
- Office established in Beijing (May 2006)
- NSF invests in U.S.-China program
- Approximately 150 projects underway
- 15 million U.S. dollars invested (not including investments in collaborative research)

China is strengthening cooperation with Chinese researchers residing in the United States. There is potential in China for immense improvements in research sophistication and for advances in industrialization in macro and nano fields and, hence, the situation should be continually monitored.

	Oral presentations	Keynote speeches	Industrialization	MEMS / NEMS	Energy transfer	Processes and microfabrication	Micro/nano fluids	Micro/nano mechanics	Measurement and Control
Total no.	108	10	14	31	12	15	6	6	14
China	45	2	1	14	5	7	1	2	13
Taiwan	8	1		5	1	0		1	
USA&Canada	33	4	7	8	4	6	2	2	
Europe	8	2	4	1		1			
Japan	4		1		1	1	1		
Korea	3						1	1	1
Australia	2	1	1						
India	0								
Singapore	0								
China / USA	3			2			1		
China / Europe	1			1					
China / Japan	1				1				

Table 1 Analysis of Oral Presentations by Topic and Country

	Posters	Systems	Devices	Energy transfer	Processes and microfabrication	Micro / nano fluids	Micro / nano mechanics
Total no.	260	35	67	31	83	23	21
China	189	24	52	22	62	13	16
Taiwan	6		5				1
USA&Canada	28	7	3	8	8		2
Europe	8	1			1	6	
Japan	5		1		1	2	1
Korea	6	1	1	1	3		
Australia	1		1				
India	8	1	2		3	1	1
Singapore	1	1					
China / USA	6		2		4		
China / Europe	1					1	
China / Japan	1				1		

Table 2 Analysis of Poster Presentations by Topic and Country