Equipment Development Center

YAMAMOTO, Hiroshi	Director
MIZUTANI, Nobuo	Technical Associate
AOYAMA, Masaki	Technical Associate
KONDOU, Takuhiko	Technical Associate
TOYODA, Tomonori	Technical Associate
TAKADA, Noriko	Technical Associate
NAKANO, Michiko	Technical Associate
KIMURA, Sachiyo	Specially Appointed Technical Associate
KOSUGI, Yuta	Specially Appointed Technical Associate
TANAKA,Takashi	Technical Fellow
SAWADA, Toshihiro	Technical Fellow
YOSHIDA, Hisashi	Technical Fellow
URANO, Hiroko	Secretary

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.

Development of Microfluidic Channel with a Step Structure by Lithography

We have developed a microfluidic channel with a step structure, which has depth of 50 μm and 1 μm, and width of 300 μm, on 70×30(mm) glass substrate by wet etching. We expect the structure to improve the efficiency of chemical reaction by limiting depth of reaction part.

Since it is not able to fabricate different depth structures by a single etching process in lithography, we need to repeat the process for each depth pattern. First, we created a channel with 50 μm depth. Next, we added 1 μm depth structure with precise position aligning. We examined etching solutions, mask materials suitable for each etching depth, roughness of resist surface, and alignment procedures. With these investigations, a step structure whose profile is shown in Figure 1 has been obtained.

High Voltage Amplifier for Driving Bimorph Pump

In order to flow very little amount of solution by using a bimorph pump that is driven by AC voltage, an embedded power supply is normally used. However, since it is difficult to adjust the output voltage, there is a problem of low reproducibility at experiments. In addition, since the cable connection is easily disconnected, troubles such as short circuit are likely to occur. We have developed high voltage amplifier for driving bimorph pump with high reproducibility and safety. It is shown in Figure 2.

First, AD9834BRUZ DDS (Direct Digital Synthesizer; Analog Devices), generates a sine wave whose amplitude is 3.5Vp-p and frequency is from 10 Hz to 100 Hz with resolution of 1 Hz. Next, ADA4077-1ARZ (Analog Devices) amplifies the fed signal by 4 times, to be followed by another amplification by ADA4077-1ARZ and AD5292BRUZ (Analog Devices) at a ratio ranging from 0 to −1. Finally, PA441DF (APEX) amplifies the signal to ±140 V. All devices are operated by ARM microcontroller LPC1114FBD48/302 (NXP) through SPI (Serial Peripheral Interface). The values are displayed on OLED screen and recorded in EEPROM.

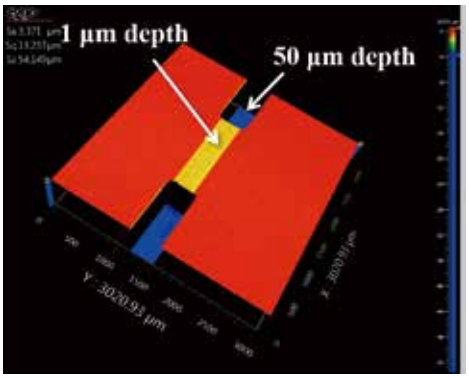

Figure 1. 3D view of the microfluidic channel with a step structure.

Figure 2. High voltage amplifier for driving bimorph pump.