



Technical Reference Bulletin Glossary of Elastomeric Terms

A

ABRASION - progressive wearing away of a surface by mechanical action such as scraping, rubbing, or erosion.

ABRASION RESISTANCE - resistance of a rubber compound to wearing away when in dynamic contact with another abrasive surface.

ABSORPTION - physical mechanism by which one substance attracts and takes up another substance (liquid, gas, or vapor) *into its interior*.

ACCELERATED LIFE TEST - any set of test conditions designed to reproduce in a short time the deterioration obtained under normal service conditions.

ACID RESISTANT - able to withstand the degrading effects of acids.

ACTIVATOR - chemical which initiates the vulcanization of an elastomer.

ADDITIVE - material added to an elastomeric compound to alter its properties, e.g. a reinforcing agent to improve strength or a chemical to add flame resistance.

ADHESION - tendency of rubber or other material to stick to a contact surface; may result from chemical or physical interlocking.

AFTER CURE - uncontrolled continuation of vulcanization after the desired cure has been effected and the heat source removed; *not the same as post cure*.

AGING - change in rubber characteristics over time brought about by environmental factors such as heat and light.

AIR CHECKS / TRAPS - surface marks or depressions on a molded rubber product resulting from air getting trapped between the material being cured and the mold surface.

AMBIENT TEMPERATURE - temperature of the environment surrounding a component; *not necessarily the same as atmospheric temperature*.

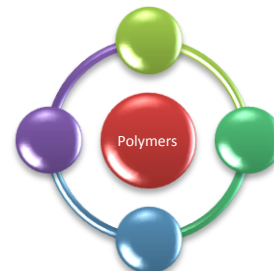
ANTI-DEGRADANT - chemical added to an elastomeric compound to shield against the degrading effects of environmental elements like oxygen or ozone.

ANTIOXIDANT - chemical added to a rubber compound to resist oxidation.

ANTIOZONANT - chemical added to a rubber compound to resist ozone (O₃) degradation.

AROMATIC HYDROCARBONS - organic compounds recognizable by their rings of carbon atoms. Benzene, for example, is a six carbon ring with three double bonds. Other aromatic hydrocarbons include toluene and xylene (see **Figure 148**).

ATMOSPHERIC CRACKING - cracking and degradation of the physical properties of a rubber product exposed to atmospheric conditions; *also known as weathering*.



B

BACKRIND - ragged indentation at the parting line of a finished rubber product resulting from molding stresses.

BANBURY MIXER - specific type of internal mixer in which rubber compounds are blended.

BLEMISH - mark or deformity on the surface of a molded product.

BLISTER - raised area on the surface of a molded product caused by the pressure of internal gases.

BLOOM - creamy or dusty deposit appearing on the surface of a molded rubber product; caused by the migration of certain compound ingredients to the rubber's surface after molding and storage.

BLOOMING - migration of plasticizers, waxes, or other compound ingredients to the surface of a molded rubber product; *also known as bleeding*.

BOND - (a) to unite two materials; or (b) the mechanical, chemical, or adhesive force which binds an elastomer to another object. Mechanical bonds use interlocking design characteristics to ensure continued physical contact. Chemical bonds are based on internal cross-linking. Adhesive bonds rely on cements or other external adhesives.

BRITTLENESS - tendency to crack upon deformation.

BRITTLENESS POINT - lowest temperature at which a rubber sample will not fracture or crack when struck once.

BUNA N - copolymer of butadiene and acrylonitrile; also known as NBR or nitrile rubber.

BUNA S - copolymer of butadiene and styrene; also known as SBR or styrene butadiene rubber.

BUTYL - copolymer of isobutylene and isoprene.

C

CATALYST - chemical that causes or accelerates the cure of a rubber compound, but that does not usually become a chemical component of the end product.

CAVITY - hollow space within the mold in which uncured rubber is shaped and vulcanized; *also known as mold cavity*.

