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Definitions of Technical Terms

What do they mean?

Accelerator - A material which, when mixed with liquid rubber (Kick-It) or liquid plastic (So-Cure), will speed up the chemical reaction between the catalyst and resin.

Air-Bubble Void - Air entrapment that has occurred either on the surface or within mold rubber or casting.

Air Vent - A small outlet designed as part of the mold, to prevent entrapment of gases.

Ambient - The surrounding environmental work conditions such as pressure or temperature.

Barcol Hardness - A hardness value obtained by measuring the resistance to penetration of a sharp steel point under a spring load. The instrument, called the Barcol Impressor, gives a direct reading on a 0 - 100 scale. The hardness value is often used as a measure of the degree of cure of a plastic.

Bond Strength - The amount of adhesion between bonded surfaces; a measure of the stress required to separate a layer of material from the base to which it is bonded.

Catalyst - A substance which changes the rate of a chemical reaction without itself undergoing permanent change in its composition; a substance which markedly speeds up the cure of a compound when added in minor quantity as compared to the amounts of primary reactants.

Cavity - Depression in mold; the space inside a mold wherein a casting medium is poured; the molded article; which forms the outer surface of the molded article (often referred to as the die); also, the space between matched molds.

Compression Mold - A mold which is open when the material is introduced, and which shapes the material by heat and by the pressure of closing. Also "compression molding."

Compression Set - Measures the resistance of material to permanent deformation. In this test, a rubber pellet is squashed to 75% of its original height, kept at that deformation for 22 hours. It is then released and allowed to return to its original height. The value reported is the percentage not returned to the original height. The smaller the number the better.

Compressive Strength - Measures the force, in PSI, needed to crush a material. A compressive modulus, which measures the resistance to being crushed, is also determined. The compressive modulus is only measured for rigid materials.

Curing Agent - A catalytic or reactive agent which when added to a resin causes polymerization; synonymous with hardener.

Curing Temperature - Temperature at which a cast, molded, or extruded product, a resin-impregnated reinforcement, an adhesive, etc., is subjected to curing.

Curing Time - The period of time for a material to fully cure. Also called demold time.

Deflection Temperature Under Load - The temperature at which a simple beam of material has deflected a given amount under load. Also called heat distortion temperature.

Delaminate / Delamination - To split a laminated rubber or resin material along the plane of its layers. The physical separation or loss of bond between laminate piles.

Demolding - The process of removing a mold from a model or a casting from a mold; by mechanical means, by hand or by the use of compressed air.

Draft - The intentional slope or taper given to the vertical surfaces of shapes designed to aid in the removal from a mold.

Elongation At Break - Elongation recorded at the moment a material breaks when being pulled apart, often expressed as a percentage of the original length.

Epoxy Plastics - Plastics based on resins made by the reaction of epoxides or oxiranes with other materials such as amines, alcohols, phenols, cardoxylic acids, acid anhydrides and unsaturated compounds.

Exotherm - The creation of heat during the curing of a plastic resin.

Extenders - Low cost materials used to dilute or extend high cost resins without much lessening of properties.

Filler - An inert material that is added to a plastic resin mixture to reduce cost, modify mechanical properties, serve as a base for color effects, or to improve the surface texture.

Flash - Extra plastic attached to a molding along the parting line.

Flexural Modulus - The ratio, within the elastic limit, of the applied stress on a test piece in flexure to the corresponding strain in the outermost fibers of the piece. Only measured for rigid pieces.

Flexural Strength - Measures the force, in PSI, needed to bend a material until it breaks. A flexural modulus can also be determined which measures the stiffness when bending the material. With plastics this value is usually higher than the straight tensile strength.

Flow - The movement of resin under pressure to fill all parts of a mold.

F.R.P. - Fibrous-glass-reinforced plastic; any type of plastic reinforced cloth, strands, or any other form of fibrous glass.

Gel - The initial semisolid phase that develops during the formation of a resin from a liquid.

Gel Time - The point in time after introducing a catalyst into a liquid polymeric system until the material becomes a continuous mass. Note: For some Smooth-On rigid urethanes, the Pot Life and Gel Time are almost simultaneous, whereas, for the elastomers there is a considerable amount of time between the end of the Pot Life and Gel Time. Also working time and gel point.

Gel Coat - A resin applied to the surface of a mold and allowed to gel prior to laying up subsequent layers. Usually used to improve the surface appearance and protect the underlying laminate from the environment.

Guide Pin - A pin or key used to bring mold halves or sections into alignment on closing or joining together so they will not shift. Usually consists of a depression in one part and a matching protrusion in another part.

Hand Lay-up - The process of placing and working successive layers of reinforcing material or resin-impregnated reinforcement in position on a mold by hand.

Hardener - A substance added to the plastic composition to control the degree of hardness of the cured plastic.

