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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

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Nuclear instrumentation - High-purity germanium crystals for radiation detectors - Measurement methods of basic characteristics

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part 1.Structure and Drafting Rules of Standardization Documents"

Drafting.

The translation method used in this document is equivalent to IEC 61435.2013 "Basic characteristics of high-purity germanium crystals for nuclear instrumentation radiation

detectors"

Methods of Measuring Sexuality.

This document has made the following editorial changes.

---Correct the incorrect content in the "Commonly Used Symbol Definition Comparison Table" in the original text of the international standard, including. the definitions of the symbols "f" and "F" are mutually exclusive

Change, the symbol "K" is changed to "k", the symbol "P" is changed to "rho", the symbol "T" [time, unit is second (s)] is changed to "t", the symbol is deleted

"()" and its definition, the average value is represented by the upper horizontal line (example taur2).

This document was proposed and managed by the National Standardization Technical Committee for Nuclear Instruments (SAC/TC30).

Drafting organizations of this document. Nuclear Industry Aerial Survey and Remote Sensing Center, Shenzhen Institute of Metrology and Quality Inspection.

Introduction

The detector manufacturer needs the specific parameters of the crystal to evaluate the characteristics of the coaxial detector. Since the physical characteristics are changed, only pass

The manufacturer's measurement results cannot deduce a complete detector performance index. This document defines the basic parameters used to determine crystals (such as electrical activity)

The method of measuring the net concentration of sexual impurities, the concentration of deep-level impurity centers and the crystallographic characteristics of crystals.

When high purity germanium (HPGe) detectors are used to detect ionizing radiation, the size and purity of the germanium crystals need to be determined. Due to the high resistance of the material

(When the temperature is 77K, the resistivity is about 10kohm.cm), and the degree of impurity compensation causes special problems in the production of germanium crystals.

And how to reasonably describe the distribution of large-volume crystal impurities in a single device, etc., the existing standards do not cover.

One of the most important characteristics of high purity germanium is the net electroactive impurity concentration (NA-ND), which determines the depletion voltage when the detector is working.

The van der Pauw method indicating n-type or p-type is usually used to determine (NA-ND), and the transfer measurement is carried out on the sheet samples immersed in liquid nitrogen. Pick

When using this technique, (NA-ND) can be calculated by resistivity or Hall coefficient. Through a series of measurements on the sample to get the resistivity or

Hall coefficient.

High-purity germanium crystal for nuclear instrument and radiation detector

Measurement methods of basic characteristics

1 Scope

This document describes the terminology and test methods for measuring the basic characteristics of high-purity germanium crystals. Including the net concentration of electroactive impurities (NA-ND),

Deep-level impurity center concentration and crystallographic characteristics.

This document applies to high-purity germanium crystals for gamma-ray and X-ray radiation detectors. The net concentration of the electroactive impurity center of this germanium single crystal

Less than 1011cm-3, usually on the order of 1010cm-3.

The test methods listed in this document are not legal, but they are widely used in the industry and provide a

The verified information satisfies the manufacturer's needs.

In GB/T 7167-2008 and GB/T 11685-2003, a complete test method for assembled germanium detectors is given.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations

Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to

This document.

GB/T 2900.66-2004 Electrotechnical terminology for semiconductor devices and integrated circuits (IEC 60050-521.2002, IDT)

GB/T 2900.97-2016 Electrotechnical terminology nuclear instrument. physical phenomena, basic concepts, instruments, systems, equipment and detectors

(IEC 60050-395.2014, IDT)1)

1) The original international standards IEC 60050-393.2003 and IEC 60050-394.2007 have been replaced by IEC 60050-395.2014.

3.1 Terms and definitions

The following terms and definitions apply to this document.

3.1.1

Semiconductor

The total conductivity caused by the two carriers is usually a material between the conductor and the insulator. The carrier concentration in this material varies with the external

Ministry conditions change and change.

Note. The term semiconductor generally applies to materials whose carriers are electrons or holes.

[Source. GB/T 2900.66-2004,521-02-01]

3.1.2

High-purity semiconductor detector

Semiconductor detectors using high-purity (such as high resistivity) semiconductor materials.

[Source. GB/T 2900.97-2016,395-03-48]

3.1.3

Hall effect

The electric field intensity generated in conductors and semiconductors that is proportional to the vector product of current density and magnetic induction.