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Comments on the correct interpretation of k₀-factors and on the proper use of the SMELS materials

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Recently plans were devised [IAEA CRP 2005-2009: "Reference Database for Neutron Activation Analysis"] for creating and publishing a library of k0-factors that are generated differently from the experimentally determined ones published and used in practice thus far [ADNDT, 85 (2003) 47]. For two reasons, we look at this anxiously. Firstly, when realizing that these "new"k0-factors will be based on values taken from (be it internationally evaluated and up-to-date) files dealing with data for decay (notably gamma ray emission probabilities) and activation (notably 2200ms-1 activation cross sections), it is clear that trackability and accuracy are likely to be jeopardized. Indeed, an evaluated cross section is (partially or fully) based on values that are experimentally measured via the "activation method", thus requiring the introduction of gamma ray emission probabilities that are selected by the experimentalist. This implies that the link is broken when they are again combined with recently evaluated gamma-ray probabilities –whereby it is irrelevant whether the latter are in se more accurate than the ones introduced formerly. This means that the way of creating these "new"k0-factors is basically incorrect. Secondly, the release of the thus obtained k0 library, next to the one for actual use in the practice of k0-NAA (managed formerly by the INW/Gent –KFKI/Budapest, and in the future by the recently established k0 Nuclear Data Committee), would inevitably bring about confusion and ambiguity.
Also in recent years, we observed from published papers and from communications at conferences that the SMELS materials (Synthetic Multi-Element Standards) are not properly used for what they were developed for [NIMA, 564 (2006) 675]. Indeed, it is seen that the SMELS are systematically applied for the validation of k0-NAA carried out in a laboratory, whereas their real potential lays in the quality control of the implementation of the k0-standardization, notably with respect to the calibration of the irradiation facility and of the Ge-detector, including also the correction for dead-time in case of short-time NAA. Indeed, the three SMELS-types are doped with elements that give rise to (n,γ) activation with epithermal-to-thermal cross section ratios and emitted gamma-ray energies ranging from low to high (thus giving information on the correctness of respectively the neutron flux characterization and the detection efficiency determination), and (for SMELS-type I) with half-lives ranging from low to high (thus giving information on the correctness of dead-time correction). Regrettably, these built-in potentials of the SMELS are overlooked in nearly all cases described in the literature.

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