Equipment Development Center

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Design and fabrication including the research and developments of the new instruments necessary for the molecular science are the mission of this center, which consists of the mechanical, electronics and glass work sections. We expanded our service to the outside researchers of universities and research institutes since 2005. The main aims of this new attempt are to contribute to the molecular science community and to improve the technology level of the center staffs.

The technical staff of the Equipment Development Center is engaged in planning, researching, designing and constructing high technology experimental instruments in collaboration with the scientific staff. And these experimental instruments are manufactured by incorporating with new technologies and new mechanical ideas. A part of our activity in the current fiscal year is described below.

Development of a Cell for a Gas-Phase Nuclear Magnetic Resonance Spectrometer

This project was proposed by Prof. Fuke (Department of Chemistry, Kobe University), who is developing a gas-phase NMR spectrometer. The apparatus was selected in System Development Program for Advanced Measurement and Analysis of JST (*Development of Systems and Technology for Advanced Measurement and Analysis*) in 2007, and it was adopted as the institution use of the latter period in 2007.

NMR spectroscopy is widely used for liquid and solid samples. The aim of the development is to extend the NMR application to the gaseous ions. The system consists of a FT ICR (ion cyclotron resonance) mass analyzer and a NMR spectrometer, and provides us NMR data of mass-selected ions. It is expected to be available with the gas phase molecular ions ($m/e < 2000$, $< 10^5$ /cm^3).

In this project, the NMR cell, which is mounted in 12T magnet, was designed and constructed. Since the magnetic bore (ϕ 155 mm × 2000 mm) is long and spatially limited, there are several difficult points for designing the cell. Figure 1 shows the schematic design of NMR cell. In order to trap slow-velocity ions in the NMR cell, the electrical noise aroused from RF magnetic fields must be efficiently suppressed. To overcome this problem, the electric wires were introduced through inside of the pipes which support the cell mechanically. A technical development was also required to mount a Cu mesh (95% transparency) on the NMR-cell electrodes. In addition to these, there are several technical problems, which we are now overcoming.

In this program, Mr. Horigome, who is the staff of UVSOR Facility, also cooperated to accomplish this joint development project. Because he has enough experience of making vacuum machinery.

We had several meetings with the researchers of Kobe University and discussed on the design of the cell. The NMR cell is going to be constructed in the latter period in 2008.

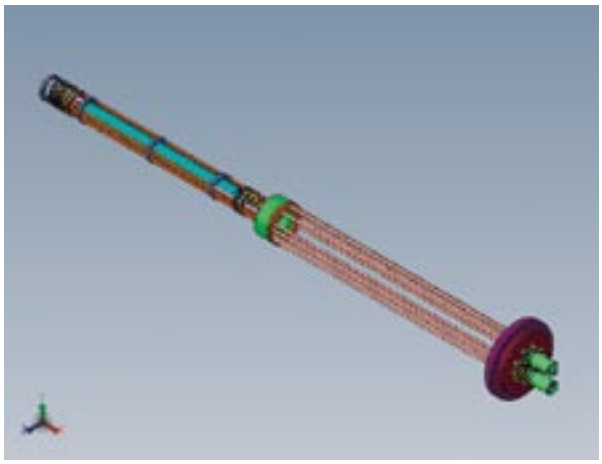

Figure 1. Schematic design of the NMR cell.

Fabrication of a Precision CNC Milling Machine

In recent years, micro fluidic channel is rapidly becoming important tools in wide science technology fields such as analytical chemistry and medical biology. The pattern of micro channels is usually fabricated by the photolithography. However, the photolithographic method requires complex chemical and mechanical processes and expensive photomasks. It is difficult to make a deep channel, and waste fluid processing an intractable problem. Due to these disadvantages of photo-

lithographic method, importance of micromachining by cutting is becoming important. In relation to this, machine tool companies are selling various micro machinery tools. Moreover, needs for micromachining is also increasing in IMS. Based on these requirements, we started the developments of micromachining technology several years ago. However, since it is difficult to make precise microstructures by using old type machine due to large cutting errors, we decided to fabricate a precise CNC milling machine. As shown in Figure 2, this machine consists of a spindle, the xyz submicron stage and a substance microscope. We fixed the spindle to an auto collimator base which is used for coarse control. As shown in Figure 3, we made a mask for synchrotron radiation etching by using this machine. This mask has 25 through holes in a plate with 30 μm thickness. We thought it was difficult to make this by using our old type machine, and the importance of the new type of precise machinery has been demonstrated.

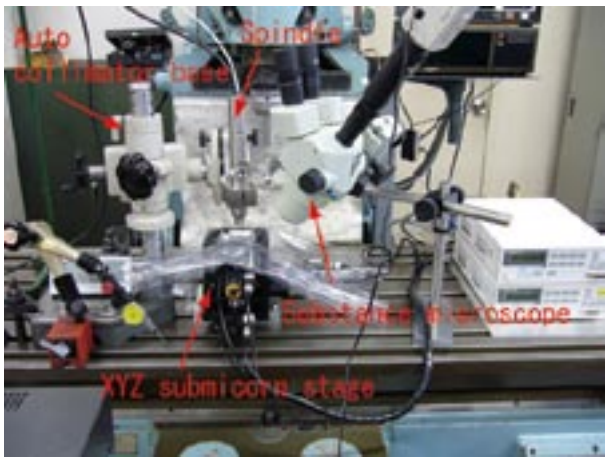

Figure 2. Newly developed Precision CNC milling machine.

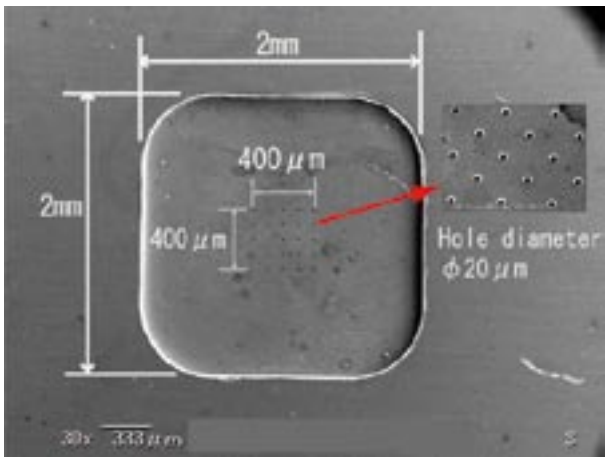

Figure 3. Mask for synchrotron radiation etching.