Measurement of Au Deposition Rate with Low-Energy Mass Analyzed Ion Beam Deposition Apparatus

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The measurement of the Au deposition rate has been measured with various measurement apparatus and reported in several papers[1]. In these previous papers, however, the energy of the bombarding Au ion beam was comparatively high (about several keV), and there were few data in the low energy region (below 100 eV). In addition, the energy spectrum of the Au ion beam to irradiate was not measured. In this presentation, we will report the Au deposition rate measured in the energy range 40-200 eV.

In this experiment, we use the low-energy mass analyzed ion beam deposition apparatus. On this apparatus, the Freeman-type sputter ion source is mounted[2]. In this ion source, a small Au target is held on the sputter electrode, and Au ions are generated with the sputtering of the Au target by the Ar plasma produced in the ion source. Then, the produced ions are extracted by the high voltage (-14 keV). In this extracted high energy ion beam, Ar ions are coexisted with the Au ions. Therefore, the extracted ion beam is passed into mass analyzer and the Au ions are selected. Next, the Au ion beam is decelerated by electrostatic field and then is deposited on the substrate. The energy spectrum of the bombarding ion beam is measured with the plasma process monitor (BALZERS, PPM421). For example, the full width of half maximum of the energy spectrum is about 10 eV when the energy of the bombarding Au ion is 40 eV.

We measured the thickness of the deposited Au film by bombarding this ion beam on the quartz crystal microbalance (QCM), The QCM controller which we use is CRTM-9000 (ULVAC). The number of the deposited atoms can be calculated by the deposited thickness obtained by the CRTM-9000. On the other hand, the number of bombarding Au ions can be calculated by the ion beam current and the bombardment time. The Au deposition rate can be calculated from these two values.

The results of the measurement of the Au deposition rate D are D=0.869 (when the ion energy is 40 eV), 0.732 (77 eV), 0.617 (100 eV), these results are consistent with the value presented in ref. 1).

1) Y. Yamamura, et al., Atomic Data Nucl. Data, **62,** 149–253 (1996)

2) T. Matsumoto, et al., Review Sci. Instrum. **71**, 1168-1170 (2000).