Yields of Gamma- and X-Ray Radiation of Alpha-Decays of ^{235}U

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Precise knowledge of gamma- and X-rays emission probabilities of uranium isotopes is vital for accurate gamma-spectrometric determination of the isotopic composition and quantity of uranium. The peak intensity ratio methods employing high resolution gamma-spectrometry and intrinsic efficiency calibration approach are known to provide most accurate and reliable isotopic information. When applied to unshielded and moderately shielded material, these methods largely benefit from de-convolution of the 90-100 keV narrow spectral interval, which contains intense gamma- and X-ray lines of major uranium isotopes ^{235}U and ^{238}U. These are the 92.37 keV and 92.79 keV gamma-rays of ^{238}U/^{234}Th, and the 93.35 keV ThKα_1 X-rays from alpha-decay of ^{235}U. Although the emission probability ratios of these lines were accurately established, their absolute yields are still lacking accuracy. For instance, as resulted from recent study [1], the yields of ^{234}Th lines become corrected by ~30%, compared with their previous values. This consequently raised a question regarding validity of the yield data for the 93.35 keV line of ^{235}U and triggered the present experimental study. This study was later extended to the reexamination of emission probabilities of other ^{235}U gamma-lines with energies above 205 keV. The experimental data used in the current work was collected using SRM 969 and CRM 146 reference uranium samples.

[1] Abousahl, S.; van Belle, P.; Lynch, B.; Ottmar, H., New Measurement of the Emission Probability of the 63.290 keV ^{234}Th Gamma Ray from ^{238}U Alpha Decay. Nuclear Instruments & Methods in Physics Research A 517 (2004) 211-218.