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Standard Terminology Relating to Rubber[1]

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1. Scope

1.1 This terminology covers definitions of technical terms used in the rubber industry. Terms that are generally understood or adequately defined in other readily available sources are not included.

1.2 Definitions for terms that have been established by other bodies recognized as expert in the field will, after ballot approval, be inserted in this terminology without change, and the source of the definition will be identified. Exceptions to this rule will be where the meaning of the term as used in the rubber industry is different from the common meaning of the term.

1.3 Users of this terminology who require mathematical expressions for the time and temperature dependent physical properties of some terms found in this standard should refer to Guide D5992 and other standards listed under referenced documents. Selected terms from Guide D5992 may be found in Annex A1.

1.4 Although this terminology standard avoids the inclusion of jargon and archaic terms as much as possible, some terms have been retained for historical reasons.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D925 Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)

D1076 Specification for Rubber—Concentrated, Ammonia Preserved, Creamed, and Centrifuged Natural Latex

D1148 Test Method for Rubber Deterioration—Discoloration from Ultraviolet (UV) or UV/Visible Radiation and Heat Exposure of Light-Colored Surfaces

D1415 Test Method for Rubber Property—International Hardness

D1646 Test Methods for Rubber—Viscosity, Stress Relaxation, and Pre-Vulcanization Characteristics (Mooney Viscometer)

D1765 Classification System for Carbon Blacks Used in Rubber Products

D3053 Terminology Relating to Carbon Black

D5992 Guide for Dynamic Testing of Vulcanized Rubber and Rubber-Like Materials Using Vibratory Methods

D6085 Practice for Sampling in Rubber Testing—Terminology and Basic Concepts

E6 Terminology Relating to Methods of Mechanical Testing

E20 Practice for Particle Size Analysis of Particulate Substances in the Range of 0.2 to 75 Micrometres by Optical Microscopy (Withdrawn 1994)[3]

E28 Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

E111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus

E126 Test Method for Inspection, Calibration, and Verification of ASTM Hydrometers

2.2 *ISO Standards:*[4]

1382-82 Rubber-Vocabulary Second Edition (Addendum 16-18-1998)

3. Terminology

abrasion, *n*—surface loss of a material due to frictional forces.

abrasion resistance index, *n*—measure of the abrasion resistance of a rubber relative to that of a standard rubber under the same specified conditions, expressed as a percentage.

accelerated life test, *n*—test method designed to approximate in a short time, the deteriorating effect of normal long-term service conditions.

accelerator, delayed action, *n*—accelerator that, in conjunction with other curing agent(s), produces, at vulcanizing

[1] This terminology is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.08 on Terminology.

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The boldface designations refer to the original source of the definition and the ASTM technical committee having jurisdiction.

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

[4] Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland.

temperatures, a period of no significant cross-linking, followed by a period of rapid cross-link formation.

accelerator (rubber), *n*—compounding material used in small amounts with a vulcanizing agent to increase the speed of vulcanization.

DISCUSSION—Properties of a vulcanizate are changed by the type or amount of accelerator used.

activator, *n*—compounding material used in small proportions to increase the effectiveness of an accelerator.

adhesion, *n*—condition in which surfaces are held together by chemical or physical forces or both.

adhesion failure, *n*—loss of structural integrity due to the separation of two bonded surfaces at the bond interface.

adhesion value, *n*—force required to cause adhesion failure.

DISCUSSION—Any separation occurring at any other point, for example, inside either component under test, is a failure of the component material, and such separation should not be considered as indicating adhesion strength.

adhesive failure, *n*—separation of two bonded surfaces that occurs within the bonding material.

DISCUSSION—Adhesive failure occurs when the adhesive strength of a bonding material is greater than its cohesive strength.

aftercure, *n*—continuation of the process of vulcanization after the energy source has been removed.

age resistance, *n*—ability of a material to resist deterioration caused by ageing.

agglomerate, compounding material, *n*—cluster of particles of one or more compounding materials loosely held together.

agglomerate, latex, *n*—cluster of rubber particles in a colloidal aqueous suspension of such particles.

agglomerates, *n*—clusters of particles of compounding materials contained in a continuous rubber phase.

agglomeration (latex), *n*—reversible or irreversible joining together of latex particles.

ageing (act of), *n*—exposure of materials to a deteriorating environment for a specified time interval.

ageing (rubber), *n*—irreversible change of material properties during exposure to a deteriorating environment, for a specified time interval.

ageing, accelerated, *n*—exposure of rubber to a test environment with the intent of producing, in a shorter time period, effects similar to normal ageing.

ageing, air bomb, *n*—process of exposing materials to the action of air at an elevated temperature and pressure.

ageing, air oven, *n*—process of exposing materials to the action of air at an elevated temperature at atmospheric pressure.

ageing, natural, *n*—ageing under normal service conditions.

ageing, oxygen bomb, *n*—process of exposing materials to the action of oxygen at an elevated temperature and pressure.

ageing, shelf, *n*—ageing during storage.

alloy, *n*—unique composition of two or more polymers that has one or more of the polymers treated or processed in a special way to confer enhanced performance characteristics on the resulting material.

anticoagulant (natural rubber latex), *n*—substance added to field latex from *Havea brasiliensis* or to guayule latex to retard bacterial action which would otherwise cause rapid coagulation of the latex.

DISCUSSION—The word "stabilizer" is often used in place of "anticoagulant" in latex terminology.

antidegradant, *n*—compounding material used to retard deterioration caused by oxidation, ozone, light, and combinations of these.

DISCUSSION—"Antidegradant" is a generic term for such additives as antioxidants, antiozonants, and waxes.

antiflex cracking agent, *n*—compounding material used to retard cracking caused by cyclic deformations.

antifoaming agent, *n*—agent that inhibits bubble formation in an agitated liquid, usually by reducing the surface tension.

antioxidant, *n*—compounding material used to retard deterioration caused by oxidation.

antiozonant, *n*—compounding material used to retard deterioration caused by ozone.

antistatic agent, *n*—material which reduces the tendency for accumulation of electric charge on the surface of an article.

apparent density, *n*—See **density, bulk**, the preferred term.

aromatic oil, *n*—hydrocarbon process oil containing at least 35 %, by mass, of aromatic hydrocarbons.

ash, *n*—residue from incineration of a material under specified conditions.

autoclave (rubber), *n*—pressure vessel used for vulcanizing rubber products by means of steam under pressure.

backrinding, *n*—molding defect in which the rubber adjacent to the spew line shrinks below the surface of the molded product, with the spew line often being ragged and torn.

bag cure, *n*—method of vulcanization in which an inflated flexible bag is used to impart positive internal pressure on the article being vulcanized.

balata, *n*—hard thermoplastic consisting of approximately equal proportions of trans-polyisoprene and resin, obtained from trees of the *Sapotaceae* family.

bale coating, *n*—coating applied to surfaces of rubber bales that inhibits adhesion to other surfaces.

ball mill, *n*—closed rotating cylinder containing hard balls (or other shaped members) that serves to grind coarse materials to a finer particle size.

bank (mill, calender, or spreader), *n*—reservoir of material at the opening between rolls (mill or calender), or at the spreader bar.

batch, *n*—product of one mixing operation.

bench marks, *n*—two marks of known separation applied to a specimen to measure the strain of the specimen during extension.

black scorch, *n*—significant, reversible increase in the elastic properties of a rubber compound due to interactions between the polymer and carbon black.

DISCUSSION—The term "black scorch" is not related to "scorch."

blank, *n*—portion of a rubber compound of suitable volume to fill the cavity of a mold.

bleeding, *n*—exuding of a liquid compounding material from the surface of a vulcanized or unvulcanized rubber.

blister(s), *n*—surface or internal imperfection(s), produced by entrapped gases or other volatiles, during the manufacture of rubber articles.

block copolymer, *n*—polymer consisting of alternating groups of monomer units, typically in the sequence A-B-A, where group A contains a set of identical monomer units and group B contains a different set of identical monomer units.

bloom (rubber), *n*—liquid or solid material that has migrated to the surface of a rubber and generally changes the surface appearance.

blow, *n*—volume expansion that occurs during the production of cellular or sponge rubber.

blowing agent, *n*—compounding material used to produce gas by chemical or physical action, or both, in the manufacture of hollow or cellular articles.

booster, *n*—synonym for **secondary accelerator**, which is the preferred term.

bound monomer, *n*—monomer that is combined or reacted with itself or other types of monomers in a polymerization reaction to form a polymer.

