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Practice for use of a cellulose triacetate dosimetry system

*Pratique de l'utilisation d'un système dosimétrique au triacétate
de cellulose*

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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 pilot project between ISO and ASTM International has been formed to develop and maintain a group of ISO/ASTM radiation processing dosimetry standards. Under this pilot project, ASTM Committee E61, 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 51650 was developed by ASTM Committee E61, Radiation Processing, through Subcommittee E61.02, Dosimetry Systems, and by Technical Committee ISO/TC 85, Nuclear energy, nuclear technologies and radiological protection.

This third edition cancels and replaces the second edition (ISO/ASTM 51650:2005), which has been technically revised.



Standard Practice for Use of a Cellulose Triacetate Dosimetry System¹

This standard is issued under the fixed designation ISO/ASTM 51650; 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 is a practice for using a cellulose triacetate (CTA) dosimetry system to measure absorbed dose in materials irradiated by photons or electrons in terms of absorbed dose to water. The CTA dosimetry system is classified as a routine dosimetry system.

1.2 The CTA dosimeter is classified as a type II dosimeter on the basis of the complex effect of influence quantities on its response (see ASTM Practice E2628).

1.3 This document is one of a set of standards that provides recommendations for properly implementing dosimetry in radiation processing, and describes a means of achieving compliance with the requirements of ASTM E2628 “Practice for Dosimetry in Radiation Processing” for a CTA dosimetry system. It is intended to be read in conjunction with ASTM E2628.

1.4 This practice covers the use of CTA dosimetry systems under the following conditions:

1.4.1 The absorbed dose range is 10 kGy to 300 kGy.

1.4.2 The absorbed-dose rate range is 3 Gy/s to 4×10^{10} Gy/s (1).²

1.4.3 The photon energy range is 0.1 to 50 MeV.

1.4.4 The electron energy range is 0.2 to 50 MeV.

1.5 *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:³

E170 Terminology Relating to Radiation Measurements and Dosimetry

E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers

E2628 Practice for Dosimetry in Radiation Processing

E2701 Guide for Performance Characterization of Dosimeters and Dosimetry Systems for Use in Radiation Processing

2.2 ISO/ASTM Standards:³

51261 Practice for Calibration of Routine Dosimetry Systems for Radiation Processing

51707 Guide for Estimating Uncertainties in Dosimetry for Radiation Processing

2.3 International Commission on Radiation Units and Measurements (ICRU) Reports:⁴

ICRU Report 85a Fundamental Quantities and Units for Ionizing Radiation

ICRU Report 80 Dosimetry Systems for Use in Radiation Processing

2.4 Joint Committee for Guides in Metrology (JCGM) Reports:

JCGM 100:2008, GUM 1995, with minor corrections, Evaluation of measurement data – Guide to the Expression of Uncertainty in Measurement⁵

JCGM 200:2008, VIM, International vocabulary of metrology – Basis and general concepts and associated terms⁶

3. Terminology

3.1 Definitions:

3.1.1 *absorbed-dose mapping*—measurement of absorbed dose within an irradiated product to produce a one-, two- or three-dimensional distribution of absorbed dose, thus rendering a map of absorbed-dose values.

3.1.1.1 *Discussion*—The CTA dosimeter strip with appropriate length provides the opportunity for high resolution measurement of dose distribution, such as depth dose distribution.

3.1.2 *absorbed-dose rate* ($\dot{D}$)—absorbed dose in a material per incremental time interval, i.e., the quotient of dD by dt . Also see E170. The SI unit is Gy s^{-1} . (ICRU-60, 4.2.6)

$$\dot{D} = dD/dt \quad (1)$$

3.1.2.1 *Discussion*—(1) The absorbed-dose rate is often specified in terms of its average value over longer time intervals, for example, in units of $\text{Gy} \cdot \text{min}^{-1}$ or $\text{Gy} \cdot \text{h}^{-1}$. (2) In

¹ This practice is under the jurisdiction of ASTM Committee E61 on Radiation Processing and is the direct responsibility of Subcommittee E61.02 on Dosimetry Systems, and is also under the jurisdiction of ISO/TC 85/WG 3.

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² The boldface numbers in parentheses refer to the bibliography at the end of this standard.

³ 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.

⁴ Available from the International Commission on Radiation Units and Measurements, 7910 Woodmont Ave., suite 800, Bethesda, MD 20814, USA.

⁵ Document produced by Working Group 1 of the Joint Committee for Guides in Metrology (JCGM/WG 1). Available free of charge at the BIPM website (<http://www.bipm.org>).

⁶ Document produced by Working Group 2 of the Joint Committee for Guides in Metrology (JCGM/WG 2). Available free of charge at the BIPM website (<http://www.bipm.org>).