
**Practice for use of a
polymethylmethacrylate dosimetry
system**

Pratique de l'utilisation d'un système dosimétrique au
polyméthylméthacrylate



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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 51276 was developed by ASTM Committee E10, Nuclear Technology and Applications, through Subcommittee E10.01, and by Technical Committee ISO/TC 85, Nuclear energy, nuclear technologies and radiological protection.

Annex A1 of this International Standard is for information only.



Standard Practice for Use of a Polymethylmethacrylate Dosimetry System¹

This standard is issued under the fixed designation ISO/ASTM 51276; 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 polymethylmethacrylate (PMMA) dosimetry systems to measure absorbed dose in materials irradiated by photons or electrons in terms of absorbed dose to water. The PMMA dosimetry system is classified as a routine dosimetry system.

1.2 The PMMA dosimeter is classified as a Type II dosimeter on the basis of the complex effect of influence quantities (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 PMMA dosimetry system. It is intended to be read in conjunction with ASTM E2628.

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

- 1.4.1 the absorbed dose range is 0.1 kGy to 150 kGy.
- 1.4.2 the absorbed dose rate is 1×10^{-2} to 1×10^7 Gy·s⁻¹.
- 1.4.3 the photon energy range is 0.1 to 25 MeV.
- 1.4.4 the electron energy range is 3 to 25 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:²

- 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

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 Radiation Processing: Dosimetry and Applications, and is also under the jurisdiction of ISO/TC 85/WG 3.

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² 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.

2.2 ISO/ASTM Standards:²

- 51261 Guide for Selection and Calibration of 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:³

- ICRU Report 60 Fundamental Quantities and Units for Ionizing Radiation
- ICRU Report 80 Dosimetry Systems for Use in Radiation Processing

2.4 ISO Reports:⁴

- GUM Guide to the Expression of Uncertainty in Measurement, 1995.
- VIM International Vocabulary of Basic and General Terms in Metrology, 2008

3. Terminology

3.1 Definitions:

3.1.1 *calibration curve*—expression of the relation between indication and corresponding measured quantity value (VIM).
3.1.1.1 *Discussion*—in radiation processing dosimetry standards, the term *dosimeter response* is generally used rather than “indication”. Thus, a calibration curve is an expression of the relation between the dosimeter response and the corresponding measured quantity value.

3.1.2 *dosimeter*—a device that, when irradiated, exhibits a quantifiable change that can be related to absorbed dose in a given material using appropriate measurement instruments and procedures.

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 *dosimeter response*—reproducible, quantifiable effect produced in the dosimeter by ionizing radiation.

NOTE 1—For PMMA dosimeters, the specific absorbance is the dosimeter response.

3.1.5 *dosimeter stock*—part of a dosimeter batch held by the user.

3.1.6 *measurement management system*—set of interrelated or interacting elements necessary to achieve metrological confirmation and continual control of measurement processes.

³ Available from International Commission on Radiation Units and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, U.S.A.

⁴ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.org>