Designation: E349 – 06 (Reapproved 2014)

Standard Terminology Relating to Space Simulation[1]

This standard is issued under the fixed designation E349; 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.

INTRODUCTION

These definitions pertain to technologies related to space environment simulation. Where possible, existing international and national standard definitions have been used.

ELECTROMAGNETIC RADIATION TERMS

FUNDAMENTAL CONCEPTS

absorption, *n*—transformation of radiant energy to a different form of energy by interaction with matter.

complex radiation, *n*—radiation composed of a number of monochromatic radiations.

diffusion, *n*—change of the spatial distribution of a beam of radiation when it is deviated in many directions by a surface or a medium.

emission, *n*— release of radiant energy.

infrared radiation, *n*—radiation for which the wavelengths of the monochromatic components are greater than those for vissible radiation, and less than about 1 mm.

NOTE 1—The limits of the spectral range of infrared radiation are not well defined and may vary according to the user. Committee E-2.1.2 of the CIE distinguishes in the spectral range between 780 nm and 1 mm:

IR-A	780 to 1400 nm
IR-B	1.4 to 3 µm
IR-C	3 µm to 1 mm

irradiation, *n*—application of radiation to an object.

monochromatic radiation, *n*—radiation characterized by a single frequency. By extension, radiation of a very small range of frequency or wavelength that can be described by stating a single frequency or wavelength.

radiation, *n*—(*1*) emission or transfer of energy in the form of electromagnetic waves or particles.
(*2*) the electromagnetic waves or particles.

NOTE 2—In general, nuclear radiations and radio waves are not considered in this vocabulary, only optical radiations, that is, electromagnetic radiations (photons) of wavelengths lying between the region of transition to X-rays (1 nm) and the region of transition to radio waves (1 mm).

reflection, *n*—return of radiation by a surface without change of frequency of the monochromatic components of which the radiation is composed.

refraction, *n*—change in the direction of propagation of radiation determined by change in the velocity of propagation in passing from one medium to another.

spectrum of radiation, *n*—(*1*) spatial display of a complex radiation produced by separation of its monochromatic components.
(*2*) composition of a complex radiation.

transmission, *n*—passage of radiation through a medium without change of frequency of the monochromatic components of which the radiation is composed.

ultraviolet radiation, *n*—radiation for which the wavelengths of the monochromatic components are smaller than those for visible radiation and more than about 1 nm.

NOTE 3—The limits of the spectral range of ultraviolet radiation are not well defined and may vary according to the user. Committee E-2.1.2 of the CIE distinguishes in the spectral range between 100 and 400 nm:

UV-A	315 to 400 nm
UV-B	280 to 315 nm
UV-C	100 to 280 nm

visible radiation, *n*—any radiation capable of causing a visual sensation.

NOTE 4—The limits of the spectral range of visible radiation are not well defined and may vary according to the user. The lower limit is generally taken between 380 and 400 nm and the upper limit between 760 and 790 nm (1 nanometer, nm = 10^{-9} m).

QUANTITIES

absorptance, *n*—ratio of the absorbed radiant or luminous flux to the incident flux. Symbol: α_e, α_v, α.

[1] These definitions are under the jurisdiction of ASTM Committee E21 on Space Simulation and Applications of Space Technology and are the direct responsibility of Subcommittee E21.02 on Terminology, Units and Editorial.

Current edition approved April 1, 2014. Published April 2014. Originally approved in 1968. Last previous edition approved in 2006 as E349 – 06. DOI: 10.1520/E0349-06R14.

NOTE 5—In general, the value of the absorptance depends upon the mode of irradiation, the spectral composition, and the state of polarization of the incident radiation.

absorptivity of an absorbing material, *n*—internal absorptance of a layer of the material such that the path of the radiation is of unit length.

diffuse reflection, *n*—diffusion by reflection in which, on the macroscopic scale, there is no regular reflection.

diffuse transmission, *n*—transmission in which diffusion occurs independently, on the macroscopic scale, of the laws of refraction.

directional emissivity of a thermal radiator, *n*—ratio of the thermal radiance of the radiator in a given direction to that of a full radiator at the same temperature. Symbol: $\varepsilon(\theta, \varphi)$; $\varepsilon(\theta, \varphi) = L_{e,th}(\theta,\varphi)/L_{e\,(\varepsilon = 1)}$.

emissivity of a thermal radiator, *n*—ratio of the thermal radiant exitance of the radiator to that of a full radiator at the same temperature. Symbol: ε, $\varepsilon = M_{e,th}/Me(\varepsilon = 1)$.

