MEMS Foundry Service at the National Institute of Advanced Industrial Science and Technology

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Outline

As part of the "Focus 21 Project" under the Ministry of Economy, Trade and Industry, the National Institute of Advanced Industrial Science and Technology (AIST) completed construction of the "MEMS Business Building" that makes available MEMS production facilities to promote the industrialization of MEMS. Operations at the building began in March 2004.

As MEMS foundry services have become more popular, the private sector has enhanced the services available for producing device prototypes with some potential for mass-production. At present, however, the private sector cannot immediately handle prototypes required in research and development or prototypes of diverse devices with limited production that are the niche of small and medium venture businesses. For this reason, AIST is serving as a collaborative research base for providing a prototype service for devices that are essential in research and development but a high risk for private businesses.

These facilities coordinate the research potential and technological seeds in MEMS possessed by AIST with the technology and needs of industry. It is hoped that these facilities will bring together the intellectual minds of industry, academia, and government in the field of MEMS, strengthen cooperation, and nurture creative personnel. The facilities are now actively operating as a control base for MEMS R&D.

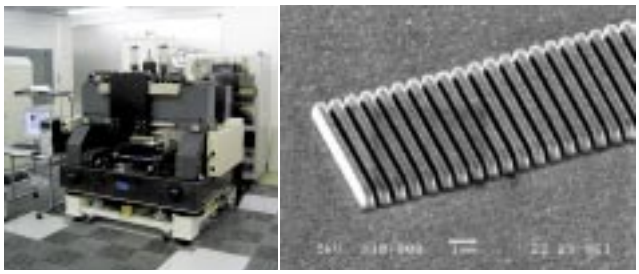
Features of the Foundry Service

To date, MEMS technology has been commercialized in the forms of medical and automotive sensors, inkjet print heads, and mirrored reflection projectors. Soon sensors and actuators developed with MEMS technology are expected to have applications in optical communications and mobile equipment, computer peripherals, portable power supplies, and biotech analysis. MEMS has reached the status of a next-generation technology that can revitalize Japan's industry.

We have identified the need to improve our developing speed and to reinforce proprietor technologies that cannot be immediately imitated, particularly material technologies that require lengthy research and development. At AIST we are rapidly developing next-generation devices through close collaboration with industry, making use of sophisticated thin film material technology used in sensors and actuators and 3D micromachine technology for silicon, as well as our own cultivated glass and carbon. Some of our primary areas of development include RF-MEMS for use in next-generation high-frequency communications, optical MEMS for use in optical communications and elements of information presentation, and fluid MEMS used in biotech analysis. These technologies have attracted much attention for their ability to make Japan's industrial goods sophisticated and differentiated. With the aim of applying MEMS to other fields, which has not been possible due to the scarcity of technical experts, our facilities have also contributed to training advanced and creative experts. In collaboration with the nonprofit organization Precision Engineering and Science Network, we have launched a hands-on MEMS course that is not merely a classroom lecture but focuses on design simulations and the practice of actual process measurements. The course has drawn praise from experts in many fields of the private sector.

Our facilities comprise primarily a high-accelerating voltage electron beam lithography device as a machining tool for use in nanoregions, a deep-focus stepper for MEMS designed to print patterns on multilevel structures with high precision, a high-aspect ratio ICP etcher having numerous uses in MEMS, and a nanoimprinter for low-cost industrial manufacturing of nanostructures. In addition to these specialized devices, the facilities include machining and measuring equipment commonly used for MEMS to provide everything necessary in one environment to support the rapid development of prototypes. We are also working to prevent reductions in service features due to the limited number of available government workers.

An optical scanner using ferroelectric material (left) and an RF switch driven by a low voltage



A nanoimprinter (left) and a nanoimprinted glass structure