3 - 21 Secondary Electron and X Ray Emission from Tungsten Induced by Proton

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Secondary electron and X-ray emission is the main mechanism for the enegy loss of the projectile during the inelastic ion-atom collisions. The knowledge of the emission yield and cross section not only provides significant information for the basic understanding of the interaction mechanism, but also is important to the technological applications such as surface analysis in scanning electron microscopes, material modification, developments of fusion device and so on. Some works have been done to sudty separately the electron and X-ray emission[1−3]. However, researches investigsting imultaneously the two phenomenon is rare. Here, we would like to present our recent experiment about the secondary emetron and X-ray emission of tungsten for proton impacting.

Fig. 1 present the Coefficient B (ratio of γ/S_e, can be understood as the KEE yield per deposition of electronic stopping power.) and M-shell X-ray yield with increasing incident energy. It is proposed that, during the interaction between the projectile and the target atom, kinetic energy of the projectile can be transferred to the valence electrons causing excitation, which result in the electron emission, or to the inner-shell electrons producing ionization, which lead to the X-ray emission following the decay of the leaved vacancies. Here is a competition of the energy transfer between the outer- and inner-shell electrons. The interaction events are statistically distributed. In the single collision, the projectile could only interact with the valence- or core-electrons. The integral result is that the ionization probabilities between the outer- and inner-shell electrons are contradictory. As a result, X-ray and electron emission could appear an inverse trend with increasing incident energy.

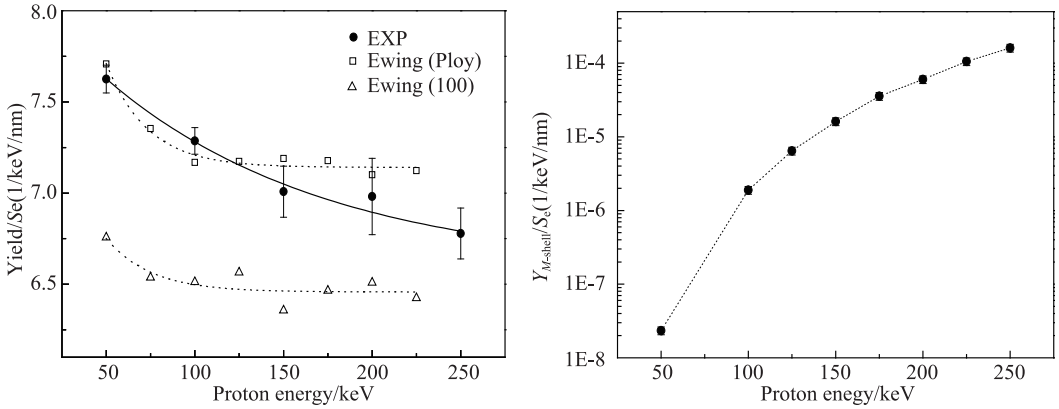

Fig. 1 (color online) Coefficient B and M-shell X-ray yield of tungsten as a function of proton energy.

References

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