



Standard Guide for Sensor Set Design and Irradiation for Reactor Surveillance, E 706(IIC)¹

This standard is issued under the fixed designation E 844; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers the selection, design, irradiation, post-irradiation handling, and quality control of neutron dosimeters (sensors), thermal neutron shields, and capsules for reactor surveillance neutron dosimetry.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety problems, 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 Dosimetry²

E 261 Practice for Determining Neutron Fluence Rate, Fluence, and Spectra by Radioactivation Techniques²

E 854 Test Method for Application and Analysis of Solid State Track Recorder (SSTR) Monitors for Reactor Surveillance, E 706(IIIB)²

E 910 Test Method for Application and Analysis of Helium Accumulation Fluence Monitors for Reactor Vessel Surveillance, E 706(IIIC)²

E 1005 Test Method for Application and Analysis of Radiometric Monitors for Reactor Vessel Surveillance, E 706(IIIA)²

E 706(IIID) Analysis of Damage Monitors for Reactor Vessel Surveillance³

E 706(IIIE) Analysis of Temperature Monitors for Reactor Vessel Surveillance³

E 706(IIE) Benchmark Testing of Reactor Vessel Dosimetry³

3. Terminology

3.1 Definitions:

3.1.1 *neutron dosimeter, sensor, monitor*—a substance irradiated in a neutron environment for the determination of neutron fluence rate, fluence, or spectrum, for example: radiometric monitor (RM), solid state track recorder (SSTR), helium accumulation fluence monitor (HAFM), damage monitor (DM), temperature monitor (TM).

3.1.2 *thermal neutron shield*—a substance (that is, cadmium, boron, gadolinium) that filters or absorbs thermal neutrons.

3.2 For definitions or other terms used in this guide, refer to Terminology E 170.

4. Significance and Use

4.1 In neutron dosimetry, a fission or non-fission dosimeter, or combination of dosimeters, can be used for determining a fluence-rate, fluence, or neutron spectrum, or both, in nuclear reactors. Each dosimeter is sensitive to a specific energy range, and, if desired, increased accuracy in a flux-spectrum can be achieved by the use of several dosimeters each covering specific neutron energy ranges.

4.2 A wide variety of detector materials is used for various purposes. Many of these substances overlap in the energy of the neutrons which they will detect, but many different materials are used for a variety of reasons. These reasons include available analysis equipment, different cross sections for different flux levels and spectra, preferred chemical or physical properties, and, in the case of radiometric dosimeters, varying requirements for different half-life isotopes, possible interfering activities, and chemical separation requirements.

5. Selection of Neutron Dosimeters and Thermal Neutron Shields

5.1 Neutron Dosimeters:

5.1.1 The choice of dosimeter material depends largely on the dosimetry technique employed, for example, radiometric monitors, helium accumulation monitors, track recorders, and damage monitors. At the present time, there is a wide variety of

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² *Annual Book of ASTM Standards*, Vol 12.02.

³ For standards that are in the draft stage and have not received an ASTM designation, see Section 5 as well as Figures 1 and 2 of Matrix E 706.