Equipment Development Center

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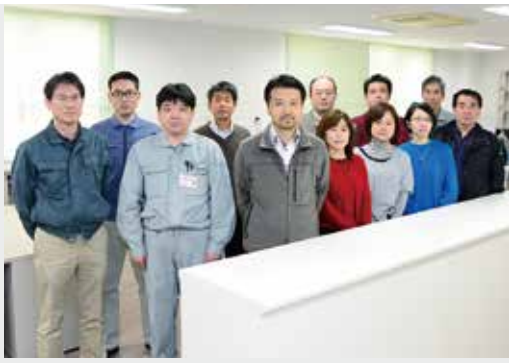

Researches and developments of novel instruments demanded in the forefront of molecular science, including their design and fabrication, are the missions of this center. Technical staffs in the two work sections, mechanics and electronics, are engaged in developing state-of-the-art experimental instruments in collaboration with scientists. We expanded our service to other universities and research institutes since 2005, to contribute to the molecular science community and to improve the technology level of the center staffs. A few selected examples of our recent developments are described below.

Fabrication of an Electric Probe with Substrate Bending Mechanism

In Research Center of Integrative Molecular Systems, a research on an organic field-effect transistor (FET) that shows switching of superconducting phase at low temperature is ongoing in order to obtain fundamental knowledge about interacting electrons in a molecular solid. The organic FET fabricated on a plastic substrate can be bended to result in a tensile strain at its convex surface, so that fine tuning of the electrons' kinetic energy is possible through the expansion of the lattice. In order to expand this method to FETs with much harder substrates such as $SrTiO_3$, a novel electrical probe (Figure 1) that can be used with Physical Properties Measurement System has been designed and fabricated.

Figure 1. Schematic of the probe.

ARM Microcontroller-Based Magnetic Field Measuring Instrument

In high-precision spectroscopies and controls, we need measure the environmental magnetic field to evaluate the noise signal from the environment. In this work, we have developed 3-axis magnetic-field measuring instrument. This is made by the commercial compass module and the Acorn reduced instruction set computing machine (ARM) microcontroller. (Figure 2)

This device consists of one micro USB connector for the power supply and communication, one rotary encoder for the operation, two switches for selecting and canceling, and one liquid crystal display with 16 characters and 4 lines. The compass module HMC5883L by Honeywell is connected to 4 core cables. All of these are controlled by the ARM microcontroller LPC1114FBD48/302 by NXP. The measured 3-axis magnetic fields are output as digital data with 12-bit resolution and the 8-levels measurement range from ±0.88 gauss to ±8.1 gauss. The ARM microcontroller reads by Inter Integrated Circuit (I^2C) and converts, formats separated by commas, and displays the measured data on liquid crystal display. These data can be recorded in a built-in 256 kbit EEPROM by selecting the measurement mode. In addition, we have added the functions of transferring the real-time measured data and the stored one on EEPROM to PC. To utilize these communications, we have developed an interface tool by Visual Basic 2015. (Figure 3).

Figure 2. Magnetic field measurement instrument.

Figure 3. Measuring magnetic field using communication application.