Tohoku University, Department of Robotics

S. Tanaka Laboratory

Chair of Nanosystem, Laboratory for Smart System Integration
http://www.mems.mech.tohoku.ac.jp/index_e.html


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Development of MEMS for various applications

Our core competence is MEMS (Micro Electro Mechanical Systems) technology, which is widely used for inertial sensors, pressure sensors, ink jet printers, frequency control devices etc. Recently, MEMS are getting more important for wireless communication, automated control, healthcare, medical diagnosis, energy saving etc. To answer such requirements, we are developing advanced gyroscopes, CMOS-integrated tactile sensors, new acoustic wave filters, microactuators etc. in conjunction with wafer-level packaging technology, piezoelectric thin films and original process tools. We are eager in industrial and international collaboration.

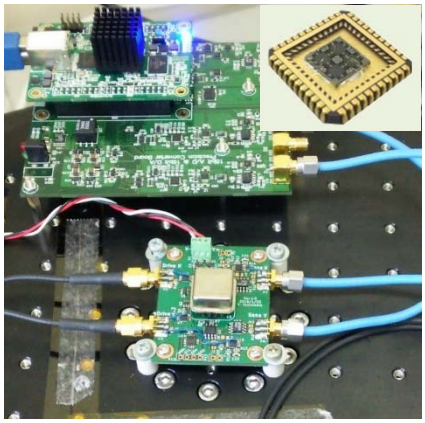

Fig. 1 High performance MEMS gyroscope

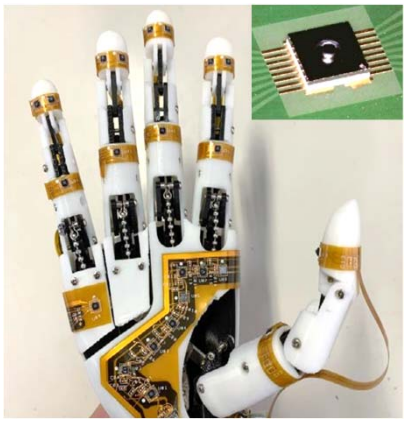

Fig. 2 Integrated tactile sensors on robot hand*

*from Prof. Naoki Fukaya, TMCIT

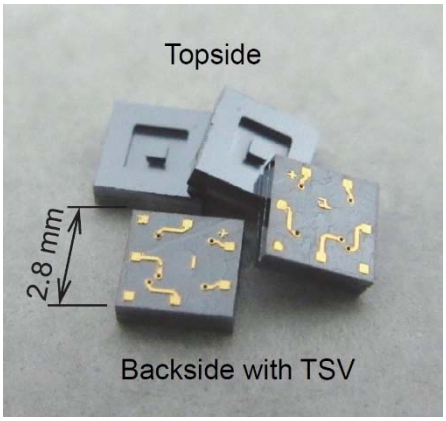

Fig. 3 MEMS-LSI integration platform with TSV

Sensors for robots, automated vehicles and health care systems

Advanced MEMS gyroscopes are developed in device and system levels for automated vehicles and robots (Fig. 1). Integrated bus-network tactile sensors are developed to cover the body of robots (Fig. 2). Ultrasonic range finders for gesture recognition, microactuators for the control of optics and other microdevices are also developed.

Wafer-level hermetic packaging and integration technology

Packaging is a key for MEMS and a source of competitiveness in market. In our laboratory, a variety of wafer-level hermetic packaging and integration technologies (Fig. 3) are ready based on metal-based wafer bonding.

Frequency selection and control devices for wireless systems

The shortage of frequency resource for wireless communication will be more critical in a coming IoT (Internet of Things) society. Modern frequency selection and control is relying on acoustic wave devices and MEMS. We are developing advanced high-Q, low-TCF SAW and BAW (surface and bulk acoustic wave) devices and RF MEMS switches for the next generation wireless systems.

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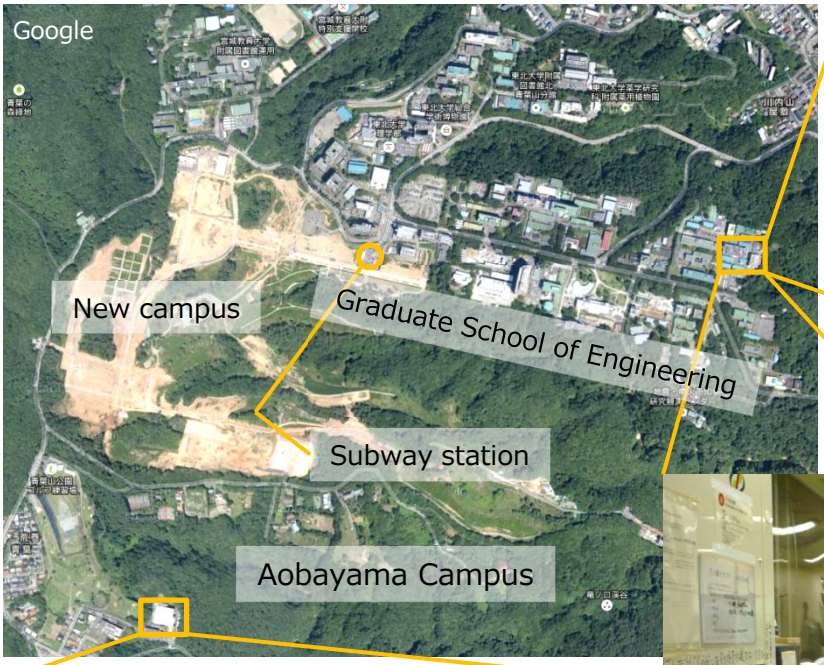
To industrial customers looking for a MEMS R&D partner

S. Tanaka Laboratory is willing to support MEMS industry in research and development based on a lot of technology, know-how and literature accumulated for a long time in Tohoku University. We can propose multiple styles of research and development, from the proof of concept using small substrates to device prototyping using 4-6 inch wafers, depending on R&D phase in each company. The proof of concept is conducted at the minimum cost and risk mainly using our cleanroom and Micro/Nano-Machining Research and Education Center (MNC). We accept researchers from companies, and they can experience the total process of MEMS development to be experts and key persons in their company's MEMS team. The visiting researcher has a chance to pursue his Ph.D as a graduate student. Prototype devices on 4-6 inch wafers are fabricated mainly in Microsystem Integration Center (Jun-ichi Nishizawa Memorial Research Center). Devices fabricated in our facilities can be commercially used with some reservations. Tools in Microsystem Integration Center can be simply used by visitors based on pay-by-the-hour system ("Hands-on Access Laboratory" system), but we recommend you collaboration with us not to lose time and money in a complacent manner, especially if you are not a MEMS expert. S. Tanaka Laboratory has a lot of experiences about difficult-to-access technologies such as wafer-level packaging, heterogeneous integration and piezoelectric thin films. Consultation about MEMS technology and business are being accepted anytime from companies.



Micro/Nano-Machining Research and Education Center (MNC)

Jun-ichi Nishizawa Memorial Research Center

Cleanroom of S. Tanaka Laboratory

Research Topics in 2020

Advanced inertial sensors for automated vehicles and robots, Tactile sensor system for robots, Frequency control devices for advanced wireless communication (SAW and BAW devices), Piezoelectric thin films and devices, Acoustic and ultrasonic sensors, Microactuators, Heterointegration technology and wafer-level packaging technology, Key technologies for sensors and microactuators, MEMS process tools (ALD tool and wafer bonder) etc.