DISCUSSION—This term is used in synthetic rubber production, and the bound monomer is normally expressed as a percentage of total polymer.

bound rubber, *n*—nonvulcanized polymer attached to a filler through any combination of absorption, chemisxorption, physical entrapment, or crosslinking of free molecules; the polymer-filler combination is insoluble in solvents that normally dissolve the polymer.

branched polymer, *n*—polymer that has side chains of the same monomer composition as the main chain attached at points along the main chain.

buffing rubber, *n*—particulate rubber produced as a byproduct of the buffing operation in the carcass preparation stage of a tire retreading; characterized by a wide range of particle sizes that are predominately elongated or acicular in shape. See **particulate rubber**.

DISCUSSION—The appearance of the unique shape of the particles of this material is only apparent in finished goods or products that contain particles having a dimension greater in size than 600 µm (30 mesh).

bulk density, *n*—mass per unit volume of a material, including any voids present.

bumping, molding process, *n*—application, release, and reapplication of pressure prior to the start of vulcanization to vent entrapped gases, thereby facilitating complete filling of the mold.

calender, *n*—machine with two or more parallel, counter-rotating rolls with a controllable, roll-to-roll spacing, rotating at selected surface speeds and controlled temperatures, used for sheeting, laminating, skim coating (topping) and friction coating, to a controlled thickness and/or surface condition.

carbon black, *n*—material consisting essentially of elemental carbon in the form of near-spherical colloidal particles and coalesced particle aggregates of colloidal size, obtained by partial combustion or thermal decomposition of hydrocarbons. **D3053**

carbon black, thermal, *n*—type of carbon black produced under controlled conditions by the thermal decomposition of hydrocarbons in the absence of air or flames.

DISCUSSION—These grades are designated with an "N" first character and a second character of "8 or 9" in Table 1 of Classification D1765. **D3053**

carbon black, thermal, acetylenic, *n*—thermal black produced from acetylene gas **D3053**

carbon gel (carbon-rubber-gel), *n*—portion of rubber that is not leached by a solvent under specified conditions, from an intimate mixture of carbon black and unvulcanized rubber.

carcass, *n*—fabric, cord, or metal reinforced section, or all three, of a rubber product as distinguished from the rubber tube, cover, or tread.

cell, *n*—single small cavity surrounded partially or completely by walls.

cell, closed, *n*—cell totally enclosed by its walls, hence not interconnecting with other cells.

cell, open, *n*—cell not totally enclosed by its walls and hence interconnecting with other cells.

cellular material, *n*—generic term for materials containing many cells (either open, closed, or both) dispersed throughout the mass.

cellular material, collapse, *n*—undesirable densification of a cellular material resulting from the breakdown of its cellular structure.

cellular material, cored, *n*—cellular material containing a multiplicity of holes (usually, but not necessarily, cylindrical in shape), molded or cut into the material in some pattern normally perpendicular to the largest surface, and extending part or all the way through the piece.

cellular material, flexible, *n*—cellular organic polymeric material that will not rupture when a specimen 200 by 25 by 25 mm (8 by 1 by 1 in.) is bent around a 25-mm (1-in.) diameter mandrel at a uniform rate of one lap in 5 s at a temperature between 18 and 29°C.

cellular rubber, *n*—rubber products containing cells or hollow receptacles which may be open, interconnecting, or closed and not interconnecting.

cellular striation, *n*—condition characterized by a layer within a cellular material that differs greatly from the characteristic cell structure.

cement, rubber, *n*—adhesive that is either a liquid dispersion or solution of raw or compounded rubber, or both.

centrifuged rubber latex, *n*—latex, the rubber concentration of which has been increased by the removal of water by centrifugal force.

chalking (rubber), *n*—formation of a powdery residue on the surface of a rubber, commonly resulting from surface degradation.

chatter marks, *n*—defect on calendered sheeting consisting of transverse narrow bands of alternately thicker and thinner material.

coagent, *n*—compounding ingredient used in small amounts to increase the crosslinking efficiency of certain non-sulfur vulcanizing systems, or to modify the properties given by such systems.

DISCUSSION—The term is usually identified with additives used to modify vulcanization by organic peroxides.

coagulant dipping (latex), *n*—dipping process in which the product form is first immersed in a coagulant solution, withdrawn, dried, and then immersed in the latex.

coagulating agent, *n*—any material used to transform a liquid or colloid system into a curdlike, semisolid, or solid-state system.

DISCUSSION—The transformation permits a separation of the solid from the remaining liquid by a chemical reaction and interaction, but not by evaporation or freezing.

coagulation (rubber latex), *n*—irreversible agglomeration of particles originally dispersed in a rubber latex.

coagulum (latex), *n*—undesirable, irreversible, agglomeration of rubber particles retained on a 180-µm mesh screen. **D1076**

coated fabric, *n*—flexible product composed of a textile fabric and an adherent polymeric material applied to one or both surfaces.

cohesive failure (bonded assembly), *n*—rupture occurring entirely within any single uniform layer of the assembly.

cold checks, *n*—defect on calendered sheeting consisting of surface roughness.

cold flow (unvulcanized rubber), *n*—slow deformation, under gravitational force, at or below room temperature.

colorfast, rubber, *n*—ability of a rubber compound to resist changes in color.

colorfast rubber, *n*—a rubber compound that resists changes in color.

comonomer, *n*—one of two or more monomer species that polymerize to form a copolymer.

complex shear modulus, G*, *n*—ratio of shear stress to shear strain, where both may include elastic and viscous components.

complex Young's modulus, E*, *n*—ratio of normal stress to normal strain, where both may include elastic and viscous components, typically measured at low strains.

compound, *n*—intimate admixture of a polymer(s) with all the materials necessary for the finished article.

compound, standard, *n*—control or reference compound prepared according to a prescribed formula and mixing procedure.

compounding ingredient, *n*—See **compounding material**, the preferred term.

compounding material, *n*—substance used as part of a rubber mix.

compression molding, *n*—molding process in which the material is placed directly in the mold cavity and compressed to shape by closure of the mold.

compression set, *n*—residual deformation of a material after removal of the compressive stress.

conditioning (environmental), *n*—storage of a rubber, under specified conditions (time, temperature, humidity) prior to testing.

conditioning (mechanical), *n*—prescribed program of deformation of a specimen prior to testing.

continuous vulcanization, *n*—process where a shaped article passes without pause through conditions designed to create a vulcanization reaction.

conventional sulfur vulcanizing system, *n*—as applied to natural and isoprene rubbers and butadiene-based synthetic rubbers, a vulcanizing system using a relatively high proportion of sulfur in which the combined sulfur exists predominantly in the polysulfidic cross links chain modifications.

DISCUSSION—The amount of free sulfur and the ratio of free sulfur to accelerator will vary from rubber to rubber.

copolymer, *n*—polymer formed from two different monomers.

copolymerization, *n*—polymerization of two or more different monomers into a single polymer.

coupling agent, *n*—a material that promotes a bond between a polymer and a filler, or between a polymer and an additive.

cracker, *n*—heavy-duty mill having two deeply corrugated or pyramid-cut rolls for breaking down a rubber or a mix, or for cutting rubber or a mix into pieces.

cracks, *n*—fissure(s) originating in the surface of a rubber vulcanizate or product as a result of natural weathering.

cracks, flex, *n*—fissures originating in the surface of a rubber vulcanizate, resulting from cyclic deformation (usually bending).

crack(s), ozone, *n*—fissure(s) originating in the surface of a rubber vulcanizate, caused by exposure to an ozone-containing environment; these fissures are perpendicular to the direction of strain, and usually occur in rubbers having main chain unsaturation.

crazing, *n*—formation of a random pattern of shallow cracks on a rubber surface usually due to ageing by light.

DISCUSSION—Unlike ozone cracking, crazing does not depend on the presence of a tensile strain in the rubber.

creaming (rubber latex), *n*—reversible process of concentration by gravitational force of rubber particles near the bottom or top of the latex.

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

crosslink, *n*—chemical bond bridging one polymer chain to another.

crosslink density, *n*—number of crosslinks per unit mass or volume of vulcanizate.

DISCUSSION—The units of crosslink density will indicate whether it is per unit mass or per unit volume.

crosslinking (the act of), *n*—formation of chemical bonds between polymer chains to give a network structure.

crowsfeet, *n*—small flowmarks of V-shape on calendered sheeting.

crystallization, polymer, *n*—arrangement of previously disordered polymer segments of repeating patterns into geometric symmetry.

cure, *n*—See **vulcanization**, the preferred term.

cure meter, *n*—testing device that measures the progress of vulcanization at a vulcanizing temperature.