CHAIN SCISSION - breaking of molecular bonds within the backbone of a polymer due to chemical or thermal attack that divides the polymer chains into smaller segments, with a resulting loss in physical properties; *also known simply as scission*.

CHAMFER - beveled edge in a component to facilitate assembly of a seal onto a rod or shaft, or into a cylinder or housing; *also known as a lead-in chamfer (see Figure 155)*.

CHECKING - cracking or crazing of an elastomer's surface due to the action of sunlight; *also known as sun checking*.

CLEAVAGE - breaking of any chemical bond; most commonly refers to the breaking of cross-link bonds between polymer chains or sidegroups that are pendent to the polymer backbone.

COEFFICIENT OF THERMAL EXPANSION - may be linear or volumetric: (a) the coefficient of linear thermal expansion is the change in length per unit of length for a one degree rise in temperature; and (b) the coefficient of volumetric thermal expansion is the change in volume divided by the product of the original volume and the change in temperature. The coefficient of volumetric thermal expansion is three times the coefficient of linear thermal expansion for a solid material.

COLD FLEXIBILITY - ability of an elastomeric product to resist cracking or breaking when flexed or bent at low temperatures; *also known as low temperature flexibility*.

COLD FLOW - increasing deformation of a rubber material under a constant compressive load; *also known as creep*.

COLD RESISTANT - able to function in low temperature applications.

COMPATIBILITY - a seal material's resistance to having its chemical (and by extension, its physical) properties degraded (either temporarily or permanently) as a result of contact with a liquid or gas.

COMPOUND - (a) molecules made up of differing atoms; and (b) a mixture of polymers and other ingredients to produce an elastomeric material.

COMPRESSION MODULUS - ratio of compression stress (force in psi) to resulting compression strain (noted as a percentage of the original specimen thickness).

COMPRESSION MOLDING - thermoset molding technique in which the uncured rubber compound is put in a heated, open mold cavity and the mold is closed under pressure (often in a hydraulic press). The material flows to completely fill the cavity. Pressure is maintained until curing is complete.

COMPRESSION SET - (a) the amount, expressed as a percentage of deflection, by which a rubber specimen does not return to its original thickness following release of a compressive load; and (b) the end result of a progressive stress relaxation. In terms of the life of a seal, stress relaxation is like dying, whereas compression set is like death.

CONDUCTIVE RUBBER - rubber material that is capable of conducting electricity, usually static electricity. To be classified as conductive, an elastomer must have a direct current resistivity of less than 105 ohm/cm.

CRACKING - sharp breaks or fissures in a rubber surface caused by excessive strain and/or exposure to detrimental environmental conditions, such as ozone, weather, or ultraviolet (UV) light; *also known as crazing*.

CREEP - increasing deformation of a rubber material under a constant compressive load; *also known as cold flow*.

CRITICAL TEMPERATURE (T_c) - (a) regarding gases, the temperature above which a gas cannot be liquefied, regardless of the amount of pressure applied to it; and (b) regarding rubber compounds, the temperature above which a rubber can no longer strain crystallize.

CROSS-SECTION - (a) view of a seal, cut at right angles to the mold parting line, exposing the seal's internal structure; and (b) one-half the difference between the outside diameter (O.D.) and inside diameter (I.D.) of a seal; *also known as width (W)*.

CRYOGENIC - pertaining to very low temperatures. Some molded articles are deflashed in cryogenic chambers.

CURE - heat-induced process whereby the long chains of the rubber molecules become cross-linked by a vulcanizing agent to form three-dimensional elastic structures. This reaction transforms soft, weak, non-cross-linked materials into strong elastic products; *also known as vulcanization*.

CURE CURVE - graphic representation plotted by a batch testing device (such as an oscillating disk rheometer) showing a rubber sample's state of cure for a given time and temperature.

CURE DATE - the quarter and year indicating the molding date of a rubber part. For example, "1Q00" denotes a cure date in the first quarter (January, February, or March) of 2000.

