§18. Dependence of Secondary Electron Emissions from Be on Oxidation under Low Energy H^+ Impact

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It is well known that SEE from metal surfaces has strong dependence upon surface conditions. In general, SEE from oxide metal surfaces is bigger than that from clean metal surfaces.

In this study, we have measured the secondary electron emissions (SEE) from the oxided Be surfaces by 2.5keV H^+ impact. Low energy H^+ ions produced by duo-plasmatron ion source are directed into a target chamber after the charge and mass selection by a Wien filter. This target chamber consists of two parts: the preparation chamber and the main chamber. In the preparation chamber an Ar ion gun is set for sputtering of a target surface and in the main chamber an Auger electron spectrometer for checking the surface conditions. The base pressure of the main-chamber is about 7×10^{-11} Torr without projectile beam on the target and about 1×10^{-10} Torr with projectile beam. Stainless steel double cylindrical cups have been used to collect the emitted electrons from the surface by ion impact. The total ion beam current I_i at the target is the sum of the incident ion current I_t at the target and the inner cup current I_c due to the particles emitted from the target, namely

$$I_i=I_t+I_c. \quad (1)$$

Then, the SEE yield γ is given by

$$\gamma=I_c/(I_t+I_c)=I_c/I_i. \quad (2)$$

The present results of SEE are shown in Fig 1. as a function of the ratio of oxygen to beryllium (O/Be) of the target surface which is determined from the Auger electron spectrum. In this figure, the circles and squares indicate the data of different Be targets. This figure shows that the SEE becomes constant at 2 when O/Be ratio is larger than 0.3. As the O/Be ratio decreases, SEE is also decreased and become nearly constant at the O/Be ratio below 0.02. This result suggests that the O/Be ratio should be less than 0.02 in order to get clean Be surfaces. This SEE value at the lowest O/Be ratio seems to in agreement with that empirically estimated by Thomas[1]. In Fig 2, we show an Auger electron spectrum taken at the cleanest surface in Fig 1 which has been obtained after 730 minutes of sputtering in all at the average current density of $2.2\mu A/cm^2$ Ar^+ ion.

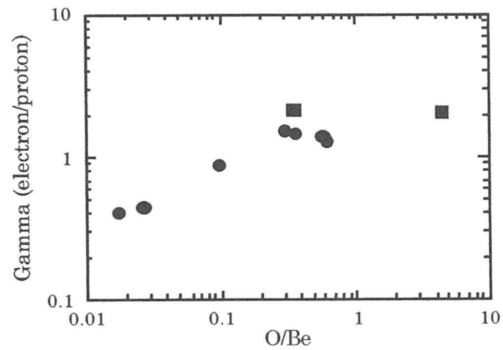

Fig. 1. SEE from Be surfaces as a function of ratio O/Be.

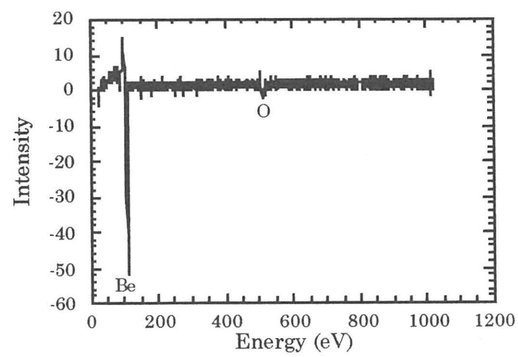

Fig. 2. Typical Auger electron spectrum from Be after sputtering by Ar ions.

Reference

(1) Thomas, E. W., Report of International Atomic Energy Agency, INDC (NDS)-322, IAEA, Vienna, Feb. 1995