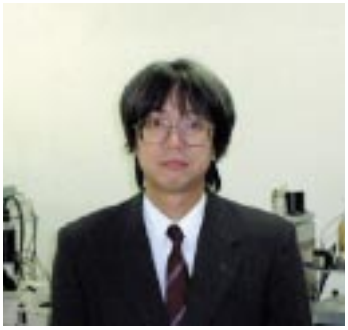
Seiko Instruments Inc.



Toshihiko Sakuhara
General Manager,
Corporate R&D Department

1. The Challenge of Micromachine Technology

With the rapid advance of information technology, the network society has been growing as never before in history, and nanotechnology has attracted worldwide attention. Seiko Instruments Inc.developed their original watch manufacturing plant and the company's precision machining technology has served as the company's basic technological power. In other words, Seiko Instruments has had a close association with micromachine technology from the beginning. In the new century, we consider micro nanotechnology to be one of our most important technological assets, and will continue our R&D efforts along with ISTF project.

2. Development of Micromachine Technology

Seiko Instruments Inc. is now doing its best to act as the organizer of prototype system development and also to promote its own machining technology based on the utilization of probe microscopes as manager for the development of micro-factory technology under the ISTF project "Micromachine Technology."

"Micro-factory" is a new production system with the catch phrase "Small products by small machines." Conventional production systems have been developed to satisfy high-volume and high-speed production, with the result that they have become larger in size. Micro-factory technology proposes to meet the social demand of the next generation which advocates production systems be changed to low-volume and wide-variety production. At the same time, production systems should be in conformance with such environment-friendly requirements as energy saving, space saving, and resource conservation. At present we are working on the second-phase prototype system (see Fig. 1) which suggests to us the high feasibility of micro-factory systems in the near future.

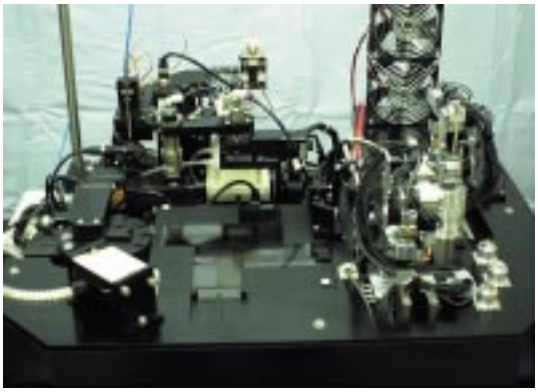


Fig. 1 Second-phase micro-factory prototype system

We have directed our R&D efforts related to machining technology as a part of micro-factory technology toward developing new machining methods instead of merely targeting downsizing conventional machining methods. For example, micro electrolytic machining and micro optical machining, making use of Scanning probe microscope (SPM) technology are being developed. SPM technology is focused on as providing the means to examine objects at the atomic or molecular levels and also as a type of nanotechnology tool. We are conducting R&D activities involving this SPM technology as micro-factory machining technology. Fig. 2 shows an example of micro electrolytic machining, which has sub-micron resolution performance and allows both electroplating and electrolytic etching (attaching and detaching) in a 1-mm^2 area.

The other machining method, micro optical machining, uses near visual field light to prove its performance beyond light diffraction limits. The micro piezoelectric motor developed in the first phase of the project is under further study for expected commercialization.

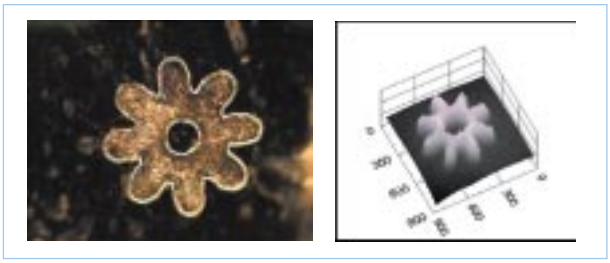


Fig. 2 A gear manufactured by micro electrolytic machining technology (Diameter: 600μm)

3. Future Stances

While working for on ISTF project, we have established our micromachine technology as the fundamental technology. From now on we will continue our efforts for commercialization of the developed devices, utilization of the technology in other applications, and application of the technology for the creation of new production systems.