NOTE 6—Formerly "*pouvoir émissif*" (fr.).

frequency, *n*—reciprocal of the period. Symbol; f, ν.

NOTE 7—When the independent variable is time, the unit of frequency is the hertz. Symbol: Hz ($1\ Hz = 1\ s^{-1}$). (This unit is also called "cycle per second," c/s.)

full radiator: blackbody (USA), Planckian radiator, *n*—thermal radiator that absorbs completely all incident radiation, whatever the wavelength, the direction of incidence, or the polarization. This radiator has, for any wavelength, the maximum spectral concentration of radiant exitance at a given temperature.

goniophotometer, *n*—photometer for measuring the directional light distribution characteristics of sources, lighting fittings, media, and surfaces.

NOTE 8—A goniophotometer for measuring the spatial distribution of luminous intensity is also called a distribution photometer.

gray body, *n*—nonselective radiator whose spectral emissivity is less than one.

integrating (Ulbrecht) sphere, *n*—part of an integrating photometer. A sphere that is coated internally with a white diffusing paint as nonselective as possible and is provided with an associated equipment for making a photometric measurement at a point of the inner surface of the sphere. A screen placed inside the sphere prevents the point under observation from receiving any radiation directly from the source.

internal absorptance of a homogeneous nondiffusing plate, *n*—ratio of the radiant or luminous flux absorbed between the entry and exit surfaces of the plate to the flux which leaves the entry surface. Symbol: a_i , $a_i + \tau_i = 1$.

NOTE 9—For a given plate, the internal absorptance is a function of the path length of the radiation in the plate and thus of the angle of incidence. The fundamental concept is spectral internal absorptance. $a_i(\lambda)$.

internal transmission density, *n*—logarithm to the base 10 of the reciprocal of the internal transmittance. Symbol: D_i, $D_i = -\log_{10} \tau_i$.

NOTE 10—See Note 12 of **internal transmittance**.

NOTE 11—In German, the symbol E is still in use and the natural logarithm is also used sometimes instead of the common logarithm; the corresponding quantity is then called "natürliches Absorptionsmass." (= In 1/τi).

internal transmittance of a homogeneous nondiffusing plate, *n*—ratio of the radiant or luminous flux reaching the exit surface of the plate to the flux which leaves the entry surface.

NOTE 12—For a given plate, the internal transmittance is a function of the path length of the radiation in the plate and thus of the angle of incidence. The fundamental concept is "spectral internal transmittance" $\tau(\lambda)$.

irradiance at a point on a surface, *n*—quotient of the radiant flux incident on an element of the surface containing the point by the area of that element. Symbol: E_e, E; $E_e = d\Phi_e/dA$; Unit: Watt per square metre, $W{\cdot}m^{-2}$.

NOTE 13—In ultraviolet radiation therapy and photobiology, this quantity is called dose rate (International Photobiology Committee, 1954).

linear absorption coefficient of an absorbing medium, *n*—quotient of the internal absorptance of a path element traversed by the radiation, by the length d of this element. Symbol: a; $- d\Phi = a\Phi dl$; Unit: m^{-1} ; $al = \ln 10D_i$.

NOTE 14—The linear absorption coefficient is also the part of the linear attenuation coefficient that is due to absorption.

NOTE 15—In German practice, a linear absorption coefficient is also defined for a homogeneous medium of finite thickness d, as the quotient of the "Absorptions-mass" (logarithm of the reciprocal of the internal transmittance), by the thickness d of the layer. According to whether the natural logarithm or the logarithm to the base 10 is used, one may distinguish the "natürliche Absorptionskoeffizient" (m_n) quotient of the "natürliche Absorptionsmass" (see Note 2, **internal transmission density**) by the thickness d of the layer traversed by the radiation, and the "dekadische Absorptionskoeffizient" (m) quotient of the internal transmission density by the thickness d of the layer.