Hardness - Hardness measures the resistance of a material to indentation. The three hardness-measuring devices used by Smooth-On are basically made of a needle on a spring that measures how far the needle indents the material. The Shore A device is a dull needle on a weak spring for measuring elastomers. The Shore D device is a sharper needle on a stronger spring for measuring rigid materials. The Barcol 935 device is an even sharper needle on an even stronger spring for measuring very hard materials. These devices are excellent for determining if a cast material is curing properly.

Heat Distortion Temperature - Measures the temperature at which a rigid material becomes rubbery. A cast bar of material is placed in an oil bath and a flexural load is applied. The oil is heated until the bar bends a preset amount.

Impact Strength - Ability of a material to withstand shock loading.

Inhibition - The failure of a material to cure properly.

Injection Molding - Liquid resin that is forced into a mold while under pressure. This will enhance the quality of parts by eliminating air bubbles.

Keys - A pin or key used to bring mold halves or sections into alignment on closing or joining together so they will not shift. Usually consists of a depression in one part and a matching protrusion in another part.

Laminate - To unite sheets or layers of material such as rubber or fiberglass by a bonding material. Pressure and/or heat may also be involved.

Lay-Up - As used in reinforcing; process of brushing or hand laying material into a mold.

Life Mask - A mold made of a living person's face or head. This is accomplished using with Alja Safe alginate or Body Double silicone rubber.

Load-Deflection Curve - A curve in which the increasing flexural loads are plotted on the ordinate axis and the deflections caused by those loads are plotted on the abscissa axis.

Master Model - An exact duplicate of a model, used to make numerous molds. Saves the actual model from the damage during mold making.

Mat - A fibrous material for reinforced plastic or gypsum consisting of randomly chopped filaments or swirled filaments; available in blankets of various widths, weights, and lengths.

Micron - One micron = .001 millimeter = .00003937 inch.

Mix Ratio - Expresses the proper proportion (either by weight or volume) of Parts A and B to be combined before pouring or brushing on model. By weight requires the use of an accurate scale whereas by volume requires only the use of equal size measuring containers.

Model - Your original object or pattern. Models can be anything made of wood, plastic, wax, clay, metal, plaster, bone, rock, etc. A model can be any shape, pattern, or texture you want to reproduce.

Modulus - Key physical property that indicates hardness of a material. More specifically, the modulus is the amount of force needed to deform a material a set amount. Modulus is measured in PSI and can be measured in any mode of deformation, i.e. tension (stretching), compression (crushing, flexing (bending), or torsion (twisting).

Modulus Of Elasticity - The ratio of the stress or load applied to the strain or deformation produced in a material that is elastically deformed. If a tensile strength of 2000 pounds per square inch results in an elongation of one percent, the modulus of elasticity is 2000 divided by 0.01, or 200,000 pounds per square inch (Young's modulus).

Mold - The cavity / form that carries a negative or reverse impression of an original model. Molds can be made of a rigid material, such as plaster or plastic resin or more commonly, a flexible material such as rubber. The material to use should be chosen considering the material of the model, the material to be used to make castings, and whether there are any undercuts.

Mold-Release Agent - A spray, liquid or powder used to prevent sticking of molded articles in the cavity.

Mold Shrinkage - The immediate shrinkage which a casting undergoes when it is removed from a mold and cooled to room temperature; the difference in dimensions, expressed in inches per inch between a molding and the mold cavity in which it was molded (at normal temperature measurement); the incremental difference between the dimensions of the molding and the mold from which it was made, expressed as a percentage of the dimensions of the mold.

MSDS - Also Material Safety Data Sheet; listing all hazards associated with the material and all safety precautions that should be taken when working with the material listed on the sheet.

Multiple-Cavity Mold - A mold with two or more mold impressions; that is, a mold which produces more than one casting per casting cycle.

Parting Line - A mark on a molded piece where the sections of a multi-piece mold have met in closing.

Pinhole - A tiny hole in the surface of a plastic material; usually occurs in multiples.

Pit - A small crater in the surface of a plastic.

Plaster - A white powder consisting mostly of gypsum. You mix plaster powder with water to make a thick liquid. You can then pour the liquid plaster into a mold to make a cast product. The plaster cures to make a rigid white casting.

Plastic Tooling - Tools constructed of plastics.

PLI - Pounds per linear inch.

PSI - Pounds per square inch.

Post-Cure - Additional elevated temperature cure, usually without pressure, to improve final properties and/or complete the cure. In certain resins, complete cure and ultimate mechanical properties are attained only by exposure of the cured resin to higher temperatures than those of curing.

Pot Life - The amount of time that a catalyzed material remains workable (pourable for a liquid or trowelable for paste) after components have been mixed together.

Premix - A molding compound prepared prior to and apart from the molding operation.