CURING TEMPERATURE - temperature at which a rubber product is vulcanized.

CYCLE TIME - the time that elapses between a given point in one molding cycle and the same point in the next cycle (for example, loading of raw stock, through molding and unloading of finished parts, then back to reloading again). Generally speaking, the longer the cycle time, the more the process costs and the more expensive the finished part will be.

D

DAMPER - device capable of minimizing motion or dissipating energy, such as a shock absorber. Because an elastomer has a viscous phase, it can be thought of as a damper, i.e. the elastomer resists motion (deformation), making it an effective seal material.

DEFLASH - process of removing excess material (flash) from the parting line of a molded rubber product.

DEFLECTION - change in the shape of a seal as a result of compression; *also known as deformation*.

DEGRADATION - breakdown in chemical structure and/or loss of physical properties after exposure to harmful agents (such as heat, sunlight, oxygen, ozone, or weather).

DUROMETER - (a) an instrument that measures the hardness of rubber by its resistance to surface penetration of an indenterpoint; and (b) the numerical scale indicating the hardness of rubber. See also "Shore A Durometer" and "Shore D Durometer."

DYNAMIC - describes an application in which the mating surfaces to be sealed are in relative motion to each other.

E

ELASTICITY - an elastomer's inherent ability to readily regain its original size and shape after being released from a deforming load.

ELASTOMER - any natural or synthetic material meeting the following requirements: (a) it must not break when stretched 100%; and (b) after being held at 100% stretch for five minutes then released, it must return to within 10% of its original length within five minutes.

ELASTOMERIC COMPOUND - combination of a base polymer and additives.

ELONGATION - percentage increase in original length (strain) of a specimen produced by a tensile force (stress) applied to the specimen. "Ultimate elongation" is the elongation at the moment the specimen breaks.

ENCAPSULATION - enclosure or jacket surrounding another material; for example, a Teflon® encapsulation over an O-ring core molded from a different material.

ENDOTHERMIC - absorbing heat.

EXTENDER - relatively inexpensive and inert material added to an elastomeric compound to reinforce or modify properties (e.g. physical, mechanical, electrical, thermal), impart certain processing properties, or reduce costs; *also known as a filler*.

EXTRUSION - pressure-induced distortion or extension of part of a seal into the clearance gap between mating seal surfaces.

F

FATIGUE RESISTANCE - capable of withstanding fatigue caused by repeated bending, extension, or compression; *also known as flex resistance*.

FILLER - relatively inexpensive and inert material added to an elastomer to reinforce or modify properties (e.g. physical, mechanical, electrical, thermal), impart certain processing properties, or reduce cost; *also known as an extender*.

FLASH - excess rubber remaining on the parting line of a molded rubber product.

FLAWS - surface imperfections that occur infrequently (i.e. not in a pattern), as with an isolated scratch or crack in the metal of a gland.

FLEX CRACKING - surface cracks caused by repeated flexural cycling.

FLEX RESISTANCE - capable of withstanding fatigue caused by repeated bending, extension, or compression; *also known as fatigue resistance*.

FLOW LINES - imperfections in a molded rubber product caused by imperfect flow of the material during molding; *also known as flow cracks or flow marks*.

FLUOROCARBON - carbon backbone, organic compound having fluorine atoms in its chemical structure. Presence of the fluorine provides increased chemical and high temperature resistance.

G

GASKET - static seal effected when a deformable material is sandwiched and compressed between two mating surfaces.

GATE MARK - raised spot or small depression seen on an injection or transfer molded product; caused when the finished molded part is removed from the injection nozzle (gate or sprue) through which the material is injected into the mold cavity; *also known as a sprue mark*.

H

HARDNESS - measure of rubber's relative resistance to an indenter point on a testing device. Shore A durometers gauge soft to medium-hard rubber. Shore D durometers are more accurate on samples harder than 90 Shore A.

