Designation: C1145 – 19

Standard Terminology of Advanced Ceramics[1]

This standard is issued under the fixed designation C1145; 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.

1. Scope

1.1 This terminology contains definitions and explanatory notes for the principal words, phrases, and terms used in advanced ceramics technology. The given definitions are technology specific and are directly applicable to the design, production, testing, analysis, characterization, and use of advanced ceramics for structural, electronic, coating, energy, chemical, nuclear, biomedical, and environmental applications.

1.2 The purpose of the standard terminology is to provide a collected technical resource and reference that promotes a common understanding of the principal technical terms used within the advanced ceramics community and encourages the use of uniform terminology in specifications and reports.

1.3 Definitions of terms appear in dictionary-definition form and include the term, part of speech (for example, n = noun; v = verb; adj = adjective), definition, and, when applicable, a delimiting phrase. Terms representing physical quantities have analytical dimensions stated immediately following the term (or letter symbol) in fundamental dimension form, using the following ASTM standard symbology for fundamental dimensions, shown within square brackets: [M] for mass, [L] for length, [T] for time, [θ] for thermodynamic temperature, and [nd] for non-dimensional quantities. Use of these symbols is restricted to analytical dimensions when used with square brackets, as the terms may have other definitions when used without the brackets.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

absorbed moisture, *n*—water held within the materials and having physical properties not substantially different from ordinary water at the same temperature and pressure.

adhesive failure, *n*—detachment and separation of a coating from the substrate with cracking and debonding at the coating-substrate interface. **(C1624)**

adsorbate, *n*—material that has been retained by the process of adsorption. **(C1274)**

adsorbent, *n*—any solid having the ability to concentrate significant quantities of other substances on its surface. **(C1274)**

adsorption, *n*—process in which molecules are concentrated on a surface by chemical or physical forces, or both. **(C1274)**

adsorption isotherm, *n*—relation between the quantity of adsorbate and the equilibrium (relative) pressure of the adsorptive, at constant temperature. **(C1274)**

DISCUSSION—Typically, the amount adsorbed is presented on an isotherm as volume in cm^3 STP (Standard Temperature and Pressure, that is, 273.15 K and 101325.02 Pa) normalized per mass of sample.

adsorptive, *n*—any substance available for adsorption. **(C1274)**

advanced ceramic, *n*—a highly engineered, high performance, predominately non-metallic, inorganic, ceramic material having specific functional attributes. **(C1198, C1259, C1292, C1322, C1368, C1525, C1576, C1674)**

agglomerate, *n—as used in fractography,* a cluster of grains, particles, platelets, or whiskers, or a combination thereof, present in a larger solid mass.

aggregate, *n*—a dense mass of particles held together by strong intermolecular or atomic cohesive forces. It is stable to normal handling and ordinary mixing techniques including high-speed stirring and ultrasonics. **(C242)**

aliquot, *n*—a representative portion of a whole that divides the whole leaving a remainder. **(C1274)**

back-face strain, *n*—the strain as meaured with a strain gage mounted longitudinally on the compressive surface of the specimen, opposite the crack or notch mouth (often this is the top surface of the specimen as tested). **(C1421)**

base exchange, *n*—a surface property exhibited by collodial inorganic materials, usually clays, whereby absorbed surface cations are replaced by other cations.

[1] This terminology is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.91 on Nomenclature and Editorial.

