



## Test Method for Antimony Content Using Neutron Activation Analysis (NAA)<sup>1</sup>

This standard is issued under the fixed designation E3063; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the measurement of antimony concentration in plastics or other hydrocarbon or organic matrix by using neutron activation analysis (NAA). The sample is activated by irradiation with neutrons from a research reactor and the subsequently emitted gamma-rays are detected with a germanium semiconductor detector. The same system may be used to determine antimony concentrations ranging from 1 ng/g to 10 000  $\mu\text{g/g}$  with the lower end of the range limited by numerous interferences and the upper limit established by the demonstrated practical application of NAA.

1.2 This test method may be used on either solid or liquid samples, provided that they can be made to conform in size and shape during irradiation and counting to a standard sample of known antimony content using very simple sample preparation. Several variants of this method have been described in the technical literature. A monograph is available which provides a comprehensive description of the principles of neutron activation analysis using reactor neutrons (**1**).<sup>2</sup>

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.* Specific precautions are given in Section 9.

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>3</sup>

**E170 Terminology Relating to Radiation Measurements and Dosimetry**

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.05 on Nuclear Radiation Metrology.

Current edition approved Oct. 1, 2016. Published October 2016. DOI: 10.1520/E3063-16.

<sup>2</sup> The boldface numbers in parentheses refer to a list of references at the end of this standard.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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 U.S. Government Document:<sup>4</sup>

**Code of Federal Regulations, Title 10, Part 20**

#### 2.3 Joint Committee for Guides in Metrology (JCGM) Reports:<sup>5</sup>

**JCGM 100:2008, GUM 1995, with minor corrections, Evaluation of measurement data—Guide to the expression of uncertainty in measurement**

### 3. Terminology

3.1 *Definitions:* See also Terminology **E170**.

3.1.1 *comparator standard*—a reference standard of known antimony content whose specific activation and counting sensitivity (counts (mg of antimony)<sup>-1</sup>) may be used to quantify the antimony content of a sample irradiated and counted under the same conditions. Often, a comparator standard is selected to have a matrix composition, physical size, density and shape very similar to the corresponding parameters of the sample to be analyzed. Differences in size, density, shape and matrix composition between sample and standard may be corrected for using physical or empirical models.

3.1.2 *gamma-ray spectrometer*—a system comprising a detector which detects individual gamma-rays and converts their energy into an electronic pulse whose voltage is proportional to the energy deposited in the detector, and a multichannel pulse-height analyzer which measures the pulse heights, assigns a digital value and stores the individual counts in the channels of a gamma-ray spectrum according to the digital values assigned.

3.1.3 *intensity*—the probability of emission of a gamma-ray of a given energy per decay. Another commonly used term is gamma abundance.

3.1.4 *monitor*—any type of detector or comparison reference material that can be used to produce a response proportional to the neutron fluence rate in the irradiation position, or to the radionuclide decay events recorded by the sample detector.

<sup>4</sup> Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

<sup>5</sup> Document produced by Working Groups of the Joint Committee for Guides in Metrology (JCGM). Available free of charge at BIPM website (<http://www.bipm.org>).