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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 30151-2013

**Characterization of the spectrum background in HP Ge
gamma-ray spectrometry**

高纯锗 γ 谱仪本底谱的特性

(English Translation)

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Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules.

This standard uses redrafted law revision adopted IEC 61976:2000 special "high purity germanium spectrometer instrument nuclear gamma-ray spectrometer spectrum of the background Sex. " the standard IEC 61976:2000 The main changes are as follows [terms of these modifications have been involved in the blank position by its outer margins A single vertical line (|) be indicated].

--- Increasing the "Introduction" to include purposes other "Scope and purpose" in the standard preparation of IEC standards related to the content of Chapter 1;

--- According to GB/T 1.1 requirement to rewrite Chapter 1, "scope";

--- Chapter 2, "Normative references", with GB/T 4960.6-2008 "Nuclear Science and Technology - Part 6. Nuclear Instrumentation" in place (see IEC 60050-393:2003 and IEC 60050-394:2007 preparation) IEC 60050-393:1996 "Nuclear Instruments Physical phenomena and basic concepts "and IEC 60050-394:1995" Nuclear Instruments Instruments "; increased references GB/T 4833.1 "Multi-channel analyzer - Part 1. Technical requirements and test methods" and GB/T 7167 "germanium gamma-ray detector test side law";

--- Change the title of Chapter 3 "Terms and Definitions";

--- Chapter 4, "the description of the spectrum" to increase the general measurement gamma spectrum, namely "HPGe gamma spectrometer gamma spectrum should adopt the

general measurement GB/Method "T 4833.1 and GB/T 7167 provided;

--- 5.1 "background continuous spectrum" "(also determine energy in any other interested)" with "(also in any other interested Point energy or energy interval determined) "to expand the background continuous spectrum measured energy range of options;

--- In 5.2 "contains the total number of tracks," add "error is relatively small and the calculation results of the measurements, it may be necessary an increase in the "first and" on. ";

--- Increase in Table A.1 Notes to Table. "The ²²⁶Ra, ²²⁶Ra and ²²²Rn under equilibrium conditions can be measured ²²⁶Ra spectrum; for ²³⁸U, ²³⁸U and ²²⁶Ra under equilibrium conditions (difficult to achieve) can be obtained by measuring the spectrum of ²³⁸U and ²²⁶Ra analysis and calculation of Spectrum. ";

--- Increase in Appendix B (informative) "illustrative examples of the bottom and continuous spectrum measurements of peak and background", that is, for Chapter 5, "this Detroit "Of the formula (1) and (2) gives a schematic view, in order to deepen the understanding of the formula, it has added two solid background continuous spectrum and background peaks Measured spectra, in order to enrich the content of this standard;

--- Increased references included in the GB/T 2900.81-2008 "Electrotechnical Terminology Nuclear Instruments Physical phenomena and basic concepts" and GB/T 2900.82-2008 "Electrotechnical Terminology nuclear instrumentation, systems, equipment and detectors." this standard by the National Nuclear Instrument Standardization Technical Committee (SAC/TC30) centralized.

This standard was drafted. Nuclear Industry Standardization Institute, Chinese Academy of Sciences Institute of High Energy Physics, Tsinghua University.

Introduction

The purpose of this standard is to describe and measure the high-purity germanium detector composed of gamma spectrometer background spectrum to provide a unified approach and its definition the method is particularly suitable for low background gamma spectrometer Review by HPGe detector configuration.

Measurement methods defined in this standard background continuous spectrum and the background peak is determined on the basis of a large number of experimental results, this method not only mention Supply manufacturers and users, but also provide a similar comparison between the measurement of several different types of high-purity germanium detector.

Background HPGe gamma Spectrometer Spectral characteristics

1 Scope

This standard specifies the gamma spectrometer with high purity germanium detector consisting of the background spectrum characteristics.

This standard applies to the high-purity germanium detector gamma spectrometer consisting of the acquisition of the background spectrum, particularly low background detectors capture the background spectrum.

This standard does not address methods to reduce background.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 4833.1 multi-channel analyzer - Part 1. Technical requirements and test methods (GB/T 4833.1-2007, IEC 61342:1995, MOD) GB/T 4960.6 nuclear science and technology - Part 6. Nuclear instrumentation GB/T 7167 germanium gamma-ray detector test methods

3 Terms and Definitions

GB/T 4960.6 and define the following terms and definitions apply to this document.

(Ionizing radiation) spectrum (of ionizing radiation) Usually it refers to with energy distribution, such as the relationship between particle emission rate and its energy value of a particular amount of radiation.

[GB/T 4960.6-2008,3.1.37] 3.2 FWHM full width at half maximum; FWHM Single peak in the distribution curve formed from the horizontal axis between two points on the curve at half peak.

[GB/T 4960.6-2008,3.2.27] 3.3 Sample Attention and need to measure a material in which the radionuclide and content.

External background in the absence of the sample in a given configuration, high-purity germanium detector measured spectrum.

Samples induced background sample-induced background Emitted by the sample, and does not include all the spectral data detector placed near any source (including samples) of all-round peak.

Total background External background and the background of the sample and induced.

The bottom peak background peak all-around peaks generated by an external source of any of the background spectrum.

Background continuum External background spectrum does not belong to any data Almighty peak.

Peak baseline Near the end of the peak region that belongs to the external background and not part of the sample induced by the almighty bottom peak count.

4 Description, Spectrum

The bottom spectrum collection time should be long enough to ensure that the energy within the range of one standard deviation 100keV statistical uncertainty about 5%. This means that, in the area of energy 100keV measured spectra, counts per channel should not be less than 400 to reduce the statistical uncertainty in the data Given the degree of impact on the bottom spectrum measurements. Mean number of spectrum should be more than enough, that is, the energy range of interest collected per channel energy representation foot Small enough so that, by - a calculation error "channel energy" transformation caused by the uncertainty compared with the theoretical value small enough.

Before you begin measuring the background spectrum, shall take all necessary precautions to avoid possible in laboratory experiments, inspection, calibration using any source of radiation to which (including natural and artificial, such as X-ray, neutron generators and particle accelerators) on the measured background spectrum.

External factors that can seriously affect the background spectrum is.

Geometrical position a) measurement;

b) shielding material and its thickness and geometry (including the probe position);

Date and time c) measurement;

d) measurement of weather conditions;

Duration e) measurement;

f) airborne radioactivity;

g) the circulation of air in the measuring chamber.

Therefore, a detailed description of the measurement location and condition [above a) ~ g)] should be included in the measurement results of the report.

HPGe gamma spectrometer general measurement gamma spectrum should adopt the method of GB/T 4833.1 provides and GB/T 7167.

Peak energy commonly used radionuclides in Appendix A.