Current edition approved July 1, 2019. Published July 2019. Originally approved in 1989. Last previous edition approved in 2013 as C1145 – 06 (2013). DOI: 10.1520/C1145-19.

baseline flexure strength, *n*—in the context of this standard, refers to the flexure strength value obtained after application of a grinding procedure specified in this standard. **(C1495)**

DISCUSSION—For the advanced ceramics to which this this standard is applicable, the baseline flexure strength is expected to be a close approximation to the inherent flexure strength.

blanchard grinding, *n*—a type of rotary grinding in which the workpiece is held on a rotating table with an axis of rotation that is parallel to the (vertical) spindle axis. **(C1495)**

body, *n*—the structural portion of a ceramic article, or the material or mixture from which it is made. **(C242)**

breaking force, [F], *n*—the force at which fracture occurs in a test specimen. **(C1674)**

DISCUSSION—In this test method, fracture consists of breakage of the test bar into two or more pieces or a loss of at least 50 % of the maximum force carrying capacity.

brittle fracture, *n*—fracture that takes place with little or no preceding plastic deformation. **(C1322)**

bundle, *n*—a collection of parallel fibers. Synonym, tow. **(C1557)**

calcine, *v* **(calcination,** *n***)—**firing or heating a granular or particulate solid at less than fusion temperature, but sufficient to remove most of its chemically combined volatile matter (that is, H_2O, CO_2) and otherwise to develop the desired properties for use.

capillary action, *n*—the phenomenon of intrusion of a liquid into interconnected small voids, pores, and channels in a solid, resulting from surface tension.

casting, drain (hollow casting), *v*—forming ceramic ware by introducing a body slip into an open, porous mold, and then draining off the remaining slip when the cast piece has reached the desired thickness. **(C242)**

cell pitch, (p), [L], *n*—the unit dimension/s for the cross-section of a cell in the honeycomb component. The cell pitch *p* is calculated by measuring the specimen dimension of interest, the cell count in that dimension, and a cell wall thickness, where $p = (d - t)/n$. **(C1674)**

DISCUSSION—The cell pitch can be measured for both the height and width of the cell; those two measurements will be equal for a square cell geometry and uniform cell wall thickness and will be unequal for a rectangular cell geometry.

cell wall thickness, (t), [L], *n*—the nominal thickness of the walls that form the cell channels of the honeycomb structure. **(C1674)**

censored strength data, *n*—strength measurements (that is, a sample) containing suspended observations such as that produced by multiple competing or concurrent flaw populations. **(C1239)**

ceramic matrix composite, *n*—material consisting of two or more materials (insoluble in one another), in which the major, continuous component (matrix component) is a ceramic, while the secondary component(s) (reinforcing component) may be ceramic, glass-ceramic, glass, metal, or organic in nature. These components are combined on a macroscale to form a useful engineering material possessing certain properties or behavior not possessed by the individual constituents. **(C1275)**

cermet, *n*—a composite material or article comprised of a ceramic and a metal or metal alloy, interdistributed in any of various geometrical forms but intimately bonded together.

channel porosity, *n*—porosity in the porous ceramic component that is defined by the large, open longitudinal honeycomb channels. Channel porosity generally has cross-sectional dimensions on the order of 1 millimeter or greater. **(C1674)**

chatter, *n*—an undesirable pattern created on the surface of a work piece, usually at regularly spaced intervals, due to an out-of-round, out-of-balance condition or due to an induced natural frequency, or its harmonics, or both, in a grinding machine.

cohesive failure, *n*—material damage and cracking in the coating or in the substrate, separate and distinct from detachment and adhesive debonding at the coating-substrate interface. **(C1624)**

colloidal particle, *n*—a dispersed particle with a linear dimension of 5 to 100 nm.

comminution, *n*—the act or process of reduction in particle size, usually but not necessarily by grinding or milling.

competing failure modes, *n*—distinguishably different types of fracture initiation events that result from concurrent (competing) flaw distributions. **(C1239)**

complete gage section, *n*—the portion of the specimen between the two outer bearings in four-point flexure and three-point flexure fixtures. **(C1161, C1674)**

DISCUSSION—The complete four-point flexure gage section is twice the size of the inner gage section. Weibull statistical analysis only includes portions of the specimen volume or surface which experience tensile stresses.

