Equipment Development Center

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Research and development 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 three work sections, mechatronics, electronics and lithography 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.

Development of 12-bit A/D Conversion Module with Contact Output

It would be useful to have a module that monitors the input analog voltage and reacts when the input voltage exceeds a threshold value. For example, it could be used to monitor abnormalities in the output voltage of laboratory equipment. For such purpose, it is enough to work in the low frequency range input of DC ~ a few kHz. We have developed such a module with a very simple configuration (Figure 1).

The input voltage range is from 0 to 5 V and threshold voltage can be adjusted using variable resistors. If the input voltage crosses the threshold, the contact output is shorted. A comparator (LM2903M by Texas Instruments) with hysteresis characteristics is provided in the front stage of the contact output to suppress the unexpected output due to slight fluctuations in input voltage near the threshold. Insulated BNC receptacle connector is used for both input and output. It works standalone by supplying 9V from the DC jack. It is also equipped with a Pmod interface for SPI communication. This interface can be used to supply power as well as to communicate with the built-in 12-bit A/D converter (MCP3221 by Microchip Technology) that can provide read input voltage values. In addition, despite the small size (45×90×25 mm) of the housing, the distance between the input and output BNC connectors is designed so as not to interfere with cable insertion and removal.

Figure 1. Module overview.

Molecular Modeling with Transparent Materials

We accept requests for making models of molecules and proteins. Scientists use these models to imagine their responses and behaviors in nanoscale. Models are also used to explain the research results in a lucid way.

3D printers are indispensable for making models. Since we introduced a full-color plastic 3D printer 3DUJ-2207 (Mimaki Engineering, Nagano, Japan) last year, we are now able to provide models with transparent resins. By using this, we can embed a full-color ribbon model in a transparent surface model (Figure 2), for example. When the ribbon model is placed in water, transparency of the ribbon model increases (Figure 3). In addition, we have made crystal models with transparent or semi-transparent crystal facets (Figure 4).

We would like to continue to contribute to the research activities of the Institute for Molecular Science by upgrading our technologies and skills.

Figure 2. Clear surface & ribbon model.

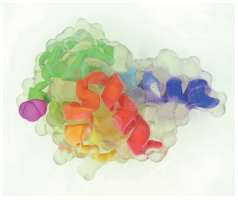

Figure 3. Underwater visibility of a model shown in Figure 2.

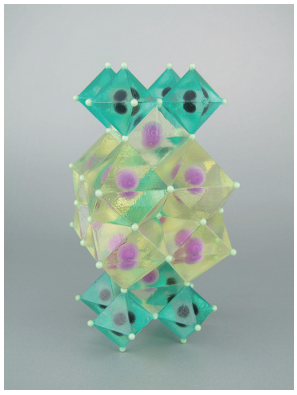

Figure 4. Crystal model with crystal facets.