



A Complete Guide to Epoxy Terminology

A-Stage: An early stage in the reaction of certain thermosetting resins in which the material is fusible and still soluble in certain liquids.

Adhesive: A substance capable of holding materials together by surface attachment. Note: Adhesive is the general term and includes among other cement, glue, mucilage and paste. All of these terms are loosely used interchangeably.

Aggregate: A hard fragmented material used with an epoxy binder as a flooring or surfacing medium. Also coarse filler used as a core for epoxy tools.

Aging: The change of a material with time under defined environmental conditions, leading to improvement or deterioration of properties.

Amine: Curing agent for epoxy resins that is any of a class of ammonia derivatives. They are derived from Ammonia (NH₃).

Artificial Weathering: The exposure of product to cyclic laboratory conditions involving changes in temperature, relative humidity, and ultra violet radiant energy, with or without direct water spray, in an attempt to produce changes in the material similar to those observed after continuous outdoor exposure. Note: The laboratory exposure conditions are usually intensified beyond those encountered in actual outdoor exposure in an attempt to achieve an accelerated effect.

ASTM: American Society for Testing Materials.

B-Stage: An intermediate stage in the reaction of certain thermosetting resins in which the material softens when heated and swells when in contact with certain liquids, but may not entirely fuse or dissolve. The resin in an uncured thermosetting system, is usually in this stage.

Baking Temperature: A temperature above 150°F. (65.6°C). Refers to curing materials at these elevated temperatures.

Bond: The union of materials by adhesives.

Bond Strength: The unit load applied in tension, compression, flexure, peel, impact, cleavage, or shear, required to break an adhesive assembly with failure occurring in or near the plane of the bond. Note: The term adherence is frequently used in place of bond strength.

Brookfield Viscosimeter: An instrument for measuring the viscosity of formulated adhesives under standard conditions of temperature.

Bubble: Internal void or a trapped globule of air or other gas.

C-Stage: The final stage in the reaction of certain thermosetting resins in which the material is relatively insoluble and infusible. Certain thermosetting resins in a fully cured state are in this stage.

Calorie: A thermal unit. A calorie is that amount of heat required to raise the temperature of one gram of water, one degree centigrade.

Catalyst: A substance which markedly speeds up the cure of an adhesive when added in minor quantity as compared to the amounts of the primary reactants.

Centigrade: A scale of temperature which features 0° and 100° as the freezing and boiling point of water respectively. To convert centigrade to Fahrenheit multiply by 1.8 and add 32, e.g., $(100^{\circ} \times 1.8) + 32 = 212^{\circ}\text{F}$.

Centipoise: 1/100th of a poise; (dyne-sec/cm²); a viscosity measurement unit.

Chalking: Formation of a dry powdery chalk-like appearance or deposit on the surface of a material. It is due to a breaking down of the material after being exposed to ultraviolet light, or other weathering.

Clarity: Degree of clearness in a cured epoxy system.

Closed-Cell Foamed Plastic: A cellular plastic in which there is a predominance of non interconnecting cells.

Coefficient Of Linear Thermal Expansion: Once cured, a measure of the change in length of an epoxy system over a given temperature range. It is expressed in inches per inch per degree C. ASTM D696-44.

Coefficient Of Thermal Expansion (CTE): Change in a unit of length or volume that accompanies a unit change in temperature.

Cohesion: The state in which the particles of a single substance are held together by primary or secondary valence forces observed in the tendency of the substance to stick to itself. As used in the adhesive field, the state in which the particles of the adhesive (or the adhered) are held together.

Compressive Modulus: The ratio within the elastic limit of compressive stress to corresponding compressive strain (deformation per original length). It is expressed in pounds per square inch. ASTM D695-54.

Compressive Strength: Crushing load at the failure of a specimen divided by the original sectional area of the specimen.

Compressive Strength, Ultimate: The maximum load in pounds that can be carried per square inch of cross section of the material under test.

Conductive: Having the quality of power of conducting or transmitting heat, electricity, or static electricity.

Conductivity: Reciprocal of volume resistivity. Conductance of a unit cube of any material.

Cross-Link: Tying together large molecules and hence changing the physical properties of material. Cross-linking usually involves formation of a three dimensional molecular network and is customarily associated with thermosetting resins.

Cure: To change the physical properties of an epoxy by chemical reaction through polymerisation, usually accomplished in the presence of heat and catalyst, alone or in combination.

Cure Cycle: The schedule of time periods at specified temperatures to which a reacting thermosetting plastic or rubber composition is subjected in order to reach certain specified properties.

Curing Agent: A catalytic or reactive agent which when added to resin causes polymerisation.

