Electron-induced x-ray emission from thick Pb and Pt targets: Experimental measurements and PENELOPE simulations

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When energetic electrons interact with solid materials, a variety of atomic processes can occur, including inner-shell ionization, bremsstrahlung emission, electron backscattering, characteristic K- and L-shell X-ray production, and secondary-electron emission [1, 2]. Electron-induced X-ray emission provides valuable information about the atomic structure of matter and has applications across several areas of science and technology. In this work, X-ray emission from thick Pb and Pt targets has been experimentally investigated using electron beams in the energy range of 10–30 keV. The L-subshell X-ray production cross sections of Pb ($Z = 82$) were determined for electron energies of 15–30 keV, while the bremsstrahlung yield from Pt ($Z = 78$) was measured for incident electron energies between 10 and 25 keV using a thick-target configuration [3].

A monoenergetic electron beam was directed onto solid targets with a thickness of approximately 0.1 mm, resulting in the production of both characteristic and continuous X-ray radiation. The emitted X-rays were recorded using a Si-PIN diode detector [4], and the acquired spectra were processed and analyzed using multichannel analyzer (MCA) software. The experimental measurements were compared with results obtained from PENELOPE Monte Carlo simulations as well as with previously published experimental data. The measured total production cross section for the Lℓ line of Pb under electron impact is reported, to the best of our knowledge, for the first time. The experimental findings exhibit good consistency with the corresponding simulation results.

References

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