NOTE 16—a/ρ, where ρ is the density of the medium, is called "mass absorption coefficient."

linear attenuation (extinction) coefficient of an absorbing and diffusing medium, for a collimated beam of radiation**,** *n*—quotient of the relative decrease in spectral concentration of radiant or luminous flux of a collimated beam of radiation during traversal with normal incidence of an infinitesimal layer of the medium by the thickness of that layer. Symbol: μ; $- d\Phi = \mu\Phi dl$; Unit: m^{-1}.

NOTE 17—This concept only applies strictly to slightly diffusing media.

NOTE 18—μ/ρ, where ρ is the density of the medium, is called the "mass attenuation coefficient."

mixed reflection, *n*—partly regular and partly diffuse reflection.

NOTE 19—The irradiance or illuminance received from a point source after regular (diffuse) reflection varies inversely as the square of the distance to the source (diffuser).

mixed transmission, *n*—partly regular and partly diffuse transmission.

NOTE 20—The irradiance or illuminance received from a point source, after regular (diffuse) transmission, varies inversely as the square of the distance to the source (diffuser).

nonselective radiator, *n*—thermal radiator whose spectral emissivity is independent of wavelength over the range considered.

opaque body, *n*—body that transmits practically no light.

period, *n*—size of the minimum interval of the independent variable after which the same characteristics of a periodic phenomenon recur.

NOTE 21—In radiation, the independent variable is the time and the corresponding quantity is the periodic time: Symbol: T; Unit: second (s).

photometer, *n*—instrument used for measuring photometric quantities.

photometry, *n*—measurement of quantities referring to radiation, evaluated according to the visual effect which it produces, as based on certain conventions.

radiance (in a given direction, at a point on the surface of a source or receptor or at a point in the path of a beam), **,** *n*—quotient of the radiant flux leaving, arriving at, or passing through an element of surface at this point and propagated in directions defined by an elementary cone containing the given direction by the product of the solid angle of the cone and the area of the orthogonal projection of the element of surface on a plane perpendicular to the given direction. Symbol: L_e, L; $L_e = d^2\Phi$ ($d\omega$ dA cos Θ); Unit: Watt per steradian and per square metre, $W \cdot sr^{-1}$ m^{-2} .

NOTE 22—Three special cases may be noted:

Case 1—At a point on the surface of a source, in a given direction, radiance is also the quotient of the radiant intensity in the given direction of an element of the surface at this point, by the area of the orthogonal projection of this element on a plane perpendicular to this direction (radiant intensity per unit projected area). $L_e = dI_e/(dA \cos \Theta)$.

Case 2—At a point on the surface of a receptor, in a given direction, radiance is also the quotient of the irradiance that is received at this point on a surface perpendicular to the given direction by the solid angle of the elementary cone containing this direction and surrounding the beam which produces this irradiance (perpendicular irradiance per unit solid angle). $L_e = dE_e/d\omega$.

Case 3—On the path and in the direction of an element of a beam, in a nondiffusing, nonabsorbing medium, the radiance is also the quotient of the radiant flux $d\Phi_e$ which transports the beam, by the geometric extent dG of the beam. The geometric extent, which may be defined by two sections of the beam of areas dA and dA' of separation l, and having angles Θ and Θ' between their normals and the direction of the beam is $dG = dA$ cos Θ $d\omega$ where the numerical value in steradians of $d\omega$ is dA' cos $\Theta' l^{-2}$. $L_0 = d\Phi_0/dG = d^2\Phi_e/(d\omega \, dA \cos \Theta)$. In the absence of diffusion, it can be demonstrated in geometrical optics that the optical extent, product of the geometric extent of an element of a beam and the square of the refractive index of the medium of propagation, is an invariant along the length of the beam whatever the deviations that it undergoes by reflection or refraction ($dG \cdot n^2$ = constant). In consequence, the basic radiance, quotient of the radiance by the square of the refractive index, is invariant along the length of an element of a beam if losses by absorption or by reflection are taken as zero ($L_e \cdot n^{-2}$ = constant).

radiance factor at a point on the surface of a nonself-radiating body, in a given direction under specified conditions of irradiation,, *n*—ratio of the radiance of the body to that of a perfect reflecting or transmitting diffuser, identically irradiated. Symbol: β.

radiant efficiency of a source of radiation, *n*—ratio of the radiant flux emitted to the power consumed. Symbol: η_e, η.

