Electron impact secondary electron emissions from atomic and molecular solid targets

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Synopsis The Sternglass theory [Sternglass, Phys. Rev. 108, (1957) 1] for fast-ion-induced secondary electron emission, which is proportional to the stopping powers, has been modified to calculate the electron impact secondary electron yield from both elemental and compound targets with atomic number Z = 4 - 92 for incident energy range $5 \le E_i \le 10^5$ eV. This modification includes the use of a realistic stopping power expression that involves calculations of the effective atomic electron number, effective mean excitation energies and realistic electron density distribution of the target atoms along with the effective charge of incident electron.

Secondary electrons (SEs) are those emitted when an elemental or compound solid targets irradiated by projectiles - electrons, ions and photons. Knowledge of secondary electron yield (SEY) lies at the heart of many diversified fields. In recent years its renewing interest grows enormously, in both research and applications including the studies of radiation effects in materials, plasma-surface interaction scanning electron microscopy (SEM) microscope images, atomic structure of a given target and also many other applications.

The theory for the SE emission (SEE) has been a subject of continuous interest and variation since its discovery, resulting in the publications of a large number of theoretical works on this topic. The objective of the present study is to propound formalism capable of furnishing reasonably accurate electron impact SEY. The SEY is proportional to the stopping power of the target material. Encouraged by our recent calculation [1] involving the electron impact stopping powers (ESPs) of material media, we use the same ESPs formula to propose a new semi analytical model for SEY in the framework of Sternglass theory [2], embodying a modified factor essential for the best fit of the data. The present work investigates the performance of our proposed *easy-to-use* model for the calculation of the electron impact SEY for both elemental and compound solids. To the best of our knowledge, still there is not a single model available in the literature capable of reproducing the experimental SEY data for large number of species over such a wider incident energy domain. In Fig. 1 we compare our results for elemental and compound targets and found good agreement with experiments.

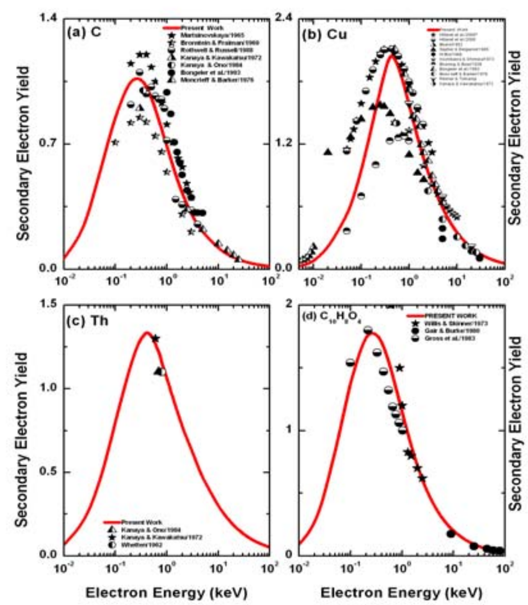

Figure 1. Electron impact SEY of (a) C, (b) Cu, (c) Th and (d) $C_{10}H_8O_4$.

Referentes

[1] A.K.F. Haque *et al.* 2016 Vacuum, 132, 123
[2] E. Sternglass, 1957 Phys. Rev. 108(1), 1

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