Next-Generation Projectss

Isao Shimoyama, Professor
Graduate School of Information Science and Technology
The University of Tokyo

The Micromachine Center created the Next-Generation Project Investigative Commission to study the future shape of MEMS. The following is a description of the findings of this study.

Characterized by miniaturization, MEMS has been developed as a major industry centered on monofunctional devices. MEMS products that have been marketed to date include pressure sensors, accelerometers, gyroscopes, inkjet print heads, DLP products, and microphones. According to a study conducted by the Micromachine Center, the market size for MEMS in Japan is expected to reach 1.36 trillion yen by 2010. Therefore, future high-density, complex MEMS, which will be smaller, more reliable, and more sophisticated, have become a major issue.

The Investigative Commission discussed the MEMS industry based on our recognition of this situation. In the future, there will be a strong demand for smaller, cheaper, more sophisticated, and more versatile electronic parts serving as key components in the telecommunication field, for which a surge in demand is anticipated, and the automotive field, which is competitive internationally. It will also be necessary to contribute to safety and security, sustainable energy, medical welfare, and other social needs. MEMS technology is the leading candidate among manufacturing technologies for meeting these needs.

Future MEMS business may develop in many shapes, including in-house-manufacturing businesses, businesses for supplying MEMS parts, foundry services, startup companies produced by spinouts, as well as design, simulation, and consulting businesses. However, MEMS R&D to date has required capital for relatively long periods, such as ten to twenty years or more. If this also proves to be a impediment in next-generation highly integrated, complex MEMS, the potential for the MEMS industry and its users will be low. Therefore, we must establish policies for the MEMS industry aimed at revitalizing the strength of Japan's manufacturing industry.

The Commission established the following four categories for technologies required for meeting our future needs through the development of high-density, complex MEMS that are smaller, more reliable, and more sophisticated.

(1) Technologies integrating MEMS and high-density semiconductors (MEMS + CMOS)

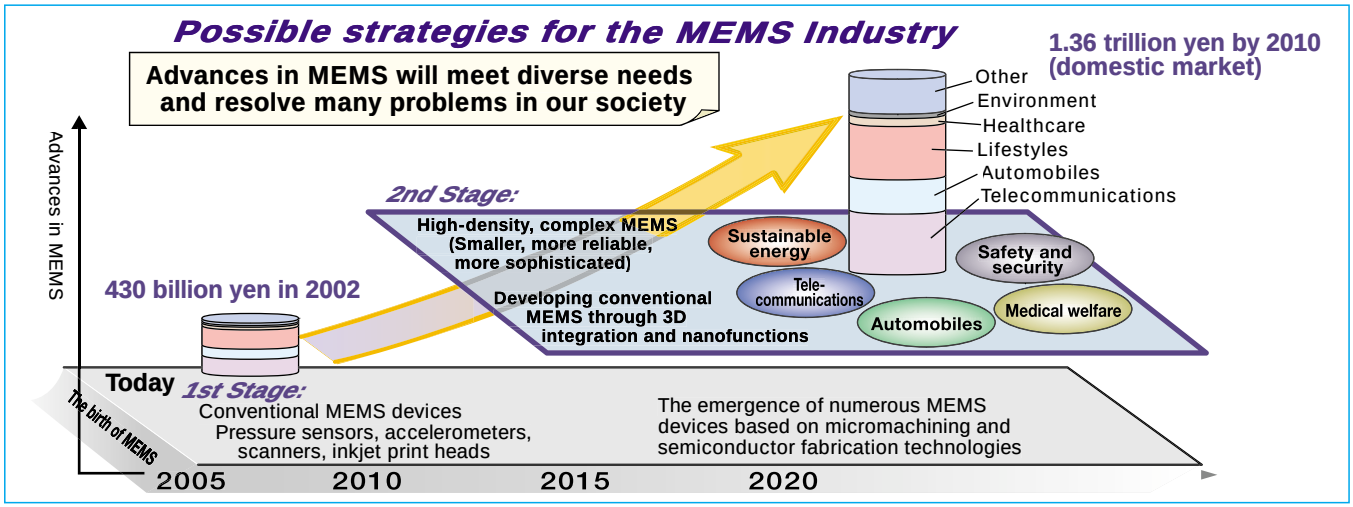
(2) Technologies for combining and increasing the density of multiple MEMS (MEMS + MEMS)

(3) Technologies for combining the functions of MEMS and nanotechnology (MEMS + NANO)

(4) Common base technologies

Of these categories, (1) involves the monolithic integration of MEMS and CMOS aimed at rapidly improving the functional capacity for knowledge accumulation; (2) involves the research and development of technologies for bonding and layering dissimilar materials and functions at the wafer level in order to combine functions, express new functions, and improve reliability; (3) involves the research and development of technologies for locally and selectively forming and expressing the functions of nanomaterials on MEMS with the aim of improving the performance of MEMS using functional expressions on the nanoscale; and (4) is aimed at constructing a common knowledge database primarily concerned with high-density, complex MEMS.

MEMS technology is our trump card for the future of the manufacturing industry. It has high added value and is supported by a strong technological strength difficult to replicate. It is our wish that the results of the Next-Generation Project Investigative Commission will be incorporated in future R&D for strengthening the competitiveness of our industry.



Possible strategies for the MEMS Industry