DISCUSSION—The measured property, normally proportional to the complex dynamic modulus, is recorded at closely spaced time intervals to produce a quasi-continuous measured property versus time curve.

cure rate, *n*—time-dependent progress of vulcanization, measured as a change in vulcanizate properties per unit time, where this rate varies over the time period.

curing agent, *n*—synonym for **vulcanizing agent**, the preferred term.

delta Mooney value, *n*—measure of the processability of a non-pigmented emulsion SBR based on the difference in viscosity recorded at specific times by a Mooney viscometer.

density, *n*—mass per unit volume of a material. **E126, E20**

density, bulk, *n*—mass per unit volume of a material, including any voids present.

desiccant, *n*—compounding material used to irreversibly absorb moisture present (in a rubber mix) particularly for the purpose of minimizing risk of porosity during vulcanization.

devulcanization, *n*—destruction of the chemical crosslinks in a vulcanized rubber.

die, cutting, *n*—single planar form having sharpened edges that is forced, in a fixed or rotating fashion, upon a material, thus resulting in a desired shape.

die, extruder, *n*—orifice with a specific geometry through which material is forced, causing the extrudate to have a specific profile.

die swell, *n*—difference between the dimensions of the cross section of an extrudate and the corresponding dimensions of the die orifice by which the extrudate is formed.

DISCUSSION—It is usually quantified as the percentage increases in the cross-sectional area.

diene polymer, *n*—polymer formed from one or more monomer species, at least one of which is a diolefin.

diene rubber, *n*—polymer having unsaturated carbon in the main chain, derived from butadiene or a substituted butadiene.

dipping (latex), *n*—process in which a layer of rubber is deposited on a mold or form as a result of immersion in a bath of compounded latex.

dispersing agent (latex), *n*—surface-active substance used to facilitate the suspension of solid compounding materials in a liquid medium and to stabilize the dispersion thereby produced.

dispersion (the act of), *n*—application of shearing forces to distribute one or more compounding materials uniformly throughout the mass of a continuum of material.

dough (rubber), *n*—paste-like mass of smooth texture, consisting of a rubber mix and solvent; it is used for spreading.

dumbbell specimen (rubber), *n*—flat specimen having a narrow straight central portion of essentially uniform cross section with enlarged ends. **D412**

durometer, *n*—instrument for measuring the indentation hardness of rubber.

dusting, *n*—application of a powder to a rubber surface, generally to prevent adhesion to another surface.

dynamic vulcanizate, *n*—See **thermoplastic vulcanizate**, the preferred term.

dynamic vulcanization, *n*—process of intimate melt mixing a thermoplastic polymer and a suitable reactive rubbery polymer to generate a thermoplastic elastomer with a chemically cross-linked rubbery phase resulting in properties close to those of a thermoset rubber when compared to the same cross-linked composition.

ebonite, *n*—hard material made by sulfur vulcanization of rubber, in which the hardness is substantially obtained by the action of the sulfur.

efficient vulcanizing (EV) systems, *n*—as applied to natural rubbers and isoprene- and butadiene-based synthetic rubbers, a vulcanizing system making efficient use of sulfur and producing at optimum cure a network containing a preponderance of thermally stable monosulfidic crosslinks.

DISCUSSION—EV systems are comprised of a sulfur donor or a combination of low concentration of free sulfur (for example, <0.5 parts per hundred parts of rubber), or both, at a comparatively high concentration of accelerator(s).

elastic, *adj*—of or pertaining to elasticity.

elastic limit, *n*—greatest stress that a material is capable of sustaining, without any permanent strain remaining, upon complete release of the stress. **E6, E28**

elastic (storage) shear modulus, G', *n*—ratio of the shear stress component in phase with the shear strain, to the shear strain.

elastic Young's modulus, E', *n*—ratio of the normal stress component in phase with the normal strain, to the normal strain, typically measured at low strains.

elasticity, *n*—rapid recovery of a material to its approximate initial shape and dimensions after substantial deformation by force and subsequent release of that force.

elastomer, *n*—an elastic polymer.

elongation, *n*—extension produced by a tensile stress.

elongation, percent, *n*—extension of a uniform section of a specimen expressed as percent of the original length.

DISCUSSION—Elongation, % =

$$\frac{(\text{final length} - \text{original length})}{\text{original length}} \times 100$$

elongation, ultimate, *n*—elongation at the time of rupture.

emulsifying agent (latex), *n*—surface-active substance used to facilitate the dispersion of an immiscible liquid compounding material in another liquid and to stabilize the emulsion thereby produced.

emulsion polymerization, *n*—process in which one or more monomers are dispersed in a micelle generating medium (such as soap or surfactants, or both) to form a stable, colloidal, aqueous dispersion for the purpose of carrying out an addition polymerization reaction.

DISCUSSION—The resulting product is a colloidally dispersed polymer system known as latex.

expanded rubber (sponge), *n*—cellular rubber having closed cells, made from solid rubber compound.

extender, *n*—organic material used to augment the polymer in a compound.

extensometer, *n*—device for determining elongation of a specimen as it is strained.

extrudate, *n*—material that issues from an extruder.

extruder, *n*—machine designed to force a rubber or rubber mix through an orifice, which is often shaped to the geometry of the desired product.

extrusion, *n*—continuous shaping of a material during plastic passage through a die.

extrusion mark (score line), *n*—mark formed on an extrudate during the extrusion process either by accident or intent.

fatigue, dynamic, *n*—deterioration of a material by repeated deformation. See **fatigue breakdown**.

fatigue breakdown, *n*—deterioration of an elastomeric product during repeated deformation.

fatigue life, *n*—number of deformations required to produce a specified state of fatigue breakdown in a test specimen or product that is deformed under a prescribed set of conditions.

field latex, *n*—See **latex, field**.

filler, *n*—solid compounding material, usually in finely divided form, which may be added in relatively large proportions to a polymer for technical or economic reasons.

filler, inert, *n*—filler having no reinforcing effect.

flash, *n*—excess material protruding from the surface of a molded article at the mold junctions.

flat cure, *n*—synonym for **plateau vulcanization**.

flex life, *n*—number of cycles required to produce a specified state of failure in a specimen that is flexed in a prescribed method.

flexometer, *n*—machine that subjects a test specimen to repeated deformation by compression, tension, shear, bending, torsion, or any combination thereof.

flocculation, *n*—formation (sometimes reversible) of loosely coherent, partially agglomerated rubber, distributed in the liquid phase of a latex.

flow marks, *n*—marks or line on a molded product, caused by imperfect fusion of flowing fronts.

foam stabilizer (latex), *n*—substance used in the preparation of latex foam, before gelation, drying, and vulcanization to help maintain the foam cell structure.

foaming agent (latex), *n*—substance used to facilitate the formation of suspended gas in latex during the production of latex foam.

former (latex), *n*—shaped object on which a rubber article is produced by dipping into a latex, from which the article is subsequently removed.

formula, *n*—list of the materials and their amounts used in the preparation of a compound.

friction coat, calender, *n*—layer of rubber compound applied to a fabric by shearing action so that it impregnates the fabric.

friction coating, *n*—applying a rubber coat (friction coat) on a textile by shearing action so that the coat impregnates the textile.

friction ratio, *n*—ratio of surface speeds of two adjacent rolls (mill, calender, or refiner).

frosting, *n*—formation of a matte, whitish appearance on a rubber surface exposed to air, resulting from the action of ozone; often confused with bloom.

furnace carbon black, *n*—type of carbon black produced by the decomposition reaction of hydrocarbons when injected into a high velocity stream of combustion gases under controlled conditions. D3053

gasket (mechanical), *n*—deformable material clamped between essentially stationary faces to prevent the passage of matter through an opening or joint.

gate (injection or transfer mold), *n*—orifice through which a shaped cavity in a mold is filled with material.

gauge length, *n*—known distance between bench marks.

gel, dry rubber, *n*—portion of unvulcanized rubber insoluble in a chosen solvent.