Density: The ratio of a substance's mass to its volume at a given temperature and pressure. Example: water at 25°C, 1 atmosphere of pressure = 1.0 gr/cm³ = 8.35 lb. Per gallon.

Dielectric Constant: When electrical energy is applied in a circuit, the insulating material of the electrical charge and releases it when the current is broken. Capacitance is the ratio of charge absorbed to the potential (voltage applied). Dielectric Constant is the ratio of an insulator's capacitance to that of dry air. (1.0). A dielectric constant of 5 means an insulator will absorb 5 times more electrical energy than air.

Dielectric Strength: The voltage which an insulating material can withstand before breakdown occurs, expressed in volts per Mil.

Diluent: A reactive or non-reactive additive whose primary function is to lower the viscosity and extend the material to which it was added.

Dispensing Supplies: Medium used to apply epoxy to pieces or units. Squeeze bottles, syringes, needles, and meter mix equipment are all examples.

Discoloration: Any change from an initial colour possessed by a material, either due to environmental or internal conditions.

Dissipation Factor: The measure of electrical energy absorbed and lost in the insulating material when energy is applied in a circuit. 20-3060 has a dissipation factor of .01. This means that .01% of the energy being stored (capacitance) is lost. Dissipation factor is the ratio of the resistive component of a capacitor to the capacitive reactance of the capacitor. Also referred to as Loss Tangent. ASTM D150-59T.

Domed: Showing a symmetrical distortion of a flat or curved section of an object so that as normally viewed. Term often used when clear “epoxy domes” are applied to labels, pins, magnets, key tags, etc.

Elasticity: That property of materials by virtue of which they tend to recover their original size and shape after deformation. Note: if the strain is proportional to the applied stress, the material is said to exhibit Hookean or ideal elasticity.

Elastomer: A material which at room temperature can be stretched repeatedly to at least twice its original length and, upon immediate release of the stress, will return with force to its approximate original length.

Elongation (%): Ability of a material to stretch or become longer.

Encapsulation: Used interchangeably with ‘Potting’. Refers to the enclosure of an item in a substance. Sometimes used specifically in reference to the enclosure of capacitors or modules.

Evacuation: The removal of entrained air from an epoxy system by vacuum. Also referred to as degassing.

Exotherm: The liberation of heat energy during a chemical reaction. Exotherm is increased in large masses.

Extender: An available or relatively inexpensive compatible material which can be added to a more valuable substance so as to increase the amount of material in useful form. The use of extenders may involve adulteration under some conditions.

Failure, Adhesive: The failure at the bond line between substrates and an adhesive; the adhesive separating entirely from the substrate.

Failure, Cohesive: Failure within the adhesive under a stress, resulting in a broken bond with all adhered surfaces still covered with adhesive.

Failure, Substrate: The failure of the substrate material itself, upon subjecting bonded adhered surfaces to a stress.

Filler: A substance, often inert, added to a system to improve properties and/or decrease cost.

Fisheyeib: Small globular mass which has not blended completely into the surrounding material and is particularly evident in a transparent or translucent material.

Flame Retardance: The ability of an epoxy system to resist combustion or burning. Some materials tend to extinguish themselves when subjected to a flame. Such materials are classified as self-extinguishing. ASTM D790-63.

Flash Point: The temperature at which the material gives off flammable vapor in sufficient quantity to ignite momentarily on the application of a flame under specified conditions.

Flexural Modulus: The ratio, within the elastic limit, of flexural stress to the corresponding strain. It is expressed in pounds per square inch. ASTM D790-63.

Flexural Strength: Ability of a material to withstand failure due to bending.

Flow: Movement of the epoxy during the curing stages before completely cured.

Forced Drying Temperatures: A temperature between room temperature and 150°F (65°C).

Fusible: Capable of being melted or fused together by melting.

Gallon: A volume equal to 231 cubic inches measured at 25°C. (77°F).

Gardner Colour Scale: A system of colour standards based upon stable solutions of ferric chloride used in the evaluation of resins, lacquers, oils and varnishes. The Gardner Scale can be correlated roughly with other colour standards such as FAC, ASTM, NPA and Lovibond.

Gel: The initial jelly-like solid phase that develops during the transition from a liquid to a solid. Note: In this state the epoxy is soft, flexible, and has no strength.

Glass Transition Temperature (T_g): Approximate midpoint of the temperature range over which a material undergoes a phase change from brittle to rubbery or vice versa.

Glossib: That property of the cured epoxy or any other material which causes it to reflect light.

Hardener: A substance or mixture of substances added to an epoxy resin to promote or control the curing reaction by taking part in it.

