§16. Dynamics of Charge Balance near Solid Surface under Ion Bombardment

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The charge balance at very near solid surface is controlled by charged particle emission, presumably secondary electron emission(SEE), and neutralization of incident ions. This establishes the surface potential which critically influences the SEE. For metals, the neutralization process is so fast that the surface potential is assumed to be zero. However, plasma wall material surfaces will be subject to modifications under bombardment of various particles and the above assumption will be not always met.

In this study, we have measured the SEE yield of oxides such as $SrCeO_3$ (5%Yb) by positive ion bombardment. This material is known to have high proton conductivity(10^{-2} S·cm^{-1}) at high temperature(~800°C) [1]. The result for 100 keV H^+ ion bombardment is shown in Fig. 1. We found that the SEE yield per ion decreases with the ion beam current. Similar results was obtained for 100 keV He^+ ion. No such dependence was observed for Al target and the SEE yield from Al was obtained to be 2 and 3 for 100 keV H^+ and He^+, respectively and these values agree reasonably well with 1.3 [2] and 2.0 [3] for clean Al surfaces, considering slight surface contamination of Al target used in this study.

The ion beam current dependence of the SEE yield as shown in Fig. 1 can be understood qualitatively as follows. The neutralization process of ions in $SrCeO_3$(5%Yb) is slow such that the surface potential is not zero and increases with ion beam current, resulting in suppression of the SEE yield. Numerical simulation is under way.

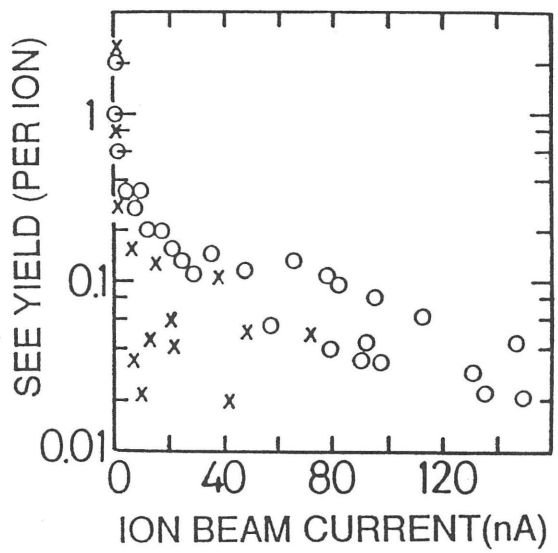

Fig. 1 Ion beam current dependence of the secondary electron emission(SEE) yield of $SrCeO_3$(5%Yb) by 100 keV H^+ ion bombardment. The open circles and crosses are the results obtained at the collector bias of 180 and 90 V for the secondary electrons, respectively.

References

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