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

gel rubber, *n*—that portion of raw rubber insoluble in a specific solvent, in which, in the absence of crosslinking, the raw rubber would be soluble.

gel time, *n*—period of time from the initial mixing of the reactants of a plastic or rubber composition to the time when gelation occurs as defined by a specified test.

gelling (latex), *n*—formation of a uniform coagulum from which the aqueous phase has not been separated.

grain, *n*—anisotropy introduced into rubber during processing operations.

granulated rubber, *n*—particulate rubber composed of mainly non-spherical particles that span a broad range of maximum "particle dimension" from below 425 µm (40 mesh) to 12 mm (0.47 in.); the key feature of this type of particulate rubber is the fraction of the material in the greater than 1-mm (0.08-in.) up to 12-mm (0.47-in.) maximum "particle dimension" range. See **particulate rubber**.

DISCUSSION—For any particulate rubber, any measurable fraction, for example, 0.1 % of particles in the greater than 2-mm (0.08-in.) to 12-mm (0.47-in.) range confers on that material the title "granulated rubber," despite a substantial fraction of particles in a much smaller particle dimension range.

green strength, *n*—characteristic property of a raw rubber or an unvulcanized rubber compound that indicates resistance to deformation when stress is applied.

ground rubber, *n*—particulate rubber composed of mainly non-spherical particles that span a range of maximum "particle dimension" from well below 425 µm (40 mesh) to 2 mm (0.08 in.) as a maximum "particle dimension." See **particulate rubber**.

DISCUSSION—For any particulate rubber, any measurable fraction, for example 0.1 % of particles in the greater than 425-µm (40 mesh) to 2-mm (0.08 in.) range with no particles in the greater than 2-mm (0.08 in.) to 12-mm (0.47 in.) range confers on that material the title "ground rubber," despite a substantial fraction of particles in a much smaller particle dimension range.

ground vulcanized rubber, *n*—vulcanized rubber in particulate form; used as an extender or filler.

guayule natural rubber, *n*—naturally occurring *cis*-1,4-polyisoprene obtained from the shrub, *Parthenium argentatum.*

gum compound, *n*—rubber compound containing only those ingredients necessary for vulcanization and small amounts of other ingredients for processing, coloring, and for improving the resistance to ageing.

gutta-percha, *n*—hard thermoplastic substance, mainly *trans*-polyisoprene obtained from trees of the *Sapotaceae* family.

hard rubber, *n*—deprecated term, see **ebonite**.

hardness, *n*—physical property of a rubber vulcanizate, characterized by resistance to indentation.

heat buildup, *n*—accumulation of thermal energy generated within a material as a result of hysteresis, evidenced by an increase in temperature.

heat-sensitive dipping (latex), *n*—dipping process in which a heated form is immersed in latex containing a substance that causes the latex to gel at an elevated temperature.

heat sensitizer, *n*—gelling agent effective only at elevated temperature.

Hevea natural rubber, *n*—naturally occurring *cis*-1,4-polyisoprene obtained from the tree, *Hevea brasiliensis*.

holland cloth, *n*—completely filled woven fabric (usually starch-filled linen) with a smooth glass-like finish on both sides, used as a separating medium for raw rubber and rubber compounds.

homogenization (raw rubber), *n*—repeated passage of raw rubber through a mill or other mixing device, under specified conditions, to ensure uniformity.

homopolymer, *n*—polymer formed from a single monomer species.

hose, *n*—flexible conduit consisting of a tube, reinforcement, and usually an outer cover.

hose assembly, *n*—length of hose with a coupling attached to one or each end.

hydrocarbon resins, *n*—plastic materials made by the polymerization of monomers composed on only hydrogen and carbon.

hysteresis, *n*—conversion of mechanical energy to heat in rubber undergoing strain.

DISCUSSION—Hysteresis is accompanied by a phase shift in which the strain lags behind the stress, producing damping forces essentially independent of frequency. See Guide D5992.

hysteresis loss, *n*—loss of mechanical energy due to hysteresis.

impact resistance, *n*—resistance to fracture under shock force.

inhibitor, *n*—material used to suppress a chemical reaction.

injection molding, *n*—process by which a rubber compound is forced into a closed mold by pressure other than the mold clamping force.

isotactic, *n*—polymeric molecular structure containing a sequence of regularly spaced asymmetric atoms arranged in like configuration in the polymer chain.

knuckles, *n*—small tough rubber pieces scattered throughout a bale of raw rubber that do not disperse easily or accept carbon black and other compounding materials during mixing.

latex, creamed, *n*—latex, the rubber concentration of which has been increased by creaming and removal of the separated serum.

latex, creaming, *n*—reversible process consisting of gravitational accumulation of rubber particles surrounded by serum, near the top or bottom of the latex.

DISCUSSION—This is generally accomplished by adding a creaming agent.

latex, creaming agent, *n*—material added to latex to promote creaming. See **latex, creaming**.

latex, field, *n*—natural rubber latex from *Hevea brasiliensis* with or without a preservative and prior to concentration or any other processing.

DISCUSSION—The preservative is added to maintain the original state of the latex as it comes from the tree.

latex, guayule, *n*—natural rubber latex from *Parthenium argentatum*, produced by processing the shrub and purifying and concentrating the latex, and with or without the addition of preservatives or stabilizers, or both.

latex, mechanical stability, *n*—the ability of latex to resist coagulation under the influence of mechanical agitation

latex rubber, *n*—colloidal aqueous dispersion of rubber.

leaching (latex), *n*—process in which latex articles are washed in water to remove water-soluble substances.

DISCUSSION—Leaching is used to improve clarity, prevent blooming of hydrophilic materials, and reduce water absorption in the finished rubber articles.

liquid curing medium (LCM), *n*—molten phase, generally a molten mixture of sodium nitrate, that is used as a heating medium for the continuous vulcanization of a rubber mix, usually following extrusion.

loss angle, δ, *n*—measure of the extent (phase shift) that the fundamental sinusoidal component of complex stress leads the fundamental sinusoidal component of dynamic strain in a steady-state sinusoidal deformation.

lot, *n*—mass or collection of articles of similar composition and characteristics.

lubricant (mold), *n*—See **release agent (mold)**, the preferred term.

macromolecular material, *n*—See **polymer**, the preferred term.

marching modulus curve, *n*—type of vulcanization during which the increasing modulus does not reach a maximum value.

masterbatch, *n*—homogeneous mixture of rubber and one or more materials in known proportions for use as a raw material in the preparation of the final compounds.

DISCUSSION—Masterbatches are used to facilitate processing or enhance the properties of the final product, or both.

mastication, *n*—breakdown or softening of raw rubber, or a mix by the combined action of mechanical work (shear) and atmospheric oxygen, sometimes accelerated by the use of a peptizer and frequently at elevated temperatures.

maturation (latex), *n*—controlled storage of compounded latex before processing, which allows stabilization and escape of air bubbles, optimizes dispersion of ingredients, and allows partial pre-vulcanization of rubber particles.

microhardness, *n*—hardness measured with an instrument having a smaller indentor and applying a lower force than the standard instrument, permitting measurements on smaller specimens or thinner sheets that are not amenable to measurement by normal instruments.

DISCUSSION—Microhardness refers to the instrument and procedure used and not a property of the rubber.

mill, *n*—machine used for rubber mastication, mixing, or sheeting, having two counter-rotating rolls with adjustable longitudinal axis separation that usually rotate at different speeds.

mineral rubber, *n*—compounding material (not a rubber) prepared from petroleum asphalt and used as a tackifier, softener, or extender.

mix, *n*—adequate mixture of rubber in any form with other material(s).

mixer, *n*—machine that incorporates and disperses compounding ingredients into rubber to form a mix or a compound, through the action of mechanical work (shear).

mixer, internal, *n*—machine with a closed cavity in which a specially shaped rotor(s) masticates the rubber or incorporates and disperses compounding materials, or both, into the rubber.

modulus, tensile, *n*—See **tensile stress at given elongation**, the preferred term.

modulus, Young's, *n*—ratio of normal stress to corresponding strain for tensile or compressive stresses below the proportional limit of the material. **E111, E28**

DISCUSSION—*proportional limit*, the greatest stress that a material is capable of sustaining without any deviation from proportionality of stress to strain (Hooke's law). **E6, E28**

mold, *n*—a device containing one or more cavities in which a substance can be shaped.

mold cavity, *n*—designated void that produces a geometrically defined shape.

mold lubricant, *n*—synonym for **release agent (mold).**

mold marks, *n*—surface imperfection transferred to a molded product from corresponding marks on a mold.

molding, compression, *n*—process of forming a material to a desired shape by flow induced by a force applied after a material is placed in the mold cavity.

molding, injection, *n*—process of forming a material by forcing it from an external heated chamber through a sprue (runner, gate) into the cavity of a closed mold by means of a pressure gradient that is independent of the mold clamping force.

molding, transfer, *n*—process of forming a material by forcing it from an auxiliary heated chamber through a sprue hole (runner, gate) into the cavity of a closed mold by means of a pressure gradient that is dependent on the mold clamping force.

molding shrinkage, *n*—difference in dimensions between a molded product and the mold cavity in which it was molded, both the mold and product being at normal room temperature when measured.

molecular mass, *n*—synonym for **molecular weight**.

molecular weight, *n*—ratio of the mass of a molecule to one-twelfth (1/12) of the mass (1.6605×10^{-27} kg) of a carbon-12 atom, or the sum of the atomic weights of the atoms in a molecule.

monomer, *n*—low molecular weight substance consisting of molecules capable of reacting with like or unlike molecules to form a polymer.

