## §7. Secondary Electron Emission from $SrCeO_3$ (5% Yb) Thin Film on Si

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We have measured the secondary electron emission (SEE) yield $\gamma_e$ from an epitaxial thin film(~100 nm) of 5% Yb doped $SrCeO_3$ (SCO) on Si by ion impact, using a cylindrical cup with a shield surrounding the cup. Positive bias was applied to the cup, and the sample and the shield were grounded.

For impact of 100 keV $H^+$ ion, whose calculated projected range (570 nm) is much longer than the film thickness, $\gamma_e$ is found to be nearly constant over a wide range of the ion beam current ($I_B$) up to a few nA and starts to decrease for larger $I_B$ as shown in Fig. 1. A peculiar or explosive increase of $\gamma_e$ was often observed for large $I_B$. Excluding the peculiar behavior, the $I_B$ dependence of $\gamma_e$ is similar to that for high Tc superconductor oxides such as polycrystalline (p-) $YBa_2Cu_3O_7$ [1] but is quite different from the strong $I_B$ dependent $\gamma_e$ observed for p-SCO [2]. $I_B$ independence of $\gamma_e$ indicates zero surface potential and no charge accumulation at both the surface and the SCO-Si interface. If this is the case, $\gamma_e$ should reach a constant with increasing the cup bias voltage. However, no saturation of $\gamma_e$ at $I_B$ independent region, e.g., $I_B = 0.1$ nA, was seen with increasing the cup bias voltage up to 90 V, implying non-zero surface potential.

For impact of 20 keV $Ar^+$ ion, whose calculated projected range (16 nm) is much shorter than the film thickness, $\gamma_e$ is found to decrease with $I_B$ (Fig. 2). A possible explanation is that the surface potential exceeds the cup bias voltage due to charge accumulation carried by $Ar^+$ and holes generated by SEE, resulting in the reduction of $\gamma_e$.

Negative and positive ion emissions are under investigation. We would like to thank Prof. M. Ishigame and Dr. N. Sata for supplying SCO films and for their helpful discussions.

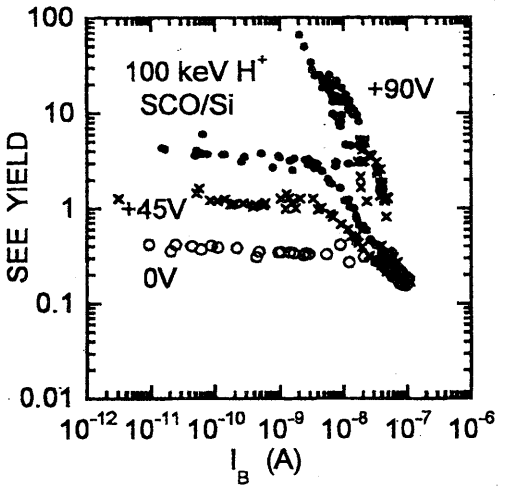


Fig. 1 SEE yield ($\gamma_e$) from SCO on Si by 100 keV $H^+$ ion impact at the cup bias of 0, +45 and +90 V.

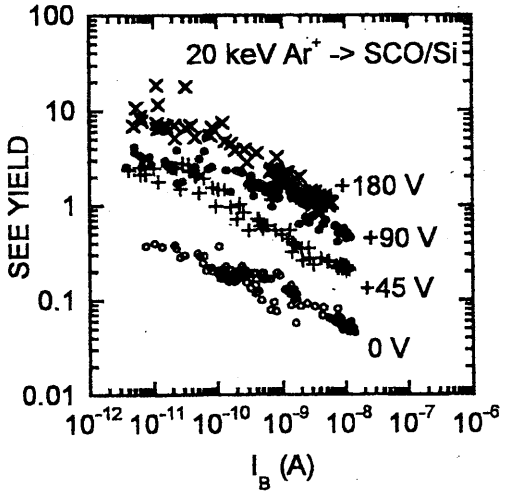


Fig. 2 SEE yield from SCO on Si by 20 keV $Ar^+$ ion impact at the cup bias of 0 to 180 V.

References

[1] N. Matsunami, S. Majima and T. Kawamura, Nucl. Instrum. Meth. B135(1998)450.

[2] K. Hosaka, N. Matsunami and H. Tawara, Nucl. Instrum. Meth. B149 (1999)414.