compositional inhomogeneity, (CI), *n—as used in fractography*, a volume-distributed flaw that is a microstructural irregularity related to the nonuniform distribution of an additive, a different crystalline or glass phase or in a multiphase material, the nonuniform distribution of a second phase.

compound flaw distributions, *n*—any form of multiple flaw distribution that is neither pure concurrent nor pure exclusive. A simple example is where every test specimen contains the flaw distribution *A*, while some fraction of the test specimens also contains a second independent flaw distribution *B*. **(C1239)**

concurrent flaw distributions, *n*—type of multiple flaw distribution in a homogeneous material where every test specimen of that material contains representative flaws from each independent flaw population. Within a given test specimen, all flaw populations are then present concurrently and are

competing with each other to cause failure. This term is synonymous with "competing flaw distributions." **(C1239)**

'constant applied stress time-to-failure' curve, *n*—a curve fitted to the values of time to failure at each of several applied stresses. **(C1576)**

DISCUSSION—In the ceramics literature, this is often called a "static fatigue" curve.

'constant applied stress time-to-failure' diagram, *n*—a plot of constant applied stress against time to failure. Constant applied stress and time to failure are both plotted on logarithmic scales. **(C1576)**

continuous fiber-reinforced ceramic matrix composite (CFCC), *n*—ceramic matrix composite in which the reinforcing phase consists of a continuous fiber, continuous yarn, or a woven fabric. **(C1275)**

coolant, *n*—usually a liquid that is applied to the workpiece or wheel, or both, during grinding for cooling, removal of grinding swarf, and for lubrication. **(C1495)**

coolant flow rate, *n*—volume of coolant per unit time delivered to the wheel and workpiece during grinding. **(C1495)**

crack, (CK), *n—as used in fractography*, a volume-distributed flaw that is a plane of fracture without complete separation.

crack deflection, *n*—a toughening mechanism in advanced ceramics or ceramic matrix composites characterized by fracture surface roughening and crack tilting/twisting during propagation around grains or a reinforcing component caused by stress fields around the grains or component developed through mismatches in thermal expansion or mechanical properties (such as elastic modulus), or both, between grains or between reinforcement and matrix.

crack orientation, *n*—a description of the plane and direction of a fracture in relation to a characteristic direction of the product. This identification is designated by a letter or letters indicating the plane and direction of crack extension. The letter or letters represent the direction normal to the crack plane and the direction of crack propagation. **(C1421)**

creep, *n*—the time-dependent part of a strain resulting from stress.

creep-feed grinding, *n*—a mode of grinding characterized by a relatively large wheel depth-of-cut and correspondingly low rate of feed. **(C1495)**

critical scratch load (L_{CN}), *n*—applied normal force at which a specific, well-defined, recognizable damage/failure event occurs or is observed in the scratch test of a specific coating on a specific substrate. **(C1624)**

DISCUSSION—The subscript *N* is used to identify progressive failure events. For example, L_{C1} is often used to identify the first level of cohesive failure in the coating itself; L_{C2} is often used to identify first adhesive failure between the coating and the substrate. Multiple subscripts can be used for progressive levels of distinct damage in a specific coating-substrate systems.

critical temperature difference, ΔT_C, *n*—temperature difference between the furnace and the ambient temperature water bath that will cause a 30 % drop in the average flexural strength. **(C1525)**

cross-feed, *n*—increment of displacement or feed in the cross-feed direction. **(C1495)**

cross-feed direction, *n*—direction in the plane of grinding which is perpendicular to the principle direction of grinding. **(C1495)**

deairing, *n*—the process of removing entrapped air or absorbed air from a mass or slurry, usually by application of a vacuum.

depth of penetration, *n—(1)* the distance a penetrant has entered into a solid material as measured from the surface of the material; *(2)* the maximum depth at which a magnetic or ultrasonic indication can be measured in a test specimen.

diamond paste, *n*—diamond dust dispersed in a paste or slurry for use as a grinding or polishing compound.