HEAT AGING - loss of physical properties as a result of exposure to heat.

HEAT RESISTANCE - rubber compound's capacity to undergo exposure to some specified level of elevated temperature

HYDROGEN BOND - an electrostatic attraction between a hydrogen atom in one molecule and a small electronegative atom (like fluorine, oxygen, or nitrogen) in an adjoining molecule. Though not nearly as strong as covalent bonds, hydrogen bonds are present in such numbers in hydrocarbon polymers that they are an important source of polymer strength.

I

I.D. - inside diameter of a seal or component.

IMMERSION - putting an article into a fluid so that it is totally covered.

IMPACT - forceful contact between two bodies, at least one of which is in motion.

INERT - inactive or non-reactive; often used to describe a material (like Teflon®) that is impervious to many chemicals.

INHIBITOR - chemical added to an elastomeric compound to ensure vulcanization does not proceed too quickly.

INJECTION MOLDING - process in which preheated rubber is injected under pressure from the heating chamber through a series of runners and sprues and into a closed, heated mold cavity, then vulcanized. Injection molding is ideal for high-volume production of molded rubber parts (see **Figure 154**).

ISO - International Organization for Standardization, a non-governmental organization whose primary aim is to develop guidelines on what constitutes an effective quality management system.

K

K (° K) - degrees Kelvin. 0° K (also known as Absolute Zero) is equal to -273° C.

L

LOW TEMPERATURE FLEXIBILITY - ability of an elastomeric product to resist cracking or breaking when flexed or bent at low temperatures.

M

MAXIMUM CURE - point at which a rubber sample is cured as much as possible without being over-cured.

MAXIMUM TEMPERATURE - highest temperature a rubber compound can withstand prior to undergoing a physical or chemical change.

MEMORY - an elastomer's ability to regain its original size and shape following deformation.

MINIMUM TEMPERATURE - lowest temperature a rubber compound can withstand prior to losing rubbery properties.

MODULUS - the force in psi (stress) required to produce a certain elongation (strain), usually 100%; a good indication of toughness and resistance to extrusion; *also known as tensile modulus or tensile stress.*

MODULUS OF ELASTICITY - ratio of the stress (force in psi) to the strain (percent increase in original length) as measured on a rubber specimen; also known as Young's modulus (E); *not the same as tensile modulus.*

MOISTURE RESISTANCE - able to resist absorbing moisture from the air or during water immersion.

MOLD - (a) to shape or process a material into a usable form; and (b) metal tools, usually steel or aluminum, machined and assembled so as to create openable cavities for the purpose of shaping and vulcanizing rubber.

MOLD CAVITY - hollow space within the mold in which uncured rubber is shaped and vulcanized; *also known simply as a cavity.*

MOLD FINISH - surface finish of the mold; determines the surface finish of any product taken from that mold.

MOLD LUBRICANT - coating used in the mold cavity to prevent a molded rubber product from sticking to the cavity during removal; *also known as mold release.*

MOLD MARKS - imperfections in a molded rubber product replicating surface defects on the mold itself.

MOLD REGISTER - accuracy of alignment of mold plates and cavities. An improperly aligned mold is said to be off-register and will produce mismatched parts.

MOLD RELEASE - coating used in the mold cavity to prevent a molded rubber product from sticking to the cavity during removal; *also known as mold lubricant.*

MOLD SHRINKAGE - dimensional loss in a molded rubber product that occurs during cooling after it has been removed from the mold.

MOLD STORAGE - holding area in which removable mold plates are stored when not in use (see **Figure 156**).

MOONEY VISCOMETER - shearing disk device used to gauge the viscosity of a rubber sample under heat and pressure. Named for developer Melvin Mooney, this was once the standard tool for determining processing characteristics but has now largely been replaced by the rheometer.

MULTIPLE CAVITY MOLD - mold in which more than one article can be made at a time.

N

NITRILE (BUNA-N) - copolymer of butadiene and acrylonitrile widely used in O-rings and other seals.