NOTE 23—The radiant efficiency of a source in a limited region of the spectrum may also be considered, that is, the ratio of the radiant flux emitted in this spectral region to the power consumed.

radiant energy, *n*—energy emitted, transferred, or received as radiation. Symbol: Q_e, Q; Unit: joule J (1 J = W·s).

NOTE 24—In ultraviolet radiation therapy and photobiology, this quantity is called "integral dose" (International Photobiology Committee, 1954).

radiant exposure at a point on a surface, *n*—surface density of the energy received. Symbol: H_e, H; $H_e = dQ_e/dA = \int E_e$ dt; Unit: joule per square metre, $J \cdot m^{-2}$.

NOTE 25—Formerly "irradiation."

NOTE 26—Equivalent definition: Product of an irradiance and its duration.

NOTE 27—In ultraviolet radiation therapy and photobiology, this quantity is called dose (International Photobiology Committee, 1954).

radiant exitance at a point on a surface, *n*—quotient of the radiant flux leaving an element of the surface containing the point, by the area of that element. Symbol: M_e, M; $M_e = d\Phi_e/dA = \int_2 L_e \cos \theta d\omega$. Unit: Watt per square metre, $W \cdot m^{-2}$.

NOTE 28—The name radiant emittance previously given to this quantity is abandoned because it has given rise to confusion. Thus, the term "emittance" has been used to designate either the flux per unit area leaving a surface (whatever the origin of the flux), the flux per unit area emitted by a surface (flux originating in the surface), or, principally, in certain circles in the United States of America, a quantity without dimensions similar to "emissivity," but applicable only to a specimen.

NOTE 29—The expression "self-radiant exitance" ($M_{e,s}$) indicates that the flux considered does not include reflected or transmitted flux.
The expression "thermal-radiant exitance" ($M_{e,th}$) indicates that the flux considered is produced by thermal radiation. These same adjectives (self, thermal) are equally applicable to other quantities, such as radiance, and so forth.

NOTE 30—In the case of a full radiator (blackbody), the radiance L_e is uniform in all directions. In consequence, when the solid angle is measured in steradians, the radiant exitance has the numerical value $M_e = \pi l_e$.

radiant flux: radiant power, *n*—power emitted, transferred, or received as radiation: Symbol: Φ_e, Φ, P; $\Phi_e = dQ_e/dt$; Unit: Watt (W).

radiant flux (surface) density at a point of a surface, *n*—quotient of the radiant flux at an element of the surface containing the point, by the area of that element. (See also **irradiance** and **radiant exitance**.) Unit: Watt per square metre, $W \cdot m^{-2}$.

radiant intensity of a source, in a given direction, *n*—quotient of the radiant flux leaving the source propagated in an element of solid angle containing the given direction, by the element of solid angle. Symbol: I_e, I; $I_e = d\Phi_e/d\omega$; Unit: Watt per steradian, $W \cdot sr^{-1}$.

NOTE 31—For a source that is not a point source: The quotient of the radiant flux received at an elementary surface by the solid angle which this surface subtends at any point of the source, when this quotient is taken to the limit as the distance between the surface and the source is increased.

radiometer, *n*—instrument for measuring radiation in energy or power units.

radiometry, *n*—measurement of the quantities associated with radiation.

reflectance, *n*—ratio of the reflected radiant or luminous flux to the incident flux. Symbol: ρ_e, ρ_v, ρ; $\pi = \rho_r + \rho_d$.