diamond tool, *n*—any tool in which the working area is inset with diamonds or diamond dust.

diamond wheel, *n*—a bonded grinding wheel in which the abrasive grains are crushed and sized natural or synthetic diamonds.

discontinuous fiber-reinforced composite, *n*—a ceramic matrix composite material reinforced by chopped fibers.

dish grinder, *n*—a grinding machine equipped with a dish-shaped abrasive wheel as a grinding mechanism

dish wheel, *n*—dish-shaped abrasive grinding wheel.

disk feeder, *n*—a rotating disk beneath the opening of a bin which delivers material from the bin at a specified rate by controlling the rate of rotation of the disk and the size of the gate opening of the bin.

disk grinder, *n*—a grinding machine equipped with a large abrasive disk as the work mechanism.

disk wheel, *n*—a bonded abrasive wheel mounted on a plate so that grinding may be done on the side of the wheel.

down-feed, *n*—increment of displacement or feed in the down feed direction. **(C1495)**

down-feed direction—direction perpendicular to the plane of grinding for a machine configuration in which the grinding wheel is located above the workpiece. **(C1495)**

down-grinding, *n*—a condition of down-grinding is said to hold when the velocity vector tangent to the surface of the wheel at points of first entry into the grinding zone has a component normal to and directed into the ground surface of the workpiece. **(C1495)**

drag, *n*—the resistance of the foot or base of a ceramic article to shrinkage during firing time due to friction with the slab or sagger on which it rests.

dressing, *n—(1)* the process of restoring the efficiency of an abrasive grinding wheel by removal of dulled grains; *(2)* reshaping the faces of grinding wheels to special contours.

dressing, *n*—a conditioning process applied to the abrasive surface of a grinding wheel to improve the efficiency of grinding. **(C1495)**

DISCUSSION—Dressing may accomplish one or more of the following: (*1*) removal of bond material from around the grit on the surface of the grinding wheel causing the grit to protrude a greater distance from the surrounding bond, (*2*) removal of adhered workpiece material which interferes with the grinding process, removal of worn grit, (*3*) removal of bond material thereby exposing underlying unworn grit, and (*4*) fracture of worn grit thereby generating sharp edges.

drum dryer, *n*—a heated, rotating drum in which tumbling or cascading raw materials are dried.

drying oven, *n*—a closed unit in which specimens are dried by heating.

drying shrinkage, *n*—the contraction of a moist body during the drying process, expressed as linear percent of the original length or volume percent of the original volume.

drying, vacuum, *n*—the technique of expediting the removal of moisture from a material or body by the use of a vacuum in conjunction with a conventional drying system.

dry milling, *n*—the process of reducing the particle size of a substance by milling without the use of a liquid medium.

dry screening, *n*—the process of separating small sizes of granular or powdered solids from coarser particles by passing them through a screen of desired mesh size while in the dry state.

dual-drum mixer, *n*—a mixer consisting of a long drum containing two compartments separated by a bulkhead with a swinging chute extending through the unit.

durability, *n*—the property of an article of being resistant to physical or chemical damage, or both, under the usual conditions of service, and of being useful over extended periods of time and use.

dust pressing, *n*—the process of forming ceramic bodies of 1.5 % or less water content by pressing in a mold.

effective gage section, *n*—that portion of the test specimen geometry that has been included within the limits of integration (volume, area, or edge length) of the Weibull distribution function. In tensile test specimens, the integration may be restricted to the uniformly stressed central gage section, or it may be extended to include transition and shank regions. **(C1239)**

elastic limit, *n*—the greatest stress that a material is capable of sustaining without permanent strain remaining upon complete release of the stress. **(C1259)**

elastic limit, [FL^{-2}], *n*—the greatest stress that a material is capable of sustaining without permanent strain remaining upon complete release of the stress. **(C1198)**

elastic modulus, *n*—the ratio of stress to strain below the proportional limit. **(C1259)**

elastic modulus, [FL^{-2}], *n*—the ratio of stress to strain below the proportional limit. **(C1198)**

electrical contact, *n*—any physical contact between two or more parts which will permit the flow of electricity between the parts.

