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Guide for use of radiation-sensitive indicators

Guide pour l'utilisation d'indicateurs sensibles aux rayonnements

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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 International Standard 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 51539 was developed by ASTM Committee E10, Nuclear Technology and Applications, through Subcommittee E10.01, and by Technical Committee ISO/TC 85, Nuclear Energy.

Standard Guide for Use of Radiation-Sensitive Indicators[1]

This standard is issued under the fixed designation ISO/ASTM 51539; 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 guide covers the use of radiation-sensitive indicators in radiation processing. These indicators may be labels, papers, inks or packaging materials which undergo a color change or become colored when exposed to ionizing radiation.[2]

1.2 The purpose of these indicators is to determine visually whether or not a product has been irradiated, rather than to measure different dose levels.

1.3 Such materials are not dosimeters and should not be used as a substitute for proper dosimetry. Information about dosimetry systems for ionizing radiation is provided in other ASTM and ISO/ASTM documents (see ISO/ASTM Guide 51261).

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:*

E 170 Terminology Relating to Radiation Measurements and Dosimetry[3]

2.2 *ISO/ASTM Standards:*

51261 Standard Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing[3]

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

ICRU Report 60 Radiation Quantities and Units

3. Terminology

3.1 *Definitions:*

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

3.1.2 *process load*—a volume of material with a specific loading configuration irradiated as a single entity.

3.1.3 *radiation-sensitive indicators*—materials such as coated or impregnated adhesive-backed substrates, inks, coatings or other materials which may be affixed to or printed on the process loads and which undergo a visual change when exposed to ionizing radiation.

3.2 Definitions of other terms used in this standard that pertain to radiation measurement and dosimetry may be found in ASTM Terminology E 170. Definitions in ASTM E 170 are compatible with ICRU 60; that document, therefore, may be used as an alternative reference.

4. Significance and Use

4.1 Radition-sensitive indicators may be used to show that products have been exposed to a radiation source. They should be used only to provide a qualitative indication of radiation exposure and may be used to distinguish processed loads from unprocessed loads.

NOTE 1—The use of such materials does not eliminate the need for other process-control procedures, such as quantitative dosimetry or the controlled segregation of irradiated from nonirradiated products.

5. Selection of Indicators

5.1 Radiation-sensitive indicators should be selected that are convenient to use, will remain attached to the product, and can withstand the stresses of the irradiation process.

5.2 Indicators should be selected that have a response appropriate for the ranges of dose, dose rate, radiation energy and environmental conditions experienced by the product.[2]

5.3 The suitability of such materials shall be determined under the conditions of use from the time of purchase until their use or expiration of their shelf life.

5.4 Indicators used for electron beam processing should be thin enough to avoid significant change of the dose distribution within the product.

6. Application

6.1 In the event of interruption of the irradiation process, radiation-sensitive indicators may help to locate the specific zone of process interruption, thereby minimizing the loss of improperly treated products.

6.2 These indicators may be used for monitoring multiple-sided irradiation processes. In the case of such a process where the absorbed dose at the far side of the product is sufficient to affect the indicator, then an unexposed indicator could be

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[1] This guide is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subommittee E10.01 on Dosimetry for Radiation Processing, and is also under the jurisdiction of ISO/TC 85/WG 3.

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[2] Abdel-Rahim, F., Miller, A., and McLaughlin, W.L., "Response of Radiation Monitoring Labels to Gamma Rays and Electrons." *Radiation Physics and Chemistry*, Vol. 25, Nos 4-6, 1985, pp. 767-775.

[3] *Annual Book of ASTM Standards*, Vol 12.02.

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

affixed to the side of the product that will face the radiation source before the first exposure and between each subsequent exposure.

NOTE 2—There are other means of monitoring multiple-sided product irradiation, such as the use of bar code labels and automatic turnover mechanisms.

7. Limitations of Use

7.1 Radiation-sensitive indicators may have nonlinear response characteristics and environmental susceptibilities that make them unsuitable for accurate dose measurement.

7.2 Exposure to environmental conditions such as heat, daylight, ultraviolet radiation, and gases produced by the irradiation process may cause undesirable changes to some of these indicator materials. The user should be aware of and follow any special handling and storage procedures that would minimize such effects.

7.3 Some irradiation or storage conditions may result in false positive or negative observations. For these reasons, indicators should not be used as a criterion for product release. Also, external environmental influences may make the interpretation of the indicators meaningless outside the irradiation facility unless appropriate controls are used.

8. Keywords

8.1 electron beam; gamma radiation; ionizing radiation; irradiation; radiation indicator; radiation processing; radiation-sensitive indicator; ICS 17.240

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