NOTE 32—When mixed reflection occurs, the (total) reflectance may be divided into two parts, regular (ρ_r) and diffuse reflectance (ρ_d), corresponding, respectively, to the two modes of reflection referred to above.
In general, the values of the various reflectances depend upon the mode of irradiation, the spectral composition, and state of polarization of the incident radiation.

reflectance factor at a point on a surface, for the part of the reflected radiation contained in a given cone with apex at the point of the surface, and for incident radiation of given spectral composition and geometric distribution, , *n*—ratio of the radiant flux reflected in the directions delimited by the cone to that reflected in the same directions by a perfect reflecting diffuser identically irradiated.

NOTE 33—For specularly reflecting surfaces that are irradiated by a source of small solid angle, the reflectance factor may be much larger than unity if the cone includes the mirror image of the source.

NOTE 34—If the solid angle of the cone approaches zero, or 2π sr, the reflectance factor approaches radiance factor or reflectance, respectively. In instruments called "reflectance spectrophotometers," the geometrical distribution is, in general, intermediate between these two extreme cases. The readings of these instruments, corrected for photometric-scale errors, wavelength-scale errors, and for deviations of the reflecting standard used from a perfect reflecting diffuser, are spectral reflectance factors. For a given sample, these values depend on the geometrical characteristics of the instrument.

NOTE 35—The term "directional reflectance" is used currently in the United States in this sense.

reflection (optical) density, *n*—logarithm to the base 10 of the reciprocal of the reflectance. Symbol: D, $D = -\log_{10} \rho$.

reflectivity, *n*—reflectance of a layer of material of such a thickness that there is no change of reflectance with increased thickness. Symbol: $\rho\ \infty$.

reflectometer, *n*—instrument for the measurement of quantities pertaining to reflection.

regular (specular) reflection, *n*—reflection without diffusion in accordance with the laws of optical reflection.

regular (direct) transmission, *n*—transmission without diffusion.

relative spectral energy (power) distribution, *n*—description of the spectral character of a radiation (description of an illuminant) by the way in which the relative spectral concentration of radiant energy varies throughout the spectrum. Symbol: $S(\lambda)$.

retroreflection; reflex reflection, *n*—reflection in which light is returned in directions close to the direction from which it came, this property being maintained over wide variations in the direction of incident light.

selective radiator, *n*—radiator whose spectral emissivity depends on the wavelength over the range considered.

solar constant, *n*—the total solar irradiance at normal incidence on a surface in free space at the earth's mean distance from the sun (1 AU).

spectral (referring to radiometric quantities) **,** *adj*—for monochromatic radiation at a specified wavelength (or frequency), or, by extension, for radiation within a narrow wavelength band about a specified wavelength.

NOTE 36—When certain quantities, such as absorptance for transmittance, and so forth, are considered for monochromatic radiation, they are functions of wavelength (or frequency, or wave number, and so forth). They then may be designated by the same term preceded by the adjective "spectral" and by the same symbol followed by λ (or ν, or σ, and so forth) in parentheses, example: spectral transmittance, $\tau(\lambda)$.

Spectral quantities are frequently plotted as a function of wavelength (or frequency) to produce a spectral curve.

If the spectral concentration of a quantity X is considered, it also may be designated by way of abbreviation by the name of the quantity preceded by the adjective "spectral" as before, and by the symbol for the quantity with the subscript λ (or ν, or σ, and so forth), but it must be remembered that X and $X\lambda$ are quantities of a different kind because $X\lambda = dX/d\lambda$.

spectral concentration of a radiometric quantity, *n*—quotient of the quantity, taken over an infinitesimal range on either side of a given wavelength, by the range. $X_e, \lambda = dX_e/d\lambda$.

NOTE 37—Frequencies, wavenumbers, or their logarithms may also be used; if there is a risk of ambiguity, this should be avoided by means of the wording: "spectral concentration in terms of frequency," and so forth. (See preliminary remarks at the beginning of "quantities" regarding use of the adjective spectral.)

spectral distribution curve of a radiometric quantity (radiant flux, radiant intensity, and so forth) **,** *n*—curve representing the spectral concentration of the quantity as a function of wavelength (see Note 37).