DISCUSSION—Definition approved by IUPAC.

Mullins Effect, *n*—softening of a vulcanized rubber (reduction in the stress at a given strain) as a result of previous deformation.

naphthenic oil, *n*—hydrocarbon process oil containing more than 30 %, by mass, of naphthenic hydrocarbons.

necking, *n*—localized reduction in cross section that may occur in a material under tensile stress.

nerve, *n*—elastic resistance of unvulcanized rubber or rubber mixes to permanent deformation.

network, *n*—three-dimensional reticulate structure formed by interchain or intrachain bonding of polymer molecules in combination with chain entanglements.

nip, *n*—radial clearance between rolls of a mill or calendar on a line of centers.

non-fill, *n*—defect resulting from the failure of the rubber to fill out all the mold pattern detail.

non-sulfur vulcanizing system, *n*—vulcanizing system not requiring free or donated sulfur.

O-ring, *n*—See **seal, O-ring**.

oligomer, *n*—polymer consisting of only a few monomer units such as a dimer, trimer, tetramer, and the like, or their mixtures.

optimum cure, *n*—state of vulcanization at which a desired property value or combination of property values is obtained.

organosol, *n*—suspension of a finely divided polymer in a plasticizer together with a volatile organic liquid.

oscillating disc cure meter, *n*—test device for determining vulcanization parameters, in which a rotationally oscillating disc is embedded in a rubber specimen in a closed heated cavity and the resistance of the rubber to disc rotation measured versus time.

overcure, *n*—state of vulcanization cure beyond the state of optimum cure.

DISCUSSION—Overcure is generally caused by too long a time or too high a temperature of vulcanization or post-vulcanization, or both, or a surplus of vulcanizing agents, or both.

packing (mechanical), *n*—deformable material used to prevent or control the passage of matter between surfaces that move in relation to each other.

paraffinic oil, *n*—hydrocarbon process oil, most or all of which is composed of alkanes

particulate rubber, *n*—rubber, vulcanized or unvulcanized, that has been transformed into a collection of particles, with or without a coating of a partitioning agent to prevent agglomeration during production, transportation, or storage (see **buffing rubber, granulated rubber, ground rubber**, and **powdered rubber**).

parting line, *n*—another name for **spew line**.

Payne Effect, *n*—in the low amplitude dynamic testing of filled rubbers, the decrease in modulus (G' or E') as the amplitude of deformation is increased.

DISCUSSION—The effect is caused by a decrease in the additive contributions of polymer-polymer interactions, hydrodynamic effects, the polymer-filler and filler-filler interactions.

peptizer (dry rubber), *n*—compounding material used in small proportions to accelerate, by chemical action, the softening of rubber under the influence of mechanical action, or heat, or both.

permeability, *n*—permeation rate divided by the pressure gradient of the gas or vapor. For a homogeneous material that obeys Fick's law, the permeability is equal to the product of the diffusion coefficient and the solubility coefficient of the gas or vapor.

DISCUSSION—Pressure gradient is the pressure differential divided by the distance between opposite faces of a solid body.

DISCUSSION—Homogeneous material is a typical polymer that may contain fillers or curatives, or both, uniformly distributed throughout the mass.

permeance, *n*—permeation rate divided by the pressure differential of a gas or vapor between opposite faces of a solid body.

DISCUSSION—Pressure differential is the difference in gas or vapor pressure across opposite faces of a solid body.

permeation rate, *n*—flow rate of a gas or vapor, under specified conditions, through a prescribed area of a solid body, divided by that area.

pick, *n*—individual filling yarn of a fabric.

piece, test, *n*—see **specimen**, the preferred term. D6085

pigment, *n*—insoluble compounding material used to impart color.

DISCUSSION—The use of "pigment" as a substitute for "compounding material" is discouraged.

plasticity, *n*—characteristic of unvulcanized rubber indicated by the degree of retention of deformation after removal of the deforming force.

Plasticity Retention Index (PRI), *n*—the ratio of a "plasticity number" measured after air-oven ageing, under specified conditions, to a "plasticity number" measured before ageing.

DISCUSSION—This is widely interpreted as a measure of oxidation resistance of raw natural rubber.

plasticizer, *n*—compounding material used to enhance the deformability of a polymeric compound.

plastisol, *n*—suspension of a finely divided polymer in a plasticizer.

plastometer, *n*—instrument for measuring the plasticity of a material.

plateau, vulcanization, *n*—vulcanization during which the value of a desired property proceeds to a maximum or minimum and then remains essentially constant for a substantial period after the initial change.

polymer, *n*—substance consisting of molecules characterized by the repetition (neglecting ends, branch junctions, and other minor irregularities) of one or more types of monomeric units.

polymer network, *n*—three-dimensional reticulate structure formed by chemical or physical linking of polymer chains.

polymerization, *n*—formation of a polymer by the chemical reaction of monomers.

poromer, *n*—See **poromeric material**, the preferred term.

poromeric material, *n*—flexible synthetic leather-like material that is permeable to air and water vapor and usually resistant to water penetration and abrasion.

porosity, *n*—presence of numerous small cavities.

portion, test, *n*—see **sample**, the preferred term. D6085

post cure, *n*—heat or radiation treatment, or both, to which a cured or partially cured thermosetting plastic or rubber composition is subjected, to enhance the level of one or more properties.

pot life, *n*—period of time during which a reacting thermosetting plastic or rubber composition remains suitable for its intended use, after mixing with a reaction-initiating agent.

powdered rubber, *n*—particulate rubber composed of mainly non-spherical particles that have a maximum particle dimension equal to or below 425 µm (40 mesh). See **particulate rubber**.

prebake resistance, *n*—deprecated term, see **precure heat tolerance (adhesives)**.

precoagulum, *n*—coagulum resulting from the partial inadvertent coagulation of a latex.

precrosslinked rubber, *n*—a rubber compound that has been vulcanized to a limited extent, but that may be further formed and vulcanized to a final product state.

precure heat tolerance (adhesives), *n*—amount of exposure (at a certain time and temperature) prior to bonding that a cure-activated adhesive system can tolerate without significant impairment of its adhesion potential.

preservative (latex), *n*—substance added to uncompounded latex before or after concentration to inhibit putrefaction and accompanying coagulation.

prevulcanizate, *n*—latex rubber that has been through a vulcanization reaction to retain its dispersed emulsion character.

prevulcanization inhibitor (PVI), *n*—compounding material that increases the time to incipient vulcanization of a rubber mix.

DISCUSSION—Unlike a retarder, a PVI does not significantly affect the vulcanization rate.

primary accelerator, *n*—principal highest concentration accelerator used in a vulcanizing system.

process oil, *n*—hydrocarbon oil derived from petroleum or other sources, used as an extender or process aid.

processability, *n*—relative ease with which raw or compounded rubber can be handled in rubber machinery.

processing, aid, *n*—compounding material that improves processability of a polymeric compound by reducing nerve, providing better dispersion of dry material, increasing the extension rate, reducing power consumption during mixing, producing smoother surfaces on calendered and extruded products, and improving knitting to name a few examples.

proofing, *n*—process of coating a fabric with raw or compounded rubber to impede penetration by a liquid, usually water.

proofing (the act of), *n*—process of coating a fabric with rubber.

qualification test, *n*—test of a particular product or material design to meet use specifications which are design driven, and do not change from lot to lot.

