§60. Control of Discharge Conditions to Reduce Hydrogen Content in Boron Films Coating

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Aiming at the reduction of H content in boron films at near room temperature by controlling glow discharge conditions, the systematic study has been performed in plasma processing teststand (PPT). So far, flash filament method (FF) at floating potential is used to measure H concentration^{1,2)}. To investigate the effect of the electric potential, boron films are prepared on Al samples at electrically floating or cathode potential, and the hydrogen concentration is measured by elastic recoil detection method (ERD) and a new modified normalizing technique with Rutherford back scattering (RBS)³⁾.

Figure 1 shows a typical RBS spectrum taken from the cathode potential B coated Al sample, on which B cannot be clearly observed, probably due to surface roughness of Al target. However, the B film thickness was measured from the shift of the Al surface edge as shown in Fig.1. Then Al edge intensity with calculated scattering cross section σ and energy stopping power ϵ under the B film was used as the measure of the probing He⁺ fluences which was used to obtain absolute H concentration from ERD spectra. This method was newly established in this work for the case of low Z thin films.

Figure 2 shows the typical hydrogen depth profiles in boron films formed on floating or cathode potential Al samples. From this figure it is observed that the H profile on the cathode potential sample is more dense, flat, and thick in comparison with the floated one.

We have investigated H/B dependence on the discharge power and the total pressure. The results showed that the H/B of the cathode potential samples, which are exposed to energetic ions, are higher than that of the floating potential ones in every case. The H/B are reduced with increasing the film growth rate (increasing the flux of boron contained radicals and/or ions), in good agreement with our results obtained so far from the FF method or RGA. Thus, it is conjectured that energetic ions flux should be reduced but the

radical one should be increased for the reduction of H concentration. We can also conclude that FF is a usable method for quick and in-situ measurement in coated film.

Fig.1. RBS spectrum taken from B film prepared on the electrically cathode potential Al sample, and the schematic illustration of the ion beam analysis system.

Fig.2. Depth profiles of hydrogen atom in boron films on electrically floating or cathode potential Al samples.

References
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