electric furnace, *n*—a furnace or kiln in which the main source of heat is provided by electrical means.

electrophoresis, *n*—the movement of colloidal particles or macromolecules through a solution under the action of an electromotive force applied through electrodes in contact with the solution.

emissivity, *n*—the ratio of the radiation given off by the surface of a body to the radiation given off by a perfect black body at the same temperature.

emulsification, *n*—the process of dispersing an immiscible liquid in another liquid.

endothermic reaction, *n*—a chemical reaction in which heat is absorbed.

endurance, thermal, *n*—the ability of a ceramic product to withstand thermal shock or to withstand deterioration during exposure to high temperatures.

engineered porosity, *n*—porosity in a component that is deliberately produced and controlled for a specific function and engineered performance. The porosity can be microporous (micron and submicron pores in the body of the ceramic) or macroporous (millimeter and larger) cells and channels in the ceramic. The porosity commonly has physical properties (volume fraction, size, shape, structure, architecture, dimensions, etc.) that are produced by a controlled manufacturing process. The porosity in the component has a direct effect on the engineering properties and performance and often has to be measured for quality control and performance verification. **(C1674)**

equibiaxial flexural strength, [F/L^2], *n*—maximum stress that a material is capable of sustaining when subjected to flexure between two concentric rings. This mode of flexure is a cupping of the circular plate caused by loading at the inner load ring and outer support ring. The equibiaxial flexural strength is calculated from the maximum-load of a biaxial test carried to rupture, the original dimensions of the test specimen, and Poisson's ratio. **(C1499)**

equibiaxial flexural strength, [F/L^2], *n*—the maximum stress that a material is capable of sustaining when subjected to flexure between two concentric rings. **(C1368)**

erosion resistance, electrical, *n*—the resistance of electrical insulating materials to erosion by the action of electrical discharges.

estimator, *n*—well-defined function that is dependent on the observations in a sample. The resulting value for a given sample may be an estimate of a distribution parameter (a point estimate) associated with the underlying population. The arithmetic average of a sample is, for example, an estimator of the distribution mean. **(C1239)**

exclusive flaw distributions, *n*—type of multiple flaw distribution created by mixing and randomizing test specimens

from two or more versions of a material where each version contains a different single flaw population. Thus, each test specimen contains flaws exclusively from a single distribution, but the total data set reflects more than one type of strength-controlling flaw. This term is synonymous with "mixtures of flaw distributions." **(C1239)**

exothermic reaction, *n*—a chemical reaction in which heat is evolved.

extraneous flaws, *n*—strength-controlling flaws observed in some fraction of test specimens that cannot be present in the component being designed. An example is machining flaws in ground bend test specimens that will not be present in as-sintered components of the same material. **(C1239)**

extrude, *v*—to shape a plastic body by forcing the body through a die.

extruder, *n*—a device, such as a pug mill, that forces plastic bodies through a die of appropriate shape and size in a continuous column.

feed, gravity, *n*—the movement of materials from one container to another container or location by force of gravity.

filament, *n*—a long flexible thread of small cross section, usually extruded or drawn.

film, *n*—a thin coating or layer of a substance over the surface of another material.

fineness, *n*—a measurement number designating the particle size of a material, usually reported as passing a screen of a particular standard size.

fines, *n*—the portions of a powder composed of particles smaller than a specified size.

finish grinding, *n*—the completion of a grinding operation to obtain a desired surface appearance or accurate dimensions.

firing expansion, *n*—the increase in the dimensions of a substance or product during thermal treatment.

fissures, *n*—surface defects consisting of narrow openings or cracks.