DISCUSSION—In specifications and test methods, this test may be referred to as a "type test."

recipe, *n*—formula, mixing procedure, and any other instructions needed for the preparation of a product.

reclaim, *n*—See **reclaimed rubber**, the preferred term.

reclaimed rubber, *n*—vulcanized rubber treated by a combination of heat, chemical agents, and intense kneading to give a material with essentially its prevulcanized plasticity, which is useful as a rubber compounding material.

recovery, *n*—degree to which a rubber product returns to its normal dimensions after being distorted.

referee test, *n*—test made to settle a disagreement as to the conformance to specified requirements, or conducted by a third party to arbitrate between conflicting results.

refiner, *n*—two-roll mill with a high friction ratio, used for such operations as processing of reclaimed rubber or slightly scorched mixes and the crushing of impurities.

reinforcement, *n*—act of increasing the mechanical performance capability of a rubber by the incorporation of materials that do not participate significantly in the vulcanization process.

reinforcing agent, *n*—material, not basically involved in the vulcanization process, used in rubber to increase the resistance of the vulcanizate to mechanical forces.

release agent (mold), *n*—substance applied to the inside surface of a mold or added to a material to be molded, to facilitate removal of the product from the mold.

resilience, *n*—ratio of energy output to energy input in a rapid (or instantaneous) full recovery of a deformed specimen.

resilience, impact, *n*—ratio of output to input mechanical energy in a rapid deformation and recovery cycle of a rubber specimen.

resin, *n*—organic material of indefinite and relatively high molecular mass that may be used as a softener, processing aid, vulcanizing agent, or reinforcing agent.

resistivity, volume, *n*—ratio of the electric potential gradient to the current density when the gradient is parallel to the current in the material.

retarder, *n*—material used to reduce the tendency of a rubber compound to vulcanize prematurely.

retracted spew, *n*—deprecated term, see **backrinding**.

reversion (vulcanization), *n*—deterioration of vulcanizate properties that may occur when vulcanization time is extended beyond the optimum.

root-mean-square strain, *n*—square root of the mean value of strain squared and averaged over one cycle of a sinusoidal deformation.

root-mean-square stress, *n*—square root of the mean value of stress squared and averaged over one cycle of a sinusoidal deformation.

rotorless cure meter, *n*—test device for measuring vulcanization and rheological parameters, in which a rubber specimen is enclosed in a heated die cavity with one surface oscillating and the resistance of the rubber to these oscillations is measured versus time.

rubber, *n*—material that is capable of recovering from large deformations quickly and forcibly, and can be, or already is, modified to a state in which it is essentially insoluble (but can swell) in boiling solvent, such as benzene, methyl ethyl ketone, or ethanol-toluene azeotrope.

DISCUSSION—A rubber in its modified state, free of diluents, retracts within 1 min to less than 1.5 times its original length after being stretched at room temperature (18 to 29°C) to twice its length and held for 1 min before release.

rubber, bound, *n*—portion of the rubber in a mix that is so closely associated with the filler as to be unextractable by the usual rubber solvents.

rubber, cellular, closed cell, *n*—cellular material in which practically all the individual cells are nonconnecting. **ISO 1382-82**

rubber, crude, *n*—See **rubber, raw**, the preferred term.

rubber, expanded, *n*—cellular rubber having closed cells made from a solid rubber compound.

rubber, gel, *n*—portion of rubber insoluble in a chosen solvent. (See also **rubber, sol**.)

rubber, glass transition temperature, *n*—approximate midpoint of the temperature range over which a reversible change in an amorphous polymer or in amorphous regions of a partially crystalline polymer occur from (or to) a viscous or rubbery condition to (or from) a hard and relatively brittle one.

rubber, hard, *n*—See **ebonite**.

rubber, natural, *n*—*cis*-1,4-polyisoprene that is obtained from plant sources, including *Hevea brasiliensis* and *Parthenium argentatum*.

rubber, oil-extended, *n*—grade of raw rubber containing a relatively high proportion of processing oil.

rubber, raw, *n*—natural or synthetic elastomer, usually in bales or packages, that is the starting material for the manufacture of rubber articles.

rubber, skim, *n*—rubber obtained by coagulating the rubber in the serum that separates out during the concentration of natural rubber latex.

rubber, sol, *n*—portion of rubber soluble in a chosen solvent. (See also **rubber, gel**.)

rubber, sponge, *n*—cellular rubber consisting predominantly of open cells and made from a dry rubber compound.

rubber, synthetic, *n*—rubber produced by polymerizing one or more monomers with or without post-polymerization chemical modification.

rubber, the vulcanized compound, *n*—crosslinked elastic material compounded from an elastomer, susceptible to large deformations by a small force and capable of rapid, forceful recovery to approximately its original dimensions and shape upon removal of the deforming force.

rubber, virgin(s), *n*—obsolete term. See **wet spots**.

rubber hardness degree, international, *n*—measure of hardness, the magnitude of which is derived from the depth of penetration of a specified indentor into a specimen as described in Test Method D1415.

DISCUSSION—The scale is so chosen that 0° would represent a material showing no measurable resistance to indentation, and 100° would represent a material showing no measurable indentation.

rubber latex, centrifuged, *n*—latex, the rubber concentration of which has been increased by the removal of serum by centrifugal force.

rubber latex, evaporated, *n*—latex, the rubber concentration of which has been increased by evaporation of some of the water.

rubber latex, preserved, *n*—rubber latex treated to inhibit putrefaction and accompanying coagulation.

rubber latex, prevulcanized, *n*—rubber latex in which the particles have been sufficiently vulcanized to produce films and useful articles by drying only.

rubber latex, stabilized, *n*—rubber latex treated to inhibit premature coagulation.

rubber products, *n*—items of commerce in which the major portion of the filler-bearing material is a rubber.

rubberize, *n*—to impregnate or coat, or both, a substrate with rubber.

runner (injection or transfer mold), *n*—secondary feed channel for transferring material under pressure from the inner end of the sprue to the cavity gate.

salt bath, *n*—heat transfer apparatus, utilizing molten salts as the heating medium, generally used for vulcanization. See **liquid curing medium (LCM)**.

sample, *n*—portion or unit(s) selected to represent the lot.

scorch, *n*—premature vulcanization of a rubber compound.

scorch, Mooney, *n*—time to incipient cure of a compound when tested in the Mooney shearing disk viscometer under specific conditions (see Test Methods D1646).

seal (mechanical), *n*—any material or device that prevents or controls the passage of matter across the separable members of a mechanical assembly.

DISCUSSION—"Seal (mechanical)" is considered to be a generic term for such words as "gasket (mechanical)," "packing (mechanical)," and "seal O-ring" as described herein.

seal, O-ring, *n*—product of precise dimensions molded in one piece to the configuration of a torus with circular cross section, suitable for use in a machined groove for static or dynamic service.

secondary accelerator, *n*—accelerator used in smaller concentrations compared to the primary accelerator, to achieve a faster rate of vulcanization.

semi-efficient vulcanizing (semi-EV) system, *n*—as applied to natural rubber and isoprene- and butadiene-based synthetic rubbers, a vulcanizing system having sulfur and accelerator concentrations between those of a conventional sulfur vulcanizing system and an EV system.

serum, (latex), *n*—dispersion medium of a rubber latex, or the solution remaining, after either coagulation or centrifugation.

set, *n*—strain remaining after complete release of the force producing the deformation.

set after break, *n*—set of a test piece after stretching it to rupture.

sheeting, *n*—process of converting a rubber, rubber mix, rubber dough, or latex into a sheet.

shelf life, *n*—See **storage life, shelf**.

shock load, *n*—sudden application of an external force.

skim coat, calender, *n*—layer of rubber compound applied to a fabric by pressure normal to the surface.

skim coating (the act of), *n*—process of applying a thin layer of rubber or rubber mix to a sheet material by means of a calender, without shear forces, between the rubber and the sheet.

skim rubber, *n*—rubber obtained from the dilute latex that is separated during the concentration of natural rubber latex.

skin, *n*—relatively dense layer at the surface of a cellular polymeric material.

skin, applied, *n*—thin surface layer of elastomeric material applied to a cellular product.

sludge, *n*—undesirable residue in rubber latex.

