
Practice for using the Fricke dosimetry system

Pratique pour l'utilisation du système dosimétrique de Fricke



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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 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 51026 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 first edition cancels and replaces the ASTM E1026-13, which has been technically revised.



Standard Practice for Using the Fricke Dosimetry System¹

This standard is issued under the fixed designation ISO/ASTM 51026; 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, testing and using the acidic aqueous ferrous ammonium sulfate solution dosimetry system to measure absorbed dose to water when exposed to ionizing radiation. The system consists of a dosimeter and appropriate analytical instrumentation. The system will be referred to as the Fricke dosimetry system. The Fricke dosimetry system may be used as either a reference standard dosimetry system or a routine dosimetry system.

1.2 This practice 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 ISO/ASTM Practice [52628](#) for the Fricke dosimetry system. It is intended to be read in conjunction with ISO/ASTM Practice [52628](#).

1.3 The practice describes the spectrophotometric analysis procedures for the Fricke dosimetry system.

1.4 This practice applies only to gamma radiation, X-radiation (bremsstrahlung), and high-energy electrons.

1.5 This practice applies provided the following are satisfied:

1.5.1 The absorbed dose range shall be from 20 to 400 Gy **(1)**.²

1.5.2 The absorbed-dose rate does not exceed 10^6 Gy·s⁻¹ **(2)**.

1.5.3 For radioisotope gamma sources, the initial photon energy is greater than 0.6 MeV. For X-radiation (bremsstrahlung), the initial energy of the electrons used to produce the photons is equal to or greater than 2 MeV. For electron beams, the initial electron energy is greater than 8 MeV.

NOTE 1—The lower energy limits given are appropriate for a cylindrical dosimeter ampoule of 12 mm diameter. Corrections for displacement effects and dose gradient across the ampoule may be required for electron beams **(3)**. The Fricke dosimetry system may be used at lower energies by

employing thinner (in the beam direction) dosimeter containers (see ICRU Report 35).

1.5.4 The irradiation temperature of the dosimeter should be within the range of 10 to 60°C.

1.6 *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

[C912 Practice for Designing a Process for Cleaning Technical Glasses](#)

[E170 Terminology Relating to Radiation Measurements and Dosimetry](#)

[E178 Practice for Dealing With Outlying Observations](#)

[E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers](#)

[E666 Practice for Calculating Absorbed Dose From Gamma or X Radiation](#)

[E668 Practice for Application of Thermoluminescence-Dosimetry \(TLD\) Systems for Determining Absorbed Dose in Radiation-Hardness Testing of Electronic Devices](#)

[E925 Practice for Monitoring the Calibration of Ultraviolet-Visible Spectrophotometers whose Spectral Bandwidth does not Exceed 2 nm](#)

[E958 Practice for Estimation of the Spectral Bandwidth of Ultraviolet-Visible Spectrophotometers](#)

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](#)

[52628 Practice for Dosimetry in Radiation Processing](#)

2.3 ISO/IEC Standard:

[ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories](#)⁴

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 that appear in parentheses refer to a bibliography at the end of this practice.

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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.