Pressure Pot - A chamber used to compress any entrapped air bubbles out of casting.

Reinforcement - A strong inert material such as glass fibers, cotton, or burlap that is added into a casting material to increase the strength of the finished product. Some casting materials act mainly as binders for reinforcement. It is the reinforcement that gives strength, hardness, and break resistance.

Release Agent - A material applied in a thin film to the surface of either an original model prior to applying mold rubber, or the mold surface prior to casting. Release agents prevent adhesion between two materials that would stick together.

Resin - A solid or semisolid material usually having a softening or melting range.

Room Temperature Curing - Materials set to handling strength at temperatures from 68° to 86° F and later reach full strength without heating.

Room Temperature Vulcanization - RTV; certain rubbers need heat treatment to cure, or vulcanize. RTV rubbers cure with no special treatment.

Rotational Cast - Referred to as spin-casting or slush-casting; rotational casting is the process where a small amount of casting material is poured into a mold. The mold is then either rotationally spun by hand or machine to coat the entire surface of the mold. This process is continued until the casting material has begun to gel leaving a hollow cavity that may be filled with a lower cost material.

Sealing Agent - A material that is used to coat your original model so that the rubber mold does not adhere to it. Models that are porous (wood, concrete, etc.) or those that contain sulfur or water need to be sealed. A suitable sealing agent may be obtained from Mann Formulated Products. Sometimes shellac or PVA may be used.

Set-Up - To harden, as in curing.

Shelf Life - The period of time during which a liquid rubber or liquid plastic can be stored under specified temperature conditions and remain suitable for use.

Shrinkage - The relative change in dimension between the length measured on the mold when it is cold and the length on the molded object 24 hours after it has been taken out of the mold. A difficult value to predict since it is dependent on many factors. A few factors include the size and shape of the casting, the type of mold material and the ambient temperature. The test allows a comparison between materials to determine which would have the least shrinkage. Measured in inches per inch.

Split Mold - A mold in which the cavity is formed of two or more components held together by an outer chase. The components are known as splits.

Spray-Up - Techniques in which a spray gun is used as the processing tool. In liquid rubber, two equal parts of rubber are fed through a meter-mixing machine that then sprays the mixed material against the model to be molded. In reinforced plastics fibrous glass and resin can be simultaneously sprayed in a mold. In foamed plastics, very fast reacting urethane foams or epoxy foams are fed in liquid streams to the gun and sprayed on the surface. On contact, the liquid starts to foam.

Sprue - A funnel-shaped opening in a mold where you pour a casting material into the mold. Also, the waste casting material in opening of a mold after you make a cast product.

Specific Gravity - The ratio of the weight on any volume of a substance to the weight of an equal volume of another substance taken as standard at a constant temperature. Weight measurement expressed in grams per cubic centimeter.

Tear Property - Indicates the materials resistance to tearing and is measured in PLI. There are different methods for testing a materials tear property. The test procedure Smooth-On uses involves cutting a 90º angle in the material then stretching the material until it tears. Another method involves preparing a sample of the material in the shape of a pair of pants then pulling the legs in opposite directions until the material tears. Each method will give vastly different values for the same material.

Tensile Properties - Include Ultimate Tensile Strength, Elongation at Break and 100% Modulus.

Ultimate Tensile Strength is the force, measured in PSI, needed to stretch a material until it breaks.

Elongation at Break is the amount the material stretches before it breaks. Elongation is measured as a percentage of the materials original dimensions.

100% Modulus is the force, measured in PSI, needed to stretch the material to twice its original dimensions.

Tensile Shear Strength - Measures a materials adhesive strength by determining the force needed to pull two pieces of metal apart that have been bonded together.

Undercut - Any indentation or protrusion in a shape that will prevent its withdrawal from a one-piece mold.

Viscosity - The resistance of the material flow measured in centipoise (CPS). A material with a low viscosity will flow easily. The viscosity of water is 1 CPS. A material with a high viscosity will not flow easily. The viscosity of peanut butter is roughly 250,000 CPS. In relation to viscosity the following terms apply:

Shear Rate - Measures how vigorously a material is being mixed. Low-Shear Rate is gentle mixing. High-Shear Rate is very vigorous mixing. Note: In Newtonian Flow, the viscosity stays the same regardless of what Shear Rate is applied.

Psuedoplastic Flow - Viscosity decreases as the Shear Rate increases making the material flow more easily the harder it is mixed.

Thixotropic Flow - Very similar to psuedoplastic flow in that the viscosity decreases as the Shear Rate increases, however, when the mixing stops thixotropic materials do not immediately return to their original viscosity. Thixotropic materials build viscosity slowly over time.

Dilatant Flow - The viscosity increases as shear rate increases causing the material to appear thicker as it is mixed.