DISCUSSION—Coagulum is not classified as sludge.

softener, *n*—compounding material used to produce a mix of reduced viscosity, which facilitates incorporation of rubber additives.

solution polymerization, *n*—process in which monomers dissolved in a common solvent react to form a polymer.

specimen, *n*—piece of material appropriately shaped and prepared so that it is ready to use for a test.

spew line, *n*—line on the surface of a molded product at the junction of the mold parts.

sponge rubber, *n*—porous elastic material with interconnecting cells, generated by gas release in the material prior to vulcanization.

spring constant, K, *n*—ratio of the normal force component in phase with the normal deformation, to the normal deformation.

sprue, *n*—material remaining in the sprue hole after molding.

sprue hole, *n*—passageway through which a rubber is forced into a mold.

stabilizer, dry rubber, *n*—substance present in or added to raw rubber to maintain properties at or near their initial values during its production, processing, and storage.

stabilizer, (latex), *n*—substance occurring naturally in or added to latex that prevents agglomeration or coagulation of the rubber particles during processing and/or compounding.

stabilizer (rubber), *n*—substance present in or added to raw rubber to maintain the properties at or near their initial values during drying, processing, and storage.

stain, contact, *n*—discoloration of a product by another material or product in the area of direct contact.

DISCUSSION—A test for direct surface discoloration of rubber covered by Test Method D1148. **D925**

stain, diffusion, *n*—discoloration of a light-colored veneer or coating, caused by the diffusion of staining materials from the rubber through the veneer or coating.

DISCUSSION—The veneer or coating is in direct intimate contact with the underlying rubber. **D925**

stain, migration, *n*—discoloration, caused by volatile constituents of a rubber, that occurs on any portion of the surface of any object in the proximity of or adjacent to but not in direct contact with the rubber causing the stain. **D925**

state of cure, *n*—relative extent or degree of vulcanization.

stiffener, *n*—compounding material used to increase the viscosity of an unvulcanized rubber mix.

stiffness, bending, *n*—force required to produce a bent configuration under specified conditions.

stock, *n*—See **compound**, the preferred term.

storage hardening, *n*—increase in the viscosity of raw or unvulcanized rubber during storage.

DISCUSSION—This differs from low-temperature crystallization by not being thermally reversible.

storage life, shelf, *n*—period of time after production during which a material or product, that is stored under specified conditions, retains its intended performance capabilities.

strain, *n*—unit change, due to force, in the size or shape of a body referred to its original size or shape. **E6, E28**

strain amplitude, *n*—ratio of the maximum deformation to the free dimension of the unrestrained test piece.

strainer, *n*—machine designed to force a rubber or rubber mix through a sieve or sieves to remove extraneous material.

stress, *n*—intensity, at a point in a body, of the internal forces (or components of force) that act on a given plane through the point.

DISCUSSION—Stress is expressed in force per unit area. As used in tension, compression, or shear, stress is calculated on the basis of the original dimensions of the appropriate cross section of the test piece.

stress relaxation, *n*—decrease in stress after a given time at constant strain.

sulfur, combined, *n*—sulfur remaining in a vulcanizate after extraction by a prescribed method.

DISCUSSION—This sulfur is bound to organic constituents (organically combined sulfur, for example, rubber, vulcanized oil) or to inorganic constituents (inorganically combined sulfur, for example, barium sulfate), or to both.

sulfur, extractable, *n*—all the sulfur removed by a solvent from a rubber mix or vulcanizate.

sulfur, free, *n*—ideally, the uncombined sulfur in a rubber mix or vulcanizate.

DISCUSSION—Practically, the analyses for free sulfur determine elemental sulfur, coordinately bound sulfur, and organically bound reactive sulfur, such as that in disulfides and polysulfides.

sulfur, total, *n*—all the sulfur present in a material, irrespective of its chemical form or origin.

sulfur donor vulcanizing system, *n*—vulcanizing system in which there is no elemental sulfur present and all of the sulfur available for the crosslinking is provided by the partial decomposition of sulfur-containing materials.

swelling, *n*—increase in volume of a specimen immersed in a liquid or exposed to a vapor.

tack, rubber, *n*—property that causes contacting surfaces of unvulcanized rubber to adhere to each other.

tackifier, *n*—compounding material that enhances the ability of vulcanized rubber to adhere to itself or another material.

tan delta (tan δ), *n*—ratio of the viscous (loss) modulus to the elastic (storage) modulus in a sinusoidal deformation; mathematically, the tangent of the loss angle, δ.

tear (rubber), *n*—mechanical rupture initiated and propagated at a site of high stress concentration caused by a cut, defect, or localized deformation.

tear strength, *n*—maximum force required to tear a specified specimen, the force acting substantially parallel to the major axis of the test specimen.

tensile green modulus, *n*—ratio of stress to strain of a raw rubber or an unvulcanized rubber compound that indicates resistance to tensile deformation or strain.

tensile green strength, *n*—yield stress of a raw rubber or an unvulcanized rubber compound that indicates loss of resistance to tensile deformation or strain.

tensile modulus, *n*—see **tensile stress at given elongation**, the preferred term.

tensile set, *n*—extension remaining after a specimen has been stretched then allowed to retract in a specified manner expressed as a percentage of the original length.

tensile strength, *n*—maximum tensile stress applied during stretching a specimen to rupture.

tensile stress, *n*—stress applied to stretch a test piece (specimen).

tensile stress at given elongation, *n*—stress required to stretch the uniform cross section of a test specimen to a given elongation.

tension fatigue, *n*—fracture, through crack growth, of a component or test specimen subjected to a repeated tensile deformation.

tension set, *n*—see **tensile set**, the preferred term.

terpolymer, *n*—polymer formed from three monomer species.

thermal degradation, *n*—irreversible and undesirable change in the properties of a material due to exposure to heat.

thermoplastic, *n*—polymer that repeatedly can be softened by heating and hardened by cooling through a temperature range characteristic of the polymer, and in the softened state can be shaped into articles.

thermoplastic, *adj*—capable of being repeatedly softened by heating and hardened by cooling through a characteristic temperature range, and which in the softened, flowable state can be shaped into articles.

thermoplastic elastomer (TPE), *n*—diverse family of rubber-like materials, that, unlike conventional vulcanized rubbers, can be processed and recycled like thermoplastic materials.

thermoplastic vulcanizate, *n*—thermoplastic elastomer with a chemically cross-linked rubbery phase, produced by dynamic vulcanization.

thermoset, *n*—polymer which changes into a non-flowable, infusible, insoluble material upon vulcanization by heat or other means.

thermoset, *adj*—capable of becoming a non-flowable, infusible, insoluble material upon vulcanization by heat or other means.

thickener (latex), *n*—substance used to raise or control the viscosity of latex without making major changes in the total solids content.

threshold strain (ozone testing), *n*—highest tensile strain at which a rubber specimen can be exposed continually to an ozone-containing environment without development of ozone cracks.

DISCUSSION—The value of the threshold strain depends on the composition of the rubber, the ozone concentration, temperature, the nature of the strain (static or dynamic), and ultraviolet light exposure.

topping (the act of), *n*—See **skim coating (the act of)**, the preferred term.

transition, first order, *n*—reversible change in phase of a material; in the case of polymers, usually crystallization or melting.

transition, glass, *n*—reversible physical change in a material from a viscous or rubbery state to a brittle, glassy state.

DISCUSSION—The midpoint of the temperature range over which this transition takes place is commonly termed the "glass transition temperature."

transition, second order, *n*—see **transition, glass**.

twist (amount of), *n*—number of turns per unit length of yarn or textile strand (or of a product such as cable or hose) around its axis.

twist, yarn, *n*—number of turns, about its axis, per unit of length, observed in a yarn or other textile strand.

ultra accelerator, *n*—highly active accelerator for fast vulcanization and often used for low-temperature vulcanization.

undercure, *n*—state of vulcanization between the onset of vulcanization and the state of optimum cure.

urethane foam, (flexible), *n*—open cell, elastomeric material made by the addition reaction of a polyol with a polyisocyanate.

