

INTERNATIONAL  
STANDARD

ISO/ASTM  
51607

Second edition  
2004-08-15

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## Practice for use of an alanine-EPR dosimetry system

Pratique pour l'utilisation d'un système dosimétrique à l'alanine  
utilisant la résonance paramagnétique électronique



Reference number  
ISO/ASTM 51607:2004(E)

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Published in the United States

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

ASTM International is one of the world's largest voluntary standards development organizations with global participation from affected stakeholders. ASTM technical committees follow rigorous due process balloting procedures.

A project between ISO and ASTM International has been formed to develop and maintain a group of ISO/ASTM radiation processing dosimetry standards. Under this project, ASTM Subcommittee E10.01, Dosimetry for Radiation Processing, is responsible for the development and maintenance of these dosimetry standards with unrestricted participation and input from appropriate ISO member bodies.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. Neither ISO nor ASTM International shall be held responsible for identifying any or all such patent rights.

International Standard ISO/ASTM 51607 was developed by ASTM Committee E10, Nuclear Technology and Applications, through Subcommittee E10.01, and by Technical Committee ISO/TC 85, Nuclear energy.



## Standard Practice for Use of an Alanine-EPR Dosimetry System<sup>1</sup>

This standard is issued under the fixed designation ISO/ASTM 51607; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision.

### 1. Scope

1.1 This practice covers materials description, dosimeter preparation, instrumentation and procedures for using the alanine-EPR dosimetry system for measuring the absorbed dose in the photon and electron irradiation processing of materials. The system is based on electron paramagnetic resonance (EPR) spectroscopy of free radicals derived from the amino acid alanine.<sup>2</sup> It is classified as a reference-standard dosimetry system (see ISO/ASTM Guide 51261)).

1.2 This practice covers alanine-EPR dosimetry systems for dose measurements under the following conditions:

1.2.1 The absorbed dose range is between 1 and 10<sup>5</sup> Gy.

1.2.2 The absorbed dose rate is up to 10<sup>2</sup> Gy s<sup>-1</sup> for continuous radiation fields and up to 5 × 10<sup>7</sup> Gy s<sup>-1</sup> for pulsed radiation fields (1-3).<sup>3</sup>

1.2.3 The radiation energy for photons and electrons is between 0.1 and 28 MeV (1, 2, 4).

1.2.4 The irradiation temperature is between – and + 90°C (2, 5).

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced documents

#### 2.1 ASTM Standards:<sup>4</sup>

E 170 Terminology Relating to Radiation Measurements and Dosimetry

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.01 on Dosimetry for Radiation Processing, and is also under the jurisdiction of ISO/TC 85/WG 3.

Current edition approved June 30, 2004. Published August 15, 2004. Originally published as ASTM E 1607 – 94. Last previous ASTM edition E 1607 – 96<sup>4</sup>. ASTM E 1607 – 94 was adopted by ISO in 1998 with the intermediate designation ISO 15566:1998(E). The present International Standard ISO/ASTM 51607:2004(E) replaces ISO 15566 and is a major revision of the last previous edition ISO/ASTM 51607–2002(E).

<sup>2</sup> The term “electron spin resonance” (ESR) is used interchangeably with electron paramagnetic resonance (EPR).

<sup>3</sup> The boldface numbers in parentheses refer to the bibliography at the end of this standard.

<sup>4</sup> For referenced ASTM and ISO/ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

E 668 Practice for Application of Thermoluminescence-Dosimetry (TLD) Systems for Determining Absorbed Dose in Radiation-Hardness Testing of Electronic Devices

#### 2.2 ISO/ASTM Standards:<sup>4</sup>

51204 Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing

51261 Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing

51400 Practice for Characterization and Performance of a High-Dose Gamma Radiation Dosimetry Calibration Laboratory

51431 Practice for Dosimetry in Electron and bremsstrahlung Irradiation Facilities for Food Processing

51707 Guide for Estimating Uncertainties in Dosimetry for Radiation Processing

#### 2.3 ICRU Reports:<sup>5</sup>

ICRU Report 14 Radiation Dosimetry: X-Rays and Gamma-Rays with Maximum Photon Energies Between 0.6 and 50 MeV

ICRU Report 17 Radiation Dosimetry: X-Rays Generated at Potentials of 5 to 150 kV

ICRU Report 34 The Dosimetry of Pulsed Radiation

ICRU Report 35 Radiation Dosimetry: Electron Beams with Energies between 1 and 50 MeV

ICRU Report 37 Stopping Powers for Electrons and Positrons

ICRU Report 44 Tissue Substitutes in Radiation Dosimetry and Measurement

ICRU Report 60 Fundamental Quantities and Units for Ionizing Radiation

#### 2.4 ISO Document:<sup>6</sup>

Guide to the Expression of Uncertainty in Measurement

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *alanine dosimeter*—specified quantity and physical form of the radiation-sensitive material alanine and any added inert substance such as a binder.

3.1.2 *alanine-EPR dosimetry system*—system used for determining absorbed dose, consisting of alanine dosimeters, an EPR spectrometer and its associated reference materials, and procedures for the system’s use.

<sup>5</sup> Available from International Commission on Radiation Units and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, U.S.A.

<sup>6</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036 or the International Organization for Standardization, 1 rue de Varembe, Case Postal 56, CH-1211, Geneva 20, Switzerland.