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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.

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

accelerated test, n —for the prediction of long term behavior of materials, a test that results in an increase either in the rate of an alteration mode or in the extent of reaction progress, when compared with expected service conditions.

DISCUSSION—

Changes in the expected alteration mechanism (s) caused by the accelerated test conditions, if any, must be accounted for in the use of the accelerated test data.

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.

aluminum-based spent nuclear fuel, *n*—irradiated nuclear fuel or target elements or assemblies, or both, that are clad in aluminum or aluminum-rich alloys.

DISCUSSION—

The microstructures contain a continuous aluminum-rich matrix with fissile-rich particles dispersed in this matrix.

aluminum-based spent nuclear fuel form or waste form, *n*—any metallic form produced from aluminum-based spent nuclear fuel and having a microstructure containing a continuous aluminum-rich matrix with uranium-rich particles dispersed in this matrix.

DISCUSSION—

This term may include the fuel itself or the product from the melt-dilute process.

analog, *n*—for the prediction of long term behavior of materials, a material, process, or system whose composition, and environmental history are sufficiently similar to those anticipated for the materials, processes, or systems of interest to permit use of insight gained regarding its condition or behavior to be applied to the material, process, or system of interest.

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.

annealing, *n*—in glass leach tests, a controlled cooling process for glass designed to reduce thermal residual stress to an acceptable level, and, in some cases, modify structure.

artificial aging, *n*—any short time treatment that is designed to duplicate or simulate the material/property changes that normally occur after prolonged exposure and radioactive decay.

attribute test, *n*—for the prediction of long-term behavior of materials, a test conducted to provide material property data that are required as input to behavior models, but are not themselves responses to the environment, such as density, thermal conductivity, mechanical properties, radionuclide content of waste forms, and so forth.

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.

bounding model, *n*—for the prediction of long term behavior of materials, a model that yields values for dependent variables or effects that are expected to be either always greater than or always less than those expected for the variables or effects to be bounded.

calcine, *v*—to fire or heat a granular or particulate solid at less than fusion temperature but sufficiently to remove most of its chemically combined volatile matter (for example, H₂O, CO₂) and otherwise to develop the desired properties for use.

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.

chemisorbed water, *n*—in the drying of spent nuclear fuel, water that is bound to other species by forces whose energy levels approximate those of chemical bounds.

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

confinement, *n*—in a dry cask storage system (DCSS) for spent nuclear fuel in the U.S., the ability of a DCSS to prevent the release of radioactive substances into the environment.

confinement systems, *n*—in a dry cask storage system (DCSS) for spent nuclear fuel in the U.S., the assembly of components of the packaging intended to retain the radioactive material during storage.

DISCUSSION—

These may include the cladding, storage system shell, bottom and lid, penetration covers, the closure welds or seals, and bolts and other components.

confirmation test, *n*—for the prediction of long term behavior of materials, a test for which results are not used in the initial development of a model or the determination of parameter values for a model but are used for comparison with predictions of that model for model validation.

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.

corrosion product, *n*—for aluminum-based spent fuel storage or disposal, an ion or compound formed during the interaction of the aluminum-based spent nuclear fuel with its storage or disposal environment.

DISCUSSION—

The corrosion product may be the result of aqueous corrosion, oxidation, reaction with moist air, or other types of chemical or electrochemical interactions.

CRUD, *acr*—in nuclear waste management, deposits on fuel surfaces of corrosion products that circulate in the reactor coolant.

DISCUSSION—

Compositions reflect materials exposed to coolant and activation products formed during irradiation.

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 × 10¹⁰ transformations per second.

debris waste, *n*—in nuclear waste management in the U.S., solid material exceeding a 60 mm particle size that is intended for disposal.

DISCUSSION—

Additionally, the solid material is a manufactured object, or plant, or animal matter, or natural geologic material.