NOTE 38—Commonly, the relative spectral distribution curve is used, that is, the curve representing the ratio of the spectral concentration of the quantity to a certain value of the same quantity.

spectrophotometer, *n*—instrument for measuring the ratio of two spectral radiometric quantities.

spectroradiometer, *n*—instrument for measuring the spectral concentration of radiant energy or radiant power.

thermal radiation, *n*—process of emission in which the radiant energy originates in the thermal agitation of the particles of matter (atoms, molecules, ions).

NOTE 39—The terms "thermal radiation" and, in German "Temperaturstrahlung" apply not only to the process of emission, but also to the radiation itself.

thermal radiator, *n*—source emitting by thermal radiation. in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

translucent body, *n*—body that transmits light principally by diffuse transmission. Objects are not seen distinctly through such a body.

transmission (optical) density, *n*—logarithm to the base 10 of the reciprocal of the transmittance. Symbol: D, $D = -\log_{10} \tau$.

transmissivity of an absorbing material, *n*—internal transmittance of a layer of the material such that the path of the radiation is of unit length.

transmittance, *n*—ratio of the transmitted radiant or luminous flux to the incident flux. Symbol: τ_e, τ_v, τ; $\tau = \tau_r + \tau_d$.

NOTE 40—Where mixed transmission occurs, the (total) transmittance may be divided into two parts, regular transmittance (τ) and diffuse transmittance (τ_d), corresponding, respectively, to the two modes of transmission referred to above.

In general, the values of the various transmittances depend upon the mode of irradiation, the spectral composition, and the state of polarization of the incident radiation.

transparent body, *n*—body in which the light transmission is mainly regular and which has a high regular transmittance. Objects are seen distinctly through such a body if its geometrical form is suitable.

uniform diffuse reflection, *n*—diffuse reflection in which the spatial distribution of the reflected radiation is such that the radiance or luminance is the same in all directions in which the radiation is reflected.

uniform diffuse transmission, *n*—diffuse transmission in which the spatial distribution of the transmitted radiation is such that the radiance or luminance is the same in all directions in which the radiation is transmitted.

wavelength, *n*—distance in the direction of propagation of a periodic wave between two successive points at which the phase is the same (at the same time).

NOTE 41—The wavelength in a medium is equal to the wavelength in vacuo divided by the refractive index of the medium. Unless otherwise stated, values of wavelength are generally those in air. The refractive index of standard air (15°C, 101.325 $N \cdot m^{-2}$) lies between 1.000 27 and 1.000 29 for visible radiations.

VACUUM TERMS

NOTE 42—Vacuum terms are now being added. Test Method E294,[2] Test Method E295[2], Practice E296[2], and Method E297[3] contain some approved terms. The Glossary of Terms Used in Vacuum Technology, published by The American Vacuum Society, is also being used where applicable.

Definitions—The following definitions are necessary to understanding meaningful application of ionization-type vacuum-measurement devices and are useful in differentiating between pressure, density, and flux measuring devices for proper application and interpretation of low-density molecular measurements.

Blears effect—the reduction of the partial pressure of organic vapors within the envelope of a tubulated ionization gage below the partial pressure that would prevail in the envelope with a tubulation having infinite conductance.

controlled-temperature enclosed gage—an enclosed gage in which the envelope is maintained at nearly uniform constant temperature by suitable means.

enclosed ionization gage—an ionization gage for which the ion source region is enclosed over at least 0.95 × 4 π steradians about the center of the region by an envelope at a known temperature with only a single opening such that all molecules entering the ion source region must have crossed a plane located outside this region.

equivalent nitrogen concentration—the quantity obtained when the ion-collector current of a nude gage (in amperes) for the gas in the system is divided by the concentration sensitivity of the gage for nitrogen. This sensitivity is defined as the ratio of gage ion collector current in amperes to molecular concentration in molecules per cubic metre of nitrogen under specified operating conditions.

equivalent nitrogen flux density—the quotient of the current output of an enclosed vacuum gage operating under specified conditions divided by the molecular flux sensitivity for nitrogen.

equivalent nitrogen pressure—

DISCUSSION—For a nude gage equivalent nitrogen pressure is obtained by multiplying the equivalent nitrogen concentration by kT where k is the Boltzmann constant and T is the mean absolute temperature of the walls from which the gas molecules travel to the ionizing region of the gage, averaged as nearly as possible on the basis of relative molecular flux.

standard equivalent nitrogen pressure—for a nude gage the value of the equivalent nitrogen pressure is obtained when T = 296K (or standard ambient temperature) is used in the factor k T.