NOMINAL SIZE - approximate size of an O-ring or seal in fractional dimensions (inches); typically given solely for reference purposes; *also known as nominal dimension*.

NON-FILL - defect in a finished molded part caused by the rubber failing to completely fill the mold cavity.

O

O.D. - outside diameter of a seal or component.

OFF-REGISTER - mismatched O-ring cross-section caused by misalignment of mold cavities.

OIL RESISTANT - ability of vulcanized rubber to resist swelling and deterioration due to oil exposure.

OIL SWELL - increase in volume of a rubber product as a result of oil absorption.

OPTIMUM CURE - vulcanization state yielding the most desirable properties.

O-RING - solid elastomer ring seal of circular cross-section; technically, a torus.

OSCILLATING SEAL - rotary seal with limited, reversing travel; as in an on/off valve.

OUTGASSING - phenomenon occurring in vacuums where the volatile materials in a rubber compound are vaporized and released into the environment.

OVER CURE - longer than optimum vulcanization causing some properties to be degraded. Over-cure can be of two types. In the first type, the material continues to harden, the modulus rises, and both tensile strength and elongation fall. In the second type, the rubber begins to break down. The material softens, and the modulus, tensile strength, and elongation all decrease.

OXIDATION - reaction of oxygen with a rubber compound, usually resulting in surface cracking and/or changes in the physical properties of the material.

OZONE (O₃) - unstable form of oxygen (usually generated by electricity) that can cause surface cracking in some elastomers.

OZONE RESISTANCE - ability of a rubber material to withstand exposure to ozone without cracking or otherwise deteriorating.

P

PACKING - generic name for a compression-type dynamic seal housed within a gland.

PARTING LINE - mark on a molded rubber article showing where separate parts of the mold cavity met.

PERMANENT SET - amount of deformation in a rubber part after a distorting load has been removed.

PERMEABILITY - measure of the ease with which a liquid or gas can pass through a rubber material (see **Figure 158**).

PIGMENT - substance included in a material mixture to colorize it in a specific way.

PIT OR POCK MARK - small surface void in a molded rubber product caused by mechanical erosion (wear) or chemical action.

POLYMER - large chainlike molecules (macromolecules) made up of small repeating units (monomers). When two different monomers are chemically combined, the resulting product is called a copolymer. When three different monomers are involved, the result is a terpolymer.

POLYMERIZE - to chemically unite two or more monomers or polymers to form a molecule with a higher molecular weight.

POST CURE - controlled continuation of vulcanization, usually in an oven, to complete the curing process, drive off residual byproducts, and provide stabilization of parts; *not the same as after cure*.

Q

QS 9000 - Quality System developed by the automotive industry to supplement the ISO 9000 standard.

R

RADIAL SEAL - O-ring or seal having compression applied to its outside diameter (O.D.) and inside diameter (I.D.).

RADIUS - (a) the distance from the center of a circle to the edge, or one-half the diameter; and (b) to round off a sharp corner, as in the "radiusing" of a gland's top edges to prevent them from nicking or cutting an O-ring during installation.

RELAXATION - decrease in the force exerted against a mating part by a rubber component that has been under a constant load for a period of time.

REPEATABILITY - consistency of test results taken within a single lab. For example, the similarity (or lack thereof) of multiple durometer readings taken on a single sample with the same tester.

REPRODUCIBILITY - consistency of test results taken among several different labs. For example, the similarity (or lack thereof) of multiple durometer readings taken on a single sample with a series of different testers.

RESILIENCE - a compound's ability to rapidly regain original size and shape following deformation. *Also known as rebound*.

REVERSION - condition in an elastomer caused by thermal or chemical attack whereby chemical bonds are broken with a resulting loss in physical properties.

RHEOMETER - cure meter which determines and plots a cure curve illustrating the state of cure for a given time and temperature; typically either an Oscillating Disk Rheometer (ODR) or a Moving Die Rheometer (MDR).

