Towards a standardless quantification by electron probe microanalysis

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Quantitative characterisation by electron probe microanalysis (EPMA) is conventionally based on the comparison of the X-ray spectrum emitted by the unknown sample with spectra originated from well known samples (standards). The need of measuring spectra from standards may pose two limitations: on the one hand, a long time is required when a great number of spectra must be registered; on the other hand, the analysable samples are restricted according to the set of standards available.

In view of the mentioned inconveniences, several attempts devoted to the implementation of standardless quantification algorithms have been carried out during the last decades. Nevertheless, the developed methods are mostly useful as semi-quantitative approximations.

This kind of methods faces multiple difficulties, because for the successful application of standardless EPMA analysis, everything must be well known. That is to say, in addition to measure the sample spectrum in adequate experimental conditions, diverse instrumental parameters, such as the efficiency of the spectrometer used and the distortion of the characteristic lines produced by the detection system, must be properly known. Moreover, realistic expressions for the description of the generation and absorption of the characteristic spectrum and bremsstrahlung are necessary. These expressions depend on a number of atomic parameters including ionisation cross-sections, relative transition probabilities, fluorescence yields, diagram and non-diagram line natural widths, etc.

Results obtained for several of the mentioned instrumental and atomic parameters will be shown, as well as their implementation in a standardless quantification algorithm. Finally, future perspectives will be discussed; particularly, the possibility of quantifying elements present in different oxidation states.