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Practice for use of a radiochromic liquid dosimetry system

Pratique de l'utilisation d'un système dosimétrique
radiochromique liquide



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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 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 51540 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 Liquid Dosimetry System¹

This standard is issued under the fixed designation ISO/ASTM 51540; 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 preparation, handling, testing, and using radiochromic liquid dosimetry systems of radiochromic dye solutions held in sealed or capped containers (for example, ampoules, vials). It also covers the use of spectrophotometric or photometric readout equipment for measuring absorbed dose in materials irradiated by photons and electrons.

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

1.2.1 The absorbed dose range is from 0.5 to 40 000 Gy for photons and electrons.

1.2.2 The absorbed dose rate is from 10^{-3} to 10^4 Gy/s.

1.2.3 The radiation energy range for photons is from 0.01 to 20 MeV.

1.2.4 The radiation energy range for electrons is from 0.01 to 20 MeV.

NOTE 1—Since electrons with energies less than 0.01 MeV may not penetrate the container of the solution, the solutions may be stirred in an open beaker with the electrons entering the solutions directly (1).²

1.2.5 The irradiation temperature range is from -40 to $+60^\circ\text{C}$.

1.3 *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

C 912 Practice for Designing a Process for Cleaning Technical Glasses

¹ 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.

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

³ For referenced 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 170 Terminology Relating to Radiation Measurements and Dosimetry

E 275 Practice for Describing and Measuring Performance of Ultraviolet, Visible, and Near Infrared Spectrophotometers

E 666 Practice for Calculating Absorbed Dose from Gamma or X Radiation

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

E 925 Practice for the Calibration of Narrow Band-Pass Spectrophotometers

E 958 Practice for Measuring Practical Spectral Bandwidth of Ultraviolet-Visible Spectrophotometers

E 1026 Practice for Using the Fricke Reference Standard Dosimetry System

2.2 ISO/ASTM Standards:

51261 Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing⁴

51400 Practice for Characterization and Performance of a High-Dose Gamma Radiation Dosimetry Calibration Laboratory⁴

51707 Guide for Estimating Uncertainties in Dosimetry for Radiation Processing⁴

2.3 International Commission on Radiation Units and Measurements (ICRU) Reports:⁵

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 Photons

ICRU Report 44 Tissue Substitutes in Radiation Dosimetry and Measurement

ICRU Report 60 Fundamental Quantities and Units for Ionizing Radiation

3. Terminology

3.1 Definitions:

⁴ Annual Book of ASTM Standards, Vol 12.02.

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