DISCUSSION—For a tubulated gage, the equivalent nitrogen pressure in newton per square metre is obtained by dividing the ion collector current in amperes for a given gas by the pressure sensitivity of the gage in amperes per newton per square metre for pure nitrogen under specified operating conditions.

gage background—the part of the indicated ion collector current produced by phenomena other than ions formed in the gas phase arriving at the collector.

gage limit—a pressure or concentration indication four times the background.

ionization gage—a vacuum gage comprising a means of ionizing the gas molecules and a means of correlating the number and type of ions produced with the pressure or concentration of the gas. Various types of ionization gages are distinguished according to the method of producing the ionization.

cold-cathode ionization gage—an ionization gage in which the ions are produced by a cold-cathode gas discharge, usually in the presence of a magnetic field.

hot-cathode ionization gage—an ionization gage in which ion production is initiated and sustained by electrons emitted from a hot cathode.

molecular flux density—the number of molecules incident on a real or imaginary surface per unit area per unit time. The unit is molecules per second per square centimetre.

[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

molecular flux sensitivity—the output current of an enclosed vacuum gage per unit molecular flux density under specified gage operating conditions and random particle motion.

nude ionization gage—an ionization gage for which the center of the ion source region is exposed to direct molecular flux (from surfaces not forming part of the gage) in all directions except for a solid angle less than 0.05 × 4 π steradians (determined by the parts of the gage head). No structures shall be within one sensing element diameter of any part of the sensing element unless similar structures are present during calibration.

NOTE 43—The solid angle subtended by a circular disk of radius r with axis passing through the center point of the solid angle at a distance y from the disk is given as follows:

$$\omega = 2\pi \left[\left(1 - y/y^2 + r^2\right)^{\frac{1}{2}} \right]$$

For ω=0.05 × 4π, the distance *y* must equal 2.07 *r*, a value which should be easily attainable for typical ionization gage electrodes mounted on a circular base of radius *r*.

orifice ionization gage—an enclosed gage containing a single orifice or port having a length less than 0.15 of its diameter such that molecules from the chamber can enter the envelope directly from within a solid angle nearly equal to 2 π steradians.

partial pressure gage—an ionization gage that indicates the partial pressure of any gas in a mixture irrespective of the partial pressure of other gases in the mixture.

partially enclosed ionization gage—a gage in which the ion formation region is enclosed over less than 0.95 × 4 π steradians but more than 0.05 × 4 π steradians about center by an envelope which has one or more openings such that not all molecules entering the ion formation region must first cross a plane located outside this region.

recovery time—the time required for the pressure indication of a gage to reach and remain within pressure indications not more than 105 % or less than 95 % of the final average steady-state value after a sudden change in the operating conditions of the gage without appreciable change in the gas pressure in the vacuum chamber. Pressure changes less than 5 % of the initial value shall be regarded as within the normal fluctuations of pressure indication.

response time—the time required for the change in pressure indication as a result of a specified gas (or vapor) within a gage tube to reach (1 − 1/*e*) (or 63 %) of the change in steady-state pressure after a relatively instantaneous change of the pressure of that gas in the vacuum chamber. The response time may depend on the time of adsorption of the gas (or vapor) on the walls of the gage tube as well as the geometry of the tube (including the connecting line to the vacuum chamber).

tubulated ionization gage—an enclosed ionization gage for which the opening in the envelope is determined by a tubulation of diameter equal to or less than the minimum diameter of the part of the envelope adjacent to the ion source region and of length at least equal to the diameter of the tubulation.

vacuum gas analyzer—a device capable of indicating the relative composition of a gas mixture at low pressures.

THERMAL ABLATIVE TERMS

ablation, *n*—a self-regulating heat and mass transfer process in which incident thermal energy is expended by sacrificial loss of material.