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低能 γ 谱仪测量 I-129 样品时放射性不均匀性影响的 MCNP5 计算

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采用 γ 谱仪测量放射性样品时，放射性在样品内部的分布情况会影响探测效率。为了更准确地获得放射性核素的含量，需要估计放射性在靶件内的分布对探测效率的影响程度。本文用 MCNP5 程序计算了低能 γ 谱仪测量 I-129 嬗变靶件时靶件内放射性分布不均匀性对探测效率的影响。计算了不同距离处几种极限分布和几种假设情况下的效率与均匀分布情况下效率的比值。计算结果表明: 在用低能 γ 谱仪测量样品中 I-129 的含量时，放射性分布均匀性的影响不能忽略, 即使是在源与探测器距离比较远的情况下。而且放射性在轴向的不均匀分布比在径向的不均匀分布对效率的影响明显。
关键词：低能 γ 谱仪；不均匀性；探测效率

MCNP5 Calculation of Radioactivity Inhomogeneity Effect in Measuring I-129 Samples Using a Low Energy Gamma Spectrometer

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Abstract: When a gamma-ray spectrometer is used to measure a radioactive sample, the radioactivity distribution in samples may affect the detection efficiency. In order to obtain more accurate content of a radioactive nuclide, the influence of the radioactivity distribution in sample should be estimated. The effect of inhomogeneous radioactivity distribution in I-129 transmutation targets on the detection efficiency was examined employing the MCNP5 code. The ratios of the efficiencies in several extreme situations and various assumed distribution to the efficiency in ideal homogenous distribution were calculated at different sample-detector distances. The calculation results shows that the radioactivity inhomogeneity in samples could not be neglected when the abundance of I-129 was measured by a low energy gamma ray spectrometer, even at a large detection distance, and that the effect of axial inhomogeneity on detection efficiency is much more significant than that of radial inhomogeneity.
Key words: low energy gamma spectrometer; inhomogeneity; detection efficiency

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