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Standard Terminology Relating to Nuclear Materials¹

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1. Scope

1.1 This terminology standard contains terms, definitions, descriptions of terms, nomenclature, and explanations of acronyms and symbols specifically associated with standards under the jurisdiction of Committee C26 on Nuclear Fuel Cycle. This terminology may also be applicable to documents not under the jurisdiction of Committee C26, in which case this terminology may be referenced in those documents.

2. Terminology

absorbed dose, D, [$L^2 T^{-2}$], *n*—absorbed dose is the mean energy imparted by ionizing radiation to a unit mass of specified material.

¹ This terminology is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.01 on Editorial and Terminology.

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DISCUSSION—

The SI unit for absorbed dose is the gray (Gy), defined as 1 J/kg.

abundance sensitivity, *n*—in methods of chemical analysis, the ratio of the ion beam intensity of the major isotope, *M*, to the background current at the adjacent mass positions.

$$\text{Abundance sensitivity} = \frac{\text{ion current at mass } M}{\text{ion current at } M \pm 1} \quad (1)$$

accuracy, *n*—the closeness of agreement between a measurement result and an accepted reference. (E170)

activity, A, [T^{-1}], *n*—the measure of the rate of spontaneous nuclear transformations of a radioactive material. The SI unit for activity is the becquerel (Bq), defined as one transformation per second. The original unit for activity was the curie (Ci), defined as 3.7×10^{10} transformations per second.

alpha radiation, *n*—is the spontaneous emission of an alpha particle, composed of two protons and two neutrons with a positive charge of plus two, during the nuclear transformation process.

DISCUSSION—

An alpha particle is the same as a helium-4 atom with no electrons.

alteration, *n*—any change in the form, state, or properties of materials.

alteration layer, *n*—*in materials interaction with water*, a layer of alteration phases at the surface of the specimen.

DISCUSSION—

Several distinct layers may form at the surface and within cracks in the material. Layers may be composed of discrete crystallites.

alteration mechanism, *n*—the series of fundamental chemical or physical processes by which alteration occurs.

alteration mode, *n*—for the prediction of long-term behavior of materials, a particular form of alteration, for example: general corrosion, localized corrosion.

alteration phase, *n*—in materials interactions with their environment, a solid phase formed as a result of material interactions, that replaces some amount of the original phase; may form by precipitation from solution or in-situ transformation of a chemically altered solid.

alteration product, *n*—see alteration phase.

analysis (physical or chemical), *n*—the determination of physical or chemical properties or composition of a material.

analyte, *n*—in method of chemical analysis, a sample component whose presence and concentration is of interest.

analytical sample, *n*—a portion of a material (solid, liquid, or gas) used in chemical, physical, or radiological analysis.

back-reaction, *n*—reaction between dissolved components and a material to re-form bonds that are broken during dissolution of this material.

becquerel (Bq), [T^{-1}], *n*—the SI unit of measure for activity, defined as one transformation per second.

beta radiation, *n*—an electron that was generated in the atomic nucleus during decay and has a negative charge of one.

bias of a measurement process, *n*—a consistent or systematic difference between a set of test results obtained from the process when measuring a property, and the accepted reference value of the property being measured.

canyon, *n*—in the nuclear industry, a long, narrow, remotely operated, radiological facility.

DISCUSSION—

A large, heavily-shielded facility where nuclear material is processed or stored.

chemical durability, *n*—in leach tests, the resistance of a material to alteration, dissolution, and release of its constituents, under the specific conditions of the test.

closed system, *n*—in leach tests, a system utilizing a test container that is impervious to material transport.

continuing calibration blank check solution (CCB)—in methods of chemical analysis, a standard solution that has no analyte and is used to verify blank response and freedom from carryover.

continuing calibration verification check solution (CCV)—in methods of chemical analysis, a standard solution (or set of solutions) used to verify freedom from excessive instrument drift; the concentration is to be near the midrange of a linear curve.

continuous flow, *n*—for leach tests, the continual replacement of solution in the reaction cell with fresh test solution.

control test, *n*—for leach tests, test conducted without a specimen to measure background concentrations in the leachant and contamination from interactions between test solution and apparatus.

crushed glass, *n*—in a glass leach test, small particles of glass produced by mechanically fracturing larger pieces of glass.