TERUMO CORPORATION

Akira Takahashi, Ph. D.
Senior Managing Director,
R&D Center

1. The Challenge of Micromachine Technology

Medical care in the future will have to meet such patients' needs as alleviation of physical burdens, support of human dignity, and reduction of medical expenses. Medical issues will have to be solved with the highest priority given to patients. In this sense, minimally invasive treatment methods are highly required. Micromachine technology is indispensable for realizing minimally invasive treatment methods. We have conducted our R & D activities based on our belief that micromachine technology will be the basic technology for medical care in the 21 century.

2. Development of Micromachine Technology

TERMO has participated in the ISTF project "Micromachine Technology" and developed "Optically driven free joint devices" and "Micro laser catheters," along with which Terumo has advanced its own micro catheter technology and micro laser technology. A single micro laser catheter, which is used in a narrow lumen such as a brain blood vessel or the like, can serve both diagnosis and treatment purposes.

In the first phase of the project, we examined techniques for laying electric wires over the external surface of a catheter tube for the purpose of mounting multiple sensors while securing the lumen for inserting a treatment device inside. As a result, we have successfully mounted a thermistor or ultrasonic vibrator in the form of a chip on the outer surface of a catheter tip. We also conducted a basic study for the utilization of a 2.8-μm laser, which allows excellent absorption in human tissues so that safe treatment would be available in blood vessels.

In the second phase of the project, we further developed the basic achievements attained in the first term. We optimized the micro catheter by making it flexible for higher operability. As for the micro laser, we implemented a micro laser head by integrating it onto the end tip of an optical fiber with the capacity of solid laser vibration having a wavelength of 2.8-μm developed in the first phase. Furthermore, we examined measures against the heat generated on the laser head and reduced the diameter of the laser head so that it can be used in combination with the micro catheter.

As for the final structure of the optically driven free joint device, we integrated a photoelectric converter and SMA actuator into a single body.

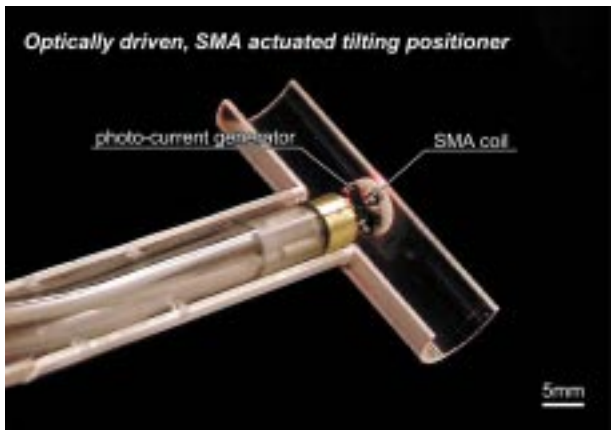


Photo 1 Prototype of optically driven free joint device

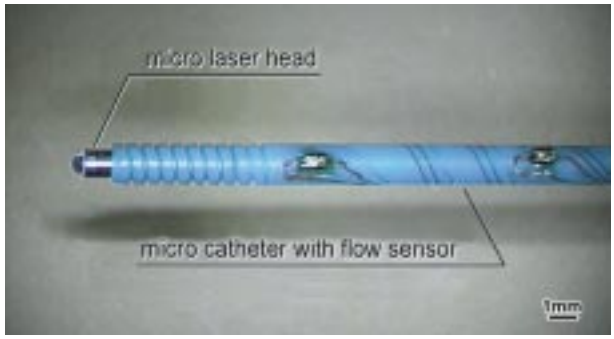


Photo 2 Prototype of micro laser catheter

3. Future Stances

In order to realize minimally invasive surgery treatment devices, micromachine technology plays an important role in downsizing those devices. We will do our best to realize such medical treatment through developing micromachine technology-based devices on the basis of our achievements accomplished in the past.