# Expectations for MemsONE

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MEMS (Micro Electro Mechanical Systems) is defined as a technology for creating fine, movable three-dimensional structures using semiconductor processing and other technologies, or the components manufactured in this way. In Japan they are called micromachines while in Europe they are known as MST (Micro System Technology), and broadly speaking, the terms have been used to mean nearly the same thing. MEMS differ from LSI circuits in that a wide range of inputs and outputs are possible, such as electrical signals, energy, mechanical displacement, physical quantities, optical signals, chemical quantities and so on. If machinery or systems are compared to humans, circuits correspond to the brain, while MEMS correspond to important parts such as the five senses and muscles. Since a wide variety of inputs and outputs are possible, MEMS can be applied in a range of fields whether in telecoms, medicine and biotechnology, automotive and so on, and since they use semiconductor process technologies, it is possible to manufacture high value-added products that are small, high performance, and have superior energy saving characteristics.

The New Energy and Industrial Technology Development Organization (hereafter, "NEDO") recognizes MEMS as an important field, and since FY1991 NEDO has carried out the Micromachine Project resulting in improvements in MEMS basic technology, and commercialization of some developments. However, since MEMS requires expensive and large scale equipment, NEDO has overseen the MEMS Project for the last 3 years since FY2003 in order to reduce risk from the viewpoint of capital investment, and to provide facilities and infrastructure. This project has carried out foundry improvements and has led to the development of high-level, three-dimensional process technologies.

Consequent to these circumstances, the Project for Development of a Design and Analysis Support System for MEMS (hereafter, "Mems-ONE Project" has been underway since FY2004 based on a 3-year plan. This project is focusing on development of a design and analysis support system for MEMS. One of the reasons why MEMS has not met its latent potential is that only limited numbers of researchers and engineers have been involved in the development of MEMS. By using this system, researchers and engineers from many other fields will more easily be able to participate in MEMS, and it will be possible to reduce the cost and time involved for MEMS development by using simulations.

One of the features of this system is a built-in database of knowledge such as MEMS terminology, explanations of representative processes and devices, and examples of analysis so that engineers who do not have much experience of MEMS can use it. At the same time, providing the system with a full materials database improves the accuracy of analysis, making it a worthwhile system for engineers who are already currently involved in MEMS development too.

When NEDO established this project, we designed the system so that it could be used both by beginners and experienced engineers. However, since MEMS is a technology in a growth field where the environment is changing significantly, we carried out a survey regarding activities to promote the Design and Analysis Support System for MEMS and its repercussion effects. This survey was conducted in parallel with the FY2004 project. When we surveyed the technology trends and the needs of society, we found that nanoimprint technology was considered a promising MEMS manufacturing technology, although in its startup phase it was still thought to be a future technology. Therefore using the NEDO system, we obtained a new budget and from FY2005 we started development of a Nanoimprint Process and Analysis System. Furthermore, from FY2006, we are starting the new High Integration Composite MEMS Fabrication Technology Development Project based on a 3-year plan. This project is scheduled to cover, (1) Development of MEMS/nano-function composite technology, (2) Development of MEMS/semiconductor integrated fabrication technology, and (3) MEMS/MEMS high integration composite technology. In future MEMS support systems, analysis of MEMS technology and semiconductor technology at the same time will likely be required, therefore from FY2006, we have been working on development of a circuit integration MEMS simulator.

The Mems-ONE Project will finish this fiscal year. However, the system developed as a result of the NEDO project will still be promoted after the end of the project, and we anticipate that the software will be improved and the database updated on a self-sustaining basis. As part of the High Integration Composite MEMS Fabrication Technology Development Project, NEDO will establish a database of high integration composite MEMS knowledge and will provide support so that the results are provided to the Mems-ONE Project. In addition, we are planning a standardization project to promote international standardization of technology developed by the Mems-ONE Project, and we expect that by going through these stages, improvement of the software and updates of the database will ultimately become self-sustaining, the results will be disseminated continuously, and the MEMS industry will continue to grow.