cumulative fraction leached, *n*—in leach tests, the sum of the amounts of a species leached during all leaching intervals divided by the amount of that species originally present in the sample.

curie (Ci), [T^{-1}]—the original unit of measure for activity, defined as 3.7×10^{10} transformations per second.

devitrified glass, *n*—an initially homogenous or phase separated glass, or both, that has partially crystallized during cooling, heat treatment, or both.

determination, *n*—the process of carrying out a series of operations specified in the test method whereby a single value is obtained.

diffusion coefficient, D, [$L^2 T^{-1}$], *n*—in diffusion modeling, an intrinsic property of a species in a host matrix that relates (1) its concentration gradient to its flux (Fick's first law), (2) its spatial rate of change in the direction of the concentration gradient to the time rate of change in its concentration (Fick's second law), or (3) its mean square displacement to time (The Einstein's equation).

dissolution, *n*—for leach tests on solids, the result of reactions in which chemical bonds are broken and species are released from a solid material and become solvated in the test solution.

dose equivalent, [$L^2 T^{-2}$], *n*—a measure of the biological effects of radiation dose from all types of radiation expressed on a common scale.

DISCUSSION—

The SI unit for dose equivalent is the sievert (Sv), which is equal to 100 rem (specialized unit for human dose equivalent). Radiation dose equivalent is often expressed in terms of microsieverts (μSv) or millirem (mrem).

dose rate, [$\text{L}^2 \text{T}^{-3}$], n —a quantity of absorbed dose received in a given unit of time.

effective diffusion coefficient (effective diffusivity), D_e , [L^2T^{-1}], n —*in diffusion modelling*, the value of the diffusion coefficient of a species in a host matrix that includes the effects of other processes (for example, adsorption) or physical constraints (for example, tortuosity and constrictivity) and which may not be known independently.

DISCUSSION—

The value of D_e is a function of temperature.

electro-mechanical manipulator (E/M), n —a remotely operated handling and lifting device, in which the various motions and functions are driven by electric motors or actuators.

DISCUSSION—

An E/M is generally used in a hot cell or similar facility on objects that are too heavy to handle with master-slave manipulators. It can be mounted on a crane bridge, wall, pedestal, or ceiling.

finite cylinder (finite medium), n —*in diffusion modelling*, a bounded body for which Fick's diffusion equation can be solved.

forward glass dissolution rate, [MT^{-1}], n —*in glass dissolution*, the rate at which the glass dissolves into solution at specific values of temperature and pH in the absence of back reactions.

gamma radiation, n —high energy, short wavelength electromagnetic radiation which originates from the atomic nucleus.

DISCUSSION—

Gamma radiation often accompanies particle emissions associated with radioactive decay. Gamma radiation has no electrical charge.

glass-ceramic, n —a solid material composed of both crystalline and glassy phases.

gray (Gy), [$\text{L}^2 \text{T}^{-2}$], n —a gray is the SI unit of absorbed dose (1 J/kg).

high density concrete, n —a concrete having a density greater than 2400 kg per cubic meter (150 lb per cubic foot).

homogeneous glass, n —a glass that is a single amorphous phase; a glass that is not separated into multiple amorphous phases.

hot cell, n —an isolated shielded containment that provides a controlled environment and is designed to safely handle radioactive and typically contaminated material and equipment.

DISCUSSION—

The design radiation levels within a hot cell are typically 1 Gy/h (100 rads per hour) or higher.

incremental fraction leached, n —*in leach tests*, the amount of a species leached during a single leaching interval divided by the amount of that species in the test specimen before the test.

initial calibration verification check solution (ICV)—in methods of chemical analysis, a standard solution (or a set of standard solutions) used to verify calibration standard levels; the concentration of analyte is to be near mid-range of the linear curve that is made from a stock solution having a different manufacturer or manufacturer lot identification than the calibration standards.

intrinsic dissolution rate, [MT^{-1}], n —*in glass dissolution*, the component of the forward dissolution rate that depends only on the glass composition.

leach test, n —*for waste forms*, a generic term for a test in which a solid material is contacted by a liquid, and the release of constituents from the material into the liquid is measured.

leachant, n —*in leach tests*, general term for the initial solution with which a solid is contacted and into which the solid dissolves or is leached.

leached layer, n —*in leach tests*, residual material at the specimen surface from which some or all soluble components have leached.