fixed-feed grinding, *n*—the process of feeding a material to be ground to a grinding wheel at a given rate or in specific increments.

flaw, *n*—structural discontinuity in an advanced ceramic body that acts as a highly localized stress raiser. **(C1322)**

DISCUSSION—The presence of such discontinuities does not necessarily imply that the ceramic has been prepared improperly or is faulty.

flexural strength, [FL^{-2}], *n*—a measure of the ultimate strength of a specified beam in bending. **(C1161, C1211, C1684)**

flexural strength, σ_f, [FL^{-2}], *n*—a measure of the strength of a specified beam specimen in bending determined at a given stress rate in a particular environment. **(C1368)**

fluid carrier, *n*—a fluid in which particles are suspended to facilitate their movement or application.

fluid-energy mill, *n*—a size-reduction apparatus in which grinding is achieved by the collision of the particles being ground in a high-velocity steam of air, steam, or other fluid.

fluorescent penetrant, *n*—an inspection penetrant which fluoresces or glows in ultraviolet light.

fluxing agent, *n*—any substance which will promote fusion of ceramic materials.

four-point-⅓-point flexure, *n*—a configuration of flexural strength testing where a test specimen is symmetrically loaded at two locations that are situated one third of the overall span away from the outer two support bearings. **(C1341)**

four-point-¼-point flexure, *n*—configuration of flexural strength testing where a specimen is symmetrically loaded at two locations that are situated one quarter of the overall span, away from the outer two support bearings. **(C1161)**

fractional open frontal area, (OFA), [ND], *n*—a fractional ratio of the open frontal area of the honeycomb architecture, calculated by dividing the total frontal area of the open channels by the full frontal area of the full size specimen, as a whole. **(C1674)**

DISCUSSION—The fractional open frontal area of the full size specimen can be calculated from the shape and dimensions of the cells and the wall thickness between cells.

fractionation, elastic, *n*—a process in which soft aggregate is separated from harder aggregate by hurling the composite aggregate against a steel plate, the hard particles rebounding farther from the plate than the softer, more friable particles.

fractography, *n*—means and methods for characterizing a fractured specimen or component. **(C1322)**

fractography, *n*—analysis and characterization of patterns generated on the fracture surface of a test specimen. Fractography can be used to determine the nature and location of the critical fracture origin causing catastrophic failure in an advanced ceramic test specimen or component. **(C1239)**

fracture origin, *n*—the source from which brittle fracture commences. **(C1239, C1322)**

fracture, spontaneous, *n*—cracking or chipping which occurs without immediately apparent external causes.

fracture strength (F/L^2), *n*—tensile stress that the material sustains at the instant of fracture. Fracture strength is calculated from the force at fracture during a tension test carried to rupture and the original cross-sectional area of the test specimen. **(C1337)**

DISCUSSION—In some cases, the fracture strength may be identical to the tensile strength if the load at fracture is the maximum for the test. Factors such as load train compliance and fiber pull-out behavior may influence the fracture strength.

fracture toughness, *n*—a generic term for measures of resistance to crack extension.

fully articulating fixture, *n*—a flexure fixture designed to be used either with flat and parallel specimens or with uneven

or nonparallel specimens. The fixture allows full independent articulation, or pivoting, of all rollers about the specimen long axis to match the specimen surface. In addition, the upper or lower pairs are free to pivot to distribute force evenly to the bearing cylinders on either side. **(C1161)**

Discussion—A three-point fixture has the inner pair of bearing cylinders replaced by a single bearing cylinder.

fundamental adhesion, *n*—summation of all interfacial intermolecular interactions between a film or coating and its substrate. **(C1624)**

furnace, arc-image, *n*—a furnace in which high temperatures are produced by focusing radiation from high-temperature arcs into the furnace chamber.

furnace, image, *n*—a furnace in which high temperatures are generated by focusing radiation from a high-temperature source, such as the sun or an electric arc.

