Activities of the G-device Project

Since April of last year, the G-device Center of the BEANS Laboratory, sponsored by the New Energy and Industrial Technology Development Organization (NEDO), has been working toward the development of an advanced sensor network system and environmentally friendly processes. In December of last year, the Center completed installation of a smart clean room and front/back-end advanced 8-inch MEMS lines (TKB812-F/B) at the Research Center for Ubiquitous MEMS and Microengineering, housed in the research base, Tsukuba East of the National Institute of Advanced Industrial Science and Technology (AIST Tsukuba East).

The smart clean room (area: 150 m^2) is designed for low-power consumption and low environmental impact. The clean room is targeted to achieve clean-on-demand control using a sensor network system to monitor temperature, humidity, particles, power consumption, and other environmental conditions, and a dedicated smart air conditioning system.

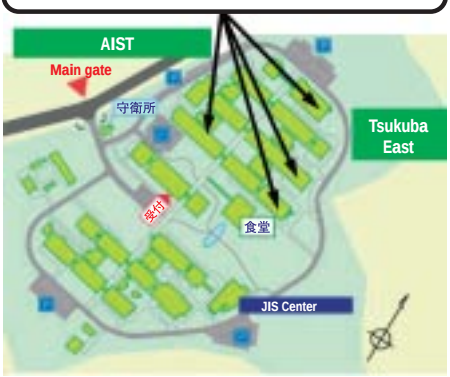
The MEMS lines form a coherent fabrication line that supports 8-inch and 12-inch wafers and includes a front-end processing line (TKB812-F) and a back-end processing and evalutation line (TKB812-B). The front-end line installed in a clean room at AIST (area: 350 m^2) covers everything from wafer cleaning to lithography, oxidation, diffusion, deposition, and etching. The back-end line installed in the smart clean room is equipped to handle chip/wafer-to-wafer bonding and wiring as well as evaluations of the processed wafer profiles and the electrical properties of devices, for example.

These production lines support microfabrication at a line width of 0.35 μm, as well as three-dimensional micromachining, enabling us to produce everything from sensors and other time-tested MEMS devices to advanced devices. In our NEDO-sponsored R&D work, the MEMS lines will be used in the trial production and evaluation of test element groups (TEGs) used for verifying processes developed in the BEANS Project, and TEGs of sensor network elements.

Our goal is to bridge the “commercialization gap” by using these facilities to provide development support in MEMS prototyping and pilot production aimed at mass production, which areas have been considered a weakness in Japan to date. At Tsukuba’s R&D center for NMEMS (TIA-NMEMS), these facilities are also expected to serve as the core of an R&D platform for operations of the future Micro/Nano Open Innovation Center (MNOIC).

Overview of the advanced 8-inch MEMS line

Advanced 8-inch MEMS line
(for 8-inch MEMS and 12-inch semiconductors)



Installation site	Process	Process and evaluation equipment
Front-end clean room (TKB 812-F)	Cleaning/drying	12" wafer cleaning system (RCA cleaning)
		Organic draft chamber, IPA vapor dryer, water purifier
	Lithography	12" DMD maskless exposure system, mask aligner, i-line stepper
		12" coater/developer, 12" oxygen plasma asher
	Deposition	Oxidation furnace, boron diffusion furnace, 12" low-temperature TEOS plasma-enhanced CVD system for forming silicon dioxide films
		Silicon nitride LPCVD furnace
		Phosphorus-doped polysilicon LPCVD furnace
		3-chamber sputtering system for depositing metal, piezoelectric (AlN), and insulating layers
	Etching	12"/8" silicon DRIE system
		ICP dry etcher for metal, ICP dry etchers for silicon dioxide/nitride films
		Silicon anisotropic wet etcher
		Dry sacrificial layer etcher
Back-end clean room (TKB 812-B)	Bonding/packaging	Chip-to-wafer (12") bonding system, wafer-to-wafer surface-activated bonding system
		12" electron beam evaporator, vacuum annealing furnace
		Laser stealth dicer, 12" blade dicer
	Evaluation	Wafer prober, noncontact-type film stress measurement system, 12" X-ray CT scanning system
		12" SEM (elemental analysis, crystallographic analysis), CD-SEM
		12" spectroscopic ellipsometer, contact-type surface profiler, optical microscope, wafer surface particle analyzer

Major equipment in the MEMS line