RUBBER - natural or synthetic elastomeric substance.

S

SCISSION - breaking of molecular bonds within the backbone of a polymer due to chemical or thermal attack that divides the polymer chains into smaller segments, with a resulting loss in physical properties; *also known as chain scission*.

SCORCHING - premature curing of rubber during storage or processing, usually caused by excessive heat.

SHEAR MODULUS (G) - measure of stiffness or resistance to deformation taken in shear rather than in tension; technically, the ratio of a shearing stress (force in psi) to shearing strain (amount of linear deflection divided by the specimen thickness). In rubber materials, shear modulus is one-third of Young's modulus (E); *not the same as tensile modulus*.

SHELF-AGING - degradation of a rubber material's properties that occurs in storage over time.

SHELF LIFE - length of time a molded rubber compound can be stored without suffering significant loss of physical properties.

SHORE A DUROMETER - instrument used to gauge soft to medium hard rubber based on resistance to a frustum (truncated) cone indenter point; most accurate for materials below 90 Shore A.

SHORE D DUROMETER - instrument used to gauge hard rubber based on resistance to a sharp, 30° angle indenter point; most accurate for materials at or above 90 Shore A.

SHRINKAGE - (a) after vulcanization, dimensional loss in a molded rubber product that occurs after it has been removed from the mold and allowed to cool; and (b) in seal service, a decrease in seal volume due to extraction of soluble components from the rubber compound by environmental fluids.

SILICONE RUBBER - silicon-oxygen backbone elastomer with excellent high temperature and low temperature properties.

SINGLE-ACTION SEAL - dynamic reciprocating seal capable of sealing in only one direction of movement.

SOLVENT - any substance, typically a liquid, capable of dissolving other substances.

SPECIFIC GRAVITY - ratio of the weight of a given substance to the weight of an equal volume of water at a specified temperature. Specific gravity is often used to identify rubber compounds.

SPRUE MARK - raised spot or small depression seen on an injection or transfer molded product; caused when the finished molded part is removed from the injection nozzle (sprue or gate) through which the material is injected into the mold cavity; *also known as a gate mark.*

SQUEEZE - compression of an O-ring's cross-section between mating surfaces; noted as both a decimal measurement (in inches and/or millimeters) and as a percentage of the original cross-section (width). Radial compression occurs on the outside diameter (O.D.) and inside diameter (I.D.). Axial compression occurs on the top and bottom surfaces.

STRESS - an applied force (in psi) resulting in material deflection (strain).

STRESS RELAXATION - steady decline in sealing force when an elastomer is compressed over a period of time. In terms of the life of a seal, stress relaxation is like dying, whereas compression set is like death.

STRETCH - measured as a percentage increase in the inside diameter (I.D.) of an O-ring, stretch results in a reduction and flattening of the seal's cross-section. There are two types of stretch: installation stretch (as the seal is being placed in the groove) and assembled stretch (once the seal is seated).

SUBLIMATION - direct conversion of a substance from a solid state to a vapor state, and from a vapor back to a solid. The substance does not become liquid during either transition.

SUN CHECKING - cracking or crazing of an elastomer's surface due to the action of sunlight; *also known simply as checking.*

SURFACE FINISH - average value of exterior roughness, often expressed in microinches RMS (Root Mean Square) or Ra (roughness average).

SWELL - volumetric increase of an elastomeric material when in contact with a fluid.

T

TEAR RESISTANCE - resistance to the growth of a nick or cut in a rubber specimen when tension is applied.

TEMPERATURE (MAXIMUM) - highest temperature a rubber compound can withstand prior to undergoing a physical or chemical change.

TEMPERATURE (MINIMUM) - lowest temperature a rubber compound can withstand prior to losing rubbery properties.

TEMPERATURE RANGE - minimum and maximum temperature limits within which a rubber material will effectively perform.