furnace, recuperative, *n*—a furnace equipped with a heat exchanger in which heat is conducted from the combustion products through a system of ducts or through flue walls in a manner so as to preheat the air as it enters the burner to unite with the fuel.

furnace, regenerative, *n*—a furnace having a cyclic heat exchanger which alternately receives heat from gaseous combustion products and transfers heat to the air or gas of the fuel mixture before combustion takes place.

furnace, solar, *n*—an image-type furnace in which solar radiation is focused into a relatively small area as a source of heat producing extremely high temperatures.

furnace, thermal gradient, *n*—a tubular furnace in which a controlled temperature gradient is maintained along its length.

fuse, *v*—to melt or join by the use of heat.

fusion casting, *n*—the process of forming items by casting molten materials in mold.

fusion point, *n*—the temperature or range of temperatures at which melting or softening, as a result of partial melting, of a composition, will occur.

fusion test, *n*—any test to determine the temperature or range of temperatures at which fusion takes place, or to determine the flow or other properties of a material at fusion temperatures.

gel, *n*—a semisolid system consisting of a network of solid aggregates in which liquid is held.

grain boundary (GB), *n*—as used in fractography, a volume-distributed flaw that is a boundary facet between two or more grains. **(C1322)**

Discussion—This flaw is most apt to be strength limiting in course-grained ceramics.

grinding axis, *n*—any reference line along which the workpiece is translated or about which it is rotated to effect the removal of material during grinding. **(C1495)**

grinding damage, *n*—any change in a material that is a result of the application of a surface grinding process. Among the types of damage are microcracks, dislocations, twins, stacking faults, voids, and transformed phases. **(C1495)**

Discussion—Although they do not represent internal changes in microstructure, chips and surface pits, which are a manifestation of microfracture, and abnormally large grinding striations are often referred to as grinding damage. Residual stresses that result from microstructural changes may also be referred to as grinding damage.

grinding direction, *n*—when used in reference to flexure test bars, refers to the angle between the long (tensile) axis of the flexure bar and the path followed by grit in the grinding wheel as they move across the ground surface. See longitudinal grinding direction and transverse grinding direction. **(C1495)**

grit depth-of-cut, *n*—nominal maximum depth that individual grit on the grinding wheel penetrate the workpiece surface during grinding. Synonymous with undeformed chip thickness. **(C1495)**

hackle, *n*—as used in fractography, a line or lines on the crack surface running in the local direction of cracking, separating parallel but non-coplanar portions of the crack surface. **(C1322)**

handling damage, (HD), *n—as used in fractography*, scratches, chips, cracks, etc., due to the handling of the specimen/component.

homogeneous, *adj*—the condition of a material in which the relevant properties (composition, structure, density, and so forth) are not a function of position for sample size used, so that a small sample taken from any location in an original body is representative of the whole. Practically, the geometrical dimensions of the sample must be large with respect to the size of the individual grains, crystals, components, pores or microcracks.

homogeneous, *n*—condition of a material in which the relevant properties (composition, structure, density, etc.) are uniform, so that any smaller sample taken from an original body is representative of the whole. Practically, as long as the geometrical dimensions of a sample are large with respect to the size of the individual grains, crystals, components, pores, or microcracks, the sample can be considered homogeneous. **(C1499)**

honeycomb cellular architecture, *n*—an engineered component architecture in which long cylindrical cells of defined geometric cross-section form a porous structure with open channels in one dimension and a nominal closed-cell architecture in the remaining two dimensions. The cross sectional geometry of the honeycomb cells can have a variety of shapes—square, hexagonal, triangular, circular, etc. **(C1674)**

Discussion—The cell walls in a honeycomb structure may have controlled wall porosity levels, engineered for filtering, separation effects, and mechanical strength.

honeycomb structure strength, S_{HS}, $[FL^{-2}]$, *n*—a measure of the maximum strength in bending of a specified honeycomb