The Use of Fundamental Parameters in XRF – an Industry Perspective

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The use of fundamental parameters in XRF has been well established for many years. In fact, the theoretical expressions linking fundamental parameters and emitted characteristic radiation were developed early on. Both experimental and theoretical work has been done on determining the values of e.g. mass attenuation coefficients, fluorescence yields, and wavelengths (or energies) of characteristic radiation and absorption edges. For several years an international venture has been ongoing to revisit the existing tabular data and to perform experiments aiming at improving accuracy of certain fundamental parameters. Several of these experiments have been run with mostly European funding, such as EMRP and EMPIR. These projects were mainly focused on modern materials such as electro-voltaic cells and semiconductor materials.

The application of fundamental parameters in XRF is mainly focused on quantitative analysis, although they are used extensively in software to propose optimal measurement and analysis conditions, and in engineering to assist development of instrumentation. In quantitative analysis and when combined with type standards, the accuracy of the fundamental parameters is of lesser importance than the internal consistency. However, in the so-called ‘standardless’ approach or wide range calibrations, both consistency and accuracy become more important.

The use of fundamental parameters is essentially the only way to deal with specimens consisting of several thin layers; or in cases where the geometry of the measured and detected volumes are far from the idealized ‘infinitely wide’ surface.

Several aspects outlined above will be discussed or illustrated.