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## Practice for use of a radiochromic film dosimetry system

Pratique de l'utilisation d'un système dosimétrique à film  
radiochromique



Reference number  
ISO/ASTM 51275:2004(E)

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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 51275 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 a Radiochromic Film Dosimetry System<sup>1</sup>

This standard is issued under the fixed designation ISO/ASTM 51275; 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 the procedures for handling, testing, and using a radiochromic film dosimetry system to measure absorbed dose in materials irradiated by photons or electrons in terms of absorbed dose in water.

1.2 This practice applies to radiochromic film dosimeters that can be used within part or all of the specified ranges as follows:

1.2.1 The absorbed dose range is 1 Gy to 100 kGy.

1.2.2 The absorbed dose rate is  $1 \times 10^{-2}$  to  $1 \times 10^{13}$  Gy/s (1-4).<sup>2</sup>

1.2.3 The radiation energy range for both photons and electrons is 0.1 to 50 MeV.

1.2.4 The irradiation temperature range is  $-78$  to  $+60^\circ\text{C}$ .

1.3 This practice applies to radiochromic films of various formats, including small pieces used to measure a single dose value, strips used for one-dimensional dose-mapping, and sheets used for two-dimensional dose-mapping. Three-dimensional dose-mapping may be achieved by proper placement of any of these formats.

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>3</sup>

E 170 Terminology Relating to Radiation Measurements and Dosimetry

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:

51261 Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing<sup>4</sup>

51400 Practice for Characterization and Performance of a High-Dose Radiation Dosimetry Calibration Laboratory<sup>4</sup>

51707 Guide for Estimating Uncertainties in Dosimetry for Radiation Processing<sup>4</sup>

2.3 *International Commission on Radiation Units and Measurements (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 60 Fundamental Quantities and Units for Ionizing Radiation

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *analysis wavelength*—wavelength used in a spectrophotometric instrument for the measurement of optical absorbance or reflectance.

3.1.2 *calibration curve*—graphical representation of the dosimetry system's response function.

3.1.3 *dosimeter batch*—quantity of dosimeters made from a specific mass of material with uniform composition, fabricated in a single production run under controlled, consistent conditions and having a unique identification code.

3.1.4 *dosimetry system*—system used for determining absorbed dose, consisting of dosimeters, measurement instruments and their associated reference standards, and procedures for the system's use.

3.1.5 *measurement quality assurance plan*—documented program for the measurement process that ensures on a continuing basis that the overall uncertainty meets the requirements of the specific application. This plan requires traceability to, and consistency with, nationally or internationally recognized standards.

3.1.6 *net absorbance,  $\Delta A$* —change in measured optical absorbance at a selected wavelength determined as the absolute difference between the pre-irradiation absorbance,  $A_0$ , and the post-irradiation absorbance,  $A$ , as follows:

$$\Delta A = |A - A_0|. \quad (1)$$

<sup>1</sup> This guide 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.

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<sup>2</sup> The boldface numbers in parentheses refer to the bibliography at the end of this practice.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 12.02.

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