Monte Carlo Modeling of Characteristics of Secondary Electron Emission

Haotian Chen, Z. J. Ding[1]

Department of Physics, University of Science and Technology of China, Hefei, Anhui 230026, China

We present an extensive theoretical investigation into the secondary electron emission properties across a spectrum of materials including graphite (C), silicon (Si), iron (Fe), copper (Cu), silver (Ag), platinum (Pt), and gold (Au), and spanning electron primary energies ranging from 0.1 to 30 keV. Employing the state-of-the-art Monte Carlo simulation method, our study hence offers a comprehensive exploration of the intricate interplay between primary beam parameters and secondary electron emission behavior.

This simulation analysis aims to understand the relation of theoretical spatial resolution with experimental parameters. For this purpose, we firstly introduce a rigorous math definition for SE1 and SE2 electrons, enabling them to be actually quantified via a Monte Carlo simulation while also in agreement with the established concept. The new definition and calculated results can then introduce novel insights into the secondary electron emission phenomena. Through detailed examination of simulated radial distributions, emission depth profiles, and angular distributions of SE1 and SE2 we unveil the emission behavior of different kinds of secondary electrons across diverse materials and under varying primary beam energies.

Our investigation thus elucidates the intrinsic relationship between the theoretical resolution of secondary electrons and critical factors such as primary beam energy and material properties. By presenting our findings within the framework of physics discourse, we wish to contribute substantively the collective understanding of electron emission and their implications for a wide range of scientific and technological endeavors.

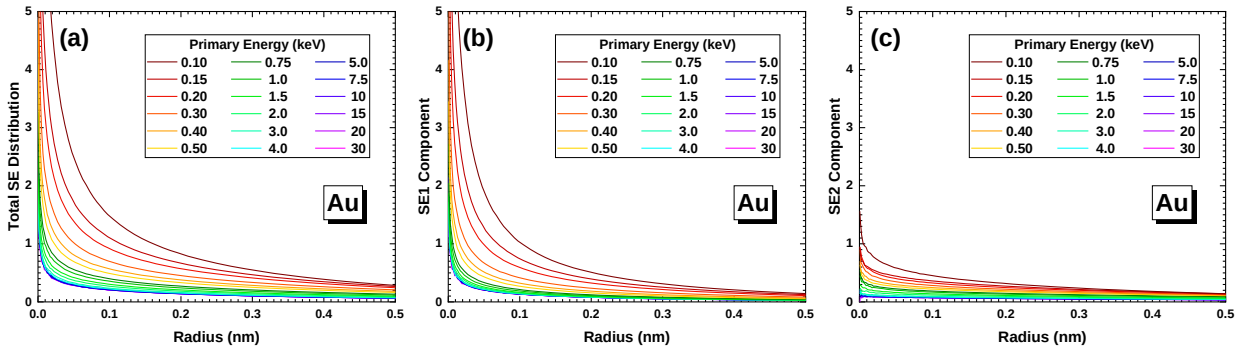

Figure 1. The distribution of position where secondary electron emission for Au.

[1] Corresponding author: zjding@ustc.edu.cn.

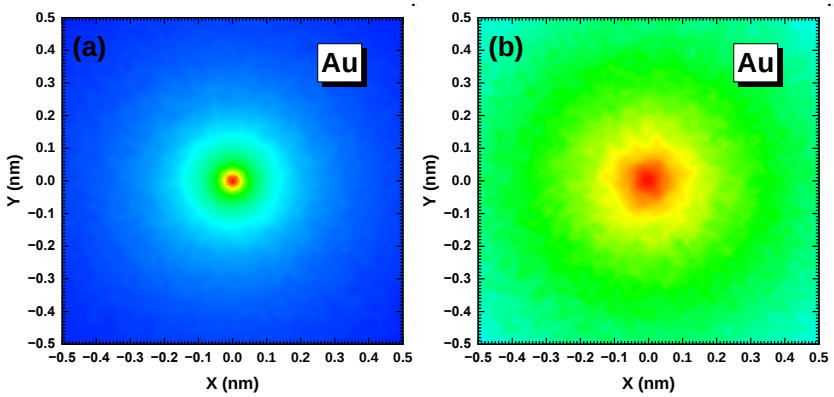

Figure 2. Radial distributions of SE1 and SE2 secondary electron components for Au.

Keywords: Monte Carlo simulation; secondary electrons; resolution.

REFERENCES

[1] H. Drescher, L. Reimer and H. Seidel. *Z. Angew Phys.* **29** (1970) 331.

[2] D. C. Joy, *J. Microsc.* **136** (1984) 241.

[3] D. C. Joy, *J. Microsc.* **140** (1985) 283.

BIOGRAPHY

Haotian Chen is a doctoral student at University of Science and Technology of China under supervision of Prof. Z. J. Ding.