XRF BY SIMULTANEOUS USE OF K- AND L-LINES OF AN ELEMENT

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In various applications K- and L-lines of the same element are simultaneously excited and occasionally also employed methodically, for example to distinguish elemental contents in different sample depths or layers. However, this simultaneous excitation leads also to more complex indirect excitation effects due to the electron cascades most probably initiated by K←L2,3 after K-ionization and is strongly influenced by Coster-Kronig/Auger transitions. This is equally true for M-lines.

This effect can be well isolated by synchrotron measurements, where a distinct jump of L-intensities is observed when the monochromatic primary photon energy exceeds the K-edge, multiplying the intensity by a factor of 5 and more. When conventional techniques with x-ray tubes are applied a fraction of tube photons with lower energies will typically excite only L-lines while those with higher energies are capable of exciting both, K- and L-lines including L-excitation via primary K-ionization; this leads to a steady change of the L-intensities as a function of tube voltage rather than a sharp jump.

This paper shows results from synchrotron experiments in comparison with computational models and translates these findings to applications with continuous excitation. The extensive employment of fundamental parameters including less commonly found values for Coster-Kronig/Auger transitions invites also a discussion of available tables.

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