Thin Film Deposition, Etching and Micro Fabrication of Electronic Materials.

T.Kanashima (3417), *M.Okuyama(3418), O.Maida (3577), M.Shimizu (3459)*1, S.Nakashima (3541)*1, M.Yoshida (3542)*1, M.Hirai (3445)*2 and H.Ohashi (1102)*3

Graduate School of Engineering Science, Osaka University
*1 Faculty of Engineering, Himeji Institute of Technology
*2 Faculty of Science, Okayama University
*3 Japan Synchrotron Radiation Research Institute

BL27SU is designed for the research on soft X-ray photo-chemistry and soft X-ray CVD. Figure-8 undulator is used in this beamline, and the soft X-rays from 0.5 to 5 keV is available. Our experiments have been carried out in the experimental station for soft X-ray CVD, because this is designed for growth of thin film of functional material, micro fabrication by functional material etching and clarification of the reaction mechanics for deposition and process.

Schematic diagram of the experimental station for Soft X-ray CVD is shown in fig. 1. It has the equipment for the researches of deposition, etching and these mechanisms. This beamline connects storage ring directly and have no window between station and ring. So, its performance must be clarified in order to introduce some gases in the chamber. N_2 gas suppling is connected to the reaction chamber. When the N_2 gas was introduced at pressure ~1 Pa under the condition that the diameter of the aperture between differential pumping chamber (DPC) and reaction chamber is 10 mm, the pressure at the point between beamline and DPC is less than 10^{-5} Pa. Addition to this, interlock system has been checked. The chamber was baked to obtain a high vacuum environment.

Soft X-rays from Figure-8 undulator was introduced to experimental station. Visible light does not include in this light. So, when soft X-rays irradiated the sapphire window on the analysis chamber, and photoluminescence of about 5x1 mm^2 was clearly observed. However, the absolute power and the spectra of soft X-rays has not been determined yet.

Electronic materials such as Si, SiO_2 film on Si and PZT film on Si were irradiated with soft X-rays for the basic studies of thin film deposition, etching and micro fabrication. The sample was set in vacuum chamber at pressure 10^{-5} Pa at room temperature or several hundred °C. The heater temperature was set to 900°C, but the temperature of sample surface is lower than that of the heater. The sample was irradiated with soft X-rays for 8 hours, but unfortunately, remarkable change or reaction has not been observed. The surface morphologies are measured by surface profiler, but SiO_2 thin films grown on Si wafer before and after irradiation are almost equal. X-ray diffraction spectra of PZT thin films before and after irradiation are measured, but no significant change is observed.

Irradiation effects have not be observed. This may be due to low power of soft X-rays and/or low substrate temperature. However, this is not clarified, yet, and more researches are required.

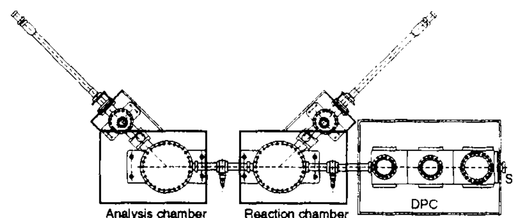

Figure 1: Schematic diagram of the experimental station for soft X-ray CVD.