UV absorber, *n*—compounding material that, through its ability to absorb ultraviolet radiation and render it harmless, retards the deterioration caused by sunlight and other UV light sources.

viscoelasticity, *n*—combination of viscous and elastic properties in a material with the relative contribution of each being dependent on time, temperature, stress, and strain rate.

viscosity, *n*—resistance of a material to flow under stress.

viscosity, Mooney, *n*—measure of the viscosity of a rubber or rubber compound determined in a Mooney shearing disk viscometer (see Test Methods D1646).

viscous (loss) shear modulus, G", *n*—ratio of the shear stress component 90° out of phase with the shear strain, to the shear strain.

viscous (loss) Young's modulus, E", *n*—ratio of the normal stress component 90° out of phase with the normal strain, to the normal strain, typically measured at low strains.

void, cellular material, *n*—cavity unintentionally formed in a cellular material and substantially larger than the characteristic individual cells.

volatile fatty acid (VFA) number (of latex), *n*—number of grams of potassium hydroxide equivalent to the volatile fatty acids in a latex sample containing 100 g of total solids.

vulcanizate, *n*—product of vulcanization, a crosslinked rubber.

vulcanization, *n*—irreversible process during which a rubber compound, through a change in its chemical structure (for example, crosslinking), becomes less plastic and more resistant to swelling by organic liquids, while elastic properties are conferred, improved, or extended over a greater range of temperature.

vulcanized vegetable oil, *n*—compounding material made by heating unsaturated vegetable oil with cross-linking agents; it is used as a processing aid or extender.

vulcanizing agent, *n*—compounding material that produces crosslinking in rubber.

vulcanizing system, *n*—combination of vulcanizing agent and, as required, accelerators, activators, and retarders used to produce the desired vulcanization characteristics or vulcanizate characteristics.

warm-up (rubber processing), *n*—reduction in viscosity of a rubber or rubber mix, by mechanical work and heat to render it suitable for further processing.

water absorption, *n*—amount of water absorbed by a material under specified test conditions.

water repellency (coated fabric), *n*—property of being resistant to wetting by liquid water.

water resistance (coated fabric), *n*—property of retarding both penetration and wetting by liquid water.

waterproofness (coated fabric), *n*—property of impenetrability by liquid water.

weathering, *n*—surface deterioration of a rubber article during outdoor exposure.

DISCUSSION—Examples are checking, cracking, or crazing.

wet spots, *n*—local patches of high moisture content in raw rubber.

DISCUSSION—Wet spots tend to resist breakdown on mastication and not take up carbon black on mixing as readily as the dry matrix (rubber).

wetting agent (latex), *n*—substance used to reduce the surface tension of latex and thereby facilitate spreading or impregnation of a surface by the latex.

wicking, *n*—transmission of a gas or liquid, due to a pressure differential or capillary action, along fibers incorporated in a rubber product.

yield point, *n*—that point on the stress-strain curve, short of ultimate failure, where the rate of stress with respect to strain goes through a zero value and may become negative.

yield strain, *n*—level of strain at the yield point.

yield stress, *n*—level of stress at the yield point.

ANNEX

(Mandatory Information)

A1. ADDITIONAL DEFINITIONS

A1.1 The following list of definitions is taken from Guide D5992. These definitions were written as a set, and appear in Guide D5992 in related groups rather than in alphabetical order. For teaching they are best read from Guide D5992, since to some extent they depend on each other and lead logically from one to another. Because this is a "terminology" document they are listed here in alphabetical order.

A1.2 Not all the definitions in Guide D5992 are included here. Those omitted deal more with equipment and analysis than with elastomers themselves.

A1.3 There are some duplications between the definitions in the main body of this terminology and those in this Annex. Those in the main body were in existence prior to the writing of Guide D5992.

bond area, *n—in describing a bonded test specimen*, the cemented area between elastomer and high-modulus attachment member.

bonded, *adj—in describing a test specimen*, one in which the elastomer to be tested is permanently cemented to members of much higher modulus for two purposes: (*1*) to provide convenient rigid attachment to the test machine, and (*2*) to define known areas for the application of forces to the elastomer.

complex, *adj—as a modifier of dynamic force*, descriptive of the total force; denoted by the asterisk (*) as a superscript symbol (F*); F* can be resolved into elastic and damping components using the phase of displacement as reference.

contact area, *n—in an unbonded specimen*, that area in contact with a high-modulus fixture, and through which applied forces pass; may or may not be constant, and if lubricated, may deliberately be allowed to change.

damping, *n*—that property of a material or system that causes it to convert mechanical energy to heat when subjected to deflection; in rubber, the property is caused by hysteresis; in some types of systems, it is caused by friction or viscous behavior.

damping, *adj—as a modifier of dynamic force*, descriptive of that component of complex force leading dynamic deflection by 90°, and that is responsible for the conversion of mechanical energy to heat; denoted by the double prime (") as a superscript symbol, as F".

delta, δ, *n—in the measurement of rubber properties*, the symbol for the phase angle by which the dynamic force leads the dynamic deflection; mathematically true only when the two dynamic waveforms are sine waves (Synonym— *loss angle*).

dynamic, *adj—in testing*, descriptive of a force or deflection function characterized by an oscillatory or transient condition, as contrasted to a static test.

dynamic, *adj—as a modifier of stiffness or modulus*, descriptive of the property measured in a test employing an oscillatory force or motion, usually sinusoidal.

elastic, *adj—as a modifier of dynamic force*, descriptive of that component of complex force in phase with dynamic deflection, that does not convert mechanical energy to heat,

and that can return energy to an oscillating mass-spring system; denoted by the single prime (') as a superscript symbol, as F'.

equivalent viscous damping, c, *n*—at a given frequency, the quotient of F"(1) divided by the velocity of the imposed deflection.

$$c = F"(1)/\omega X^{*}(1)$$

DISCUSSION—The equivalent viscous damping is useful when dealing with equations in many texts on vibration. It is an equivalent only at the frequency for which it is calculated.

hysteresis, *n*—the phenomenon taking place within rubber undergoing strain that causes conversion of mechanical energy to heat, and which, in the "rubbery" region of behavior (as distinct from the glassy or transition regions), produces forces essentially independent of frequency. (See also **hysteretic** and **viscous**.)

hysteresis loop, *n*—the Lissajous figure, or closed curve, formed by plotting dynamic force against dynamic deflection for a complete cycle.

hysteresis loss, *n*—per cycle, the amount of mechanical energy converted to heat due to straining; mathematically, the area within the hysteresis loop, having units of the product of force and length.

hysteretic, *adj—as a modifier of damping*, descriptive of that type of damping in which the damping force is proportional to the amplitude of motion across the damping element.

loss angle, *n*—synonym for **delta** (δ).

loss factor, *n*—synonym for **tandel** (tanδ) (η).

lubricated, *adj—in describing an elastomeric test specimen having at least two plane parallel faces and to be tested in compression*, one in which the plane parallel faces are separated from plane parallel platens of the apparatus by a lubricant, thereby eliminating, insofar as possible, friction between the elastomer and platens, permitting the contact surfaces of the specimen to expand in area as the platens are moved closer together.

modulus, *n*—the ratio of stress to strain; that property of a material which, together with the geometry of a specimen, determines the stiffness of the specimen; may be static or dynamic, and if dynamic, is mathematically a vector quantity, the phase of which is determined by the phase of the complex force relative to that of deflection. (See also **complex, elastic, damping**.)

Mullins Effect, *n*—the phenomenon occurring in vulcanized rubber whereby the second and succeeding hysteresis loops exhibit less area than the first, due to breaking of physical cross-links; may be permanent or temporary, depending on the nature of the material. (See also **preflex effect**.)

phase angle, *n*—in general, the angle by which one sine wave leads another; units are either radians or degrees.

preflex effect, *n*—the phenomenon occurring in vulcanized rubber, related to the Mullins Effect, whereby the dynamic moduli at low strain amplitude are less after a history to high strains than before. (See also **Mullins Effect.**) (Also called strain history effect.)

shear, *adj*—descriptive of properties measured using a specimen deformed in shear, for example, shear modulus.

static, (1), *adj—in testing*, descriptive of a test in which force or deflection is caused to change at a slow constant rate, within or in imitation of tests performed in screw-operated universal test machines.

static, (2), *adj—in testing*, descriptive of a test in which force or deflection is applied and then is truly unchanging over the duration of the test, often as the mean value of a dynamic test condition.

static, (3), *adj—as a modifier of stiffness or modulus*, descriptive of the property measured in a test performed at a slow constant rate.

stiffness, *n*—that property of a specimen that determines the force with which it resists deflection, or the deflection with which it responds to an applied force; may be static or dynamic (See also **complex, elastic, damping**.) (Synonym—*spring rate*).

storage, *adj—as a modifier of energy*, descriptive of that component of energy absorbed by a strained elastomer that is not converted to heat and is available for return to the overall mechanical system; by extension, descriptive of that component of modulus or stiffness that is elastic.

unbonded, *adj—in describing a test specimen*, one in which the elastomer is molded or cut to shape, but that otherwise demands that forces be applied directly to the elastomer.

viscous, *adj—as a modifier of damping*, descriptive of that type of damping in which the damping force is proportional to the velocity of motion across the damping element, so named because of its derivation from an oil-filled dashpot damper.