



Standard Test Method for Measuring Reaction Rates and Fast-Neutron Fluences by Radioactivation of Sulfur-32¹

This standard is issued under the fixed designation E265; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method describes procedures for measuring reaction rates and fast-neutron fluences by the activation reaction $^{32}\text{S}(\text{n},\text{p})^{32}\text{P}$.

1.2 This activation reaction is useful for measuring neutrons with energies above approximately 3 MeV.

1.3 With suitable techniques, fission-neutron fluences from about 5×10^8 to 10^{16} n/cm² can be measured.

1.4 Detailed procedures for other fast-neutron detectors are described in Practice E261.

1.5 *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:²

E170 Terminology Relating to Radiation Measurements and Dosimetry

E181 Test Methods for Detector Calibration and Analysis of Radionuclides

E261 Practice for Determining Neutron Fluence, Fluence Rate, and Spectra by Radioactivation Techniques

E720 Guide for Selection and Use of Neutron Sensors for Determining Neutron Spectra Employed in Radiation-Hardness Testing of Electronics

E721 Guide for Determining Neutron Energy Spectra from Neutron Sensors for Radiation-Hardness Testing of Electronics

E844 Guide for Sensor Set Design and Irradiation for Reactor Surveillance, E 706 (IIC)

E944 Guide for Application of Neutron Spectrum Adjustment Methods in Reactor Surveillance, E 706 (IIA)

E1018 Guide for Application of ASTM Evaluated Cross Section Data File, Matrix E706 (IIB)

3. Terminology

3.1 Definitions:

3.1.1 Refer to Terminology E170.

4. Summary of Test Method

4.1 Elemental sulfur or a sulfur-bearing compound is irradiated in a neutron field, producing radioactive ^{32}P by means of the $^{32}\text{S}(\text{n},\text{p})^{32}\text{P}$ activation reaction.

4.2 The beta particles emitted by the radioactive decay of ^{32}P are counted by techniques described in Methods E181 and the reaction rate, as defined in Practice E261, is calculated from the decay rate and irradiation conditions.

4.3 The neutron fluence above 3 MeV can then be calculated from the spectral-averaged neutron activation cross section, $\bar{\sigma}$, as defined in Practice E261.

5. Significance and Use

5.1 Refer to Guides E720 and E844 for the selection, irradiation, and quality control of neutron dosimeters.

5.2 Refer to Practice E261 for a general discussion of the determination of fast-neutron fluence and fluence rate with threshold detectors.

5.3 The activation reaction produces ^{32}P , which decays by the emission of a single beta particle in 100 % of the decays, and which emits no gamma rays. The half life of ^{32}P is 14.284 (36)³ days (1)⁴ and the maximum beta energy is 1710.66 (21) keV (1).

¹ This test method is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.07 on Radiation Dosimetry for Radiation Effects on Materials and Devices.

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² 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.

³ The non-boldface number in parentheses after the nuclear data indicates the uncertainty in the last significant digit of the preceding number. For example, 8.1 s (5) means 8.1 ± 0.5 seconds.

⁴ The boldface numbers in parentheses refer to the list of references at the end of this test method.