TEMPERATURE (SERVICE) - range of temperatures to which a rubber compound will be subjected in a given application.

TENSILE MODULUS - the force in psi (stress) required to produce a certain elongation (strain), usually 100%; a good indication of toughness and resistance to extrusion; *also known as modulus or tensile stress*.

TENSILE STRENGTH - force in pounds per square inch (psi) required to break a rubber specimen.

TENSILE STRESS - the force in psi (stress) required to produce a certain elongation (strain), usually 100%; a good indication of toughness and resistance to extrusion; *also known as modulus or tensile modulus*.

TENSION SET - increase in the length of an elastomeric specimen following initial stretching and release.

THERMAL EXPANSION - linear or volumetric expansion of a material due to a temperature increase.

THERMOSET - polymeric material that forms permanent covalent bonds in an irreversible chemical reaction known as cross-linking, curing, or vulcanizing. Although the cured part can later be softened by heat, it cannot be remelted or reprocessed without extensive chemical treatment.

TOLERANCE - allowable deviation (plus and minus) from a specified dimension.

TOOL - alternative name for a mold.

TORSIONAL STRENGTH - ability of a material to resist twisting and its damaging effects.

TRANSFER MOLDING - method of molding thermosetting materials (see **Figure 163**). The elastomeric compound is placed in a transfer chamber (pot) which is part of the mold, heated, then squeezed down through a sprue, a runner, and a gate leading into a closed mold cavity to be shaped and vulcanized. The advantages of transfer molding are that vulcanization is faster, so the process is more efficient, and the part is formed with little or no flash.

TRIM - removal of excess material from a molded rubber product.

TRIM CUT - damage done to a molded rubber product by excessive trimming.

U

ULTIMATE ELONGATION - amount, expressed as a percentage of original length, that a specimen has stretched at the time of breakage.

UNDER-CURE - degree of incomplete vulcanization resulting in undeveloped physical properties and tackiness.

V

VACUUM - condition in which the pressure in a chamber is less than atmospheric pressure.

VAN DER WAALS FORCES - weak electrostatic attractions between polymer chains that are adjacent but that have not yet been cross-linked. These intermolecular forces are at their peak when a material is cool. Heating the material weakens the forces and "loosens" the chains, thus increasing pliability and making molding possible.

VISCOMETER - shearing disk device used to gauge the viscosity of a rubber sample under heat and pressure. Often referred to as the Mooney Viscometer, this device was once the most common tool for determining processing characteristics but has now largely been replaced by the rheometer.

VISCOSITY - resistance to flow; the thicker the substance (such as a liquid), the more viscous it is, i.e. the less it flows.

VOID - unintended empty space, such as a pit or air pocket.

VOLUME CHANGE - increase (swell) or decrease (shrinkage) in the volume of a specimen which has been immersed in a fluid, noted as a percentage of original volume.

VOLUME SHRINKAGE - volumetric decrease of an elastomeric material when in contact with a fluid; *also known simply as shrinkage.*

VOLUME SWELL - volumetric increase of an elastomeric material when in contact with a fluid; *also known simply as swell.*

VULCANIZATE - cured rubber compound.

VULCANIZATION - heat-induced process whereby the long chains of the rubber molecules become cross-linked by a vulcanizing agent to form three-dimensional elastic structures. This reaction transforms soft, weak, non-cross-linked materials into strong elastic products; *also known as cure.*

VULCANIZING AGENT - material added to an uncured batch of rubber that causes the polymer chains to crosslink to one another (vulcanize), forming a three-dimensional elastic structure; *also known as curing agent.*

W

WEATHERING - cracking and degradation of the physical properties of a rubber product exposed to atmospheric conditions; *also known as atmospheric cracking.*

Y

YOUNG'S MODULUS (E) - a measure of material stiffness; defined as the ratio of the stress (force in psi) to the strain (percentage increase in original length) as measured on a rubber specimen; also known as modulus of elasticity; *not the same as tensile modulus.*