Heat Distortion (Deflection) Temperature: The temperature at which a material softens enough to distort under a given load. It is not usually considered to be beyond the maximum usable temperature, but is an indication of the maximum usable temperature when the material is load bearing at a given load. As the load decreases, the maximum usable temperature will increase.

Heat Sink: Any device that absorbs and draws off heat from a hot object, thereby neutralising the extreme temperature.

Humidity (Absolute): The amount of moisture present in the atmosphere expressed in grams per cubic metre.

Humidity (Relative): The ratio of the amount of moisture contained in the atmosphere to the amount of moisture that can be carried in the atmosphere at a given temperature. Relative humidity is expressed in percent, e.g., 75% R.H. at a given temperature means that the air is 75% saturated with moisture.

Hygroscopic: A property of absorbing and holding moisture.

Impregnate: To fill the voids and spaces of an electrical unit with a compound. (This does not imply complete fill or complete coating of the surfaces by a holefree film).

Insulation Resistance: The ratio of the direct voltage applied to electrodes in contact with an epoxy system to the total current between them. It is dependent upon both the volume and surface resistance of the epoxy systems. ASTM D2576 I.

Intermittent Operating Or Service Temperature: The temperature to which the epoxy system can be subjected for short periods of time without degradation of its properties.

Izod Impact Strength: A measure of the brittleness of a material. Brittle materials will have low izod impact values (.15 for example). Tough materials will have high izod impact strengths (.60 for example)

Maximum Service Temperature: Highest recommended continuous use temperature based upon thermal endurance and historical data.

Modifier: Any ingredient added to an epoxy formulation that changes its properties.

Moisture Resistance: Having some resistance to high humidity. A moisture resistant adhesive will not be easily affected by moisture. Will not easily change its chemical and physical properties due to moisture. Should not be confused with “water proof”.

OHM Unit: Unit of electrical resistance. Resistance of a circuit in which a potential difference of one volt produces a current of one ampere.

Opaque: Any material is opaque if no light can be transmitted through it.

Operating Or Service Temperature: The temperature at which an epoxy system can operate continuously without degradation of its properties.

Orange-Peel: Uneven surface somewhat resembling an orange peel.

Pigment: The fine solid particle, usually inorganic, used in the preparation of coloured products, and substantially insoluble in the vehicle. In contrast, a dye is soluble.

Pit: Small regular or irregular crater in a surface, usually with its width approximately of the same order of magnitude as its depth.

Pot Life: The length of working time of a two component reactive system from the time of the addition of the curing agent in a specific mass (i.e. 100 grams). It is expressed in minutes.

Potting: Similar to encapsulating, except that steps are taken to insure complete penetration of all the voids in the object before the resin polymerises.

P.S.I: Pounds per square inch; a unit measure of pressure.

Set: To convert an epoxy into a fixed or hardened state by chemical or physical action through polymerisation.

Shear Strength: The shear force required to break a specimen divided by its cross-sectional area; the force being applied parallel to the cross-sectional area.

Shore A Hardness: The reading of a material's hardness on a durometer, the scale of which is 0-100, used on elastomers and other flexible materials. Consists of a pin point depression into the material, the material being at least 100 mils thick. A Shore A reading of 80 equal a Shore D reading of 30.

Shore D Hardness: The reading of a material's hardness on a durometer similar to the Shore A durometer, the scale of which 0-100, used on rigid and semi-rigid materials. Consist of a pin point depression into the material. Both the Shore A and Shore D instruments are made by the Shore Instrument Manufacturing Company, Inc., Jamaica, NY.

Shrinkage: The decrease in volume, or contraction, of a material by the escape of any volatile substance, or by a chemical or physical change in the material.

Softening Range: The range of temperature in which a thermoplastic changes from a rigid to a soft state.

Specific Gravity: The ratio of the weight of any volume of a mass or substance to the weight of an equal volume of water at given temperature. The specific gravity of a substance times the density of water equals the density of the substance.

Storage life: The period of time during which a packaged epoxy or curing agent can be stored under specific temperature conditions and remain stable for use. Sometimes called shelf life.

Stress: An applied force or pressure, as tension or shear, exerted on a body which produces a resultant strain on the material. The ability of material to withstand a stress depends on the strength of its cohesive force or molecular resistance.

Stripper: A compound used to remove undesirable foreign material from a surface. Such compounds should possess good penetration, rinse freely and not attack the substrate.

Stripping: The removal of undesirable substance from a surface by abrasive or chemical action.

Substrate: A material upon the surface of which an epoxy is spread for any purpose, such as bonding or coating.

Surface Resistivity: The resistance to a current flow along the surface of an insulator material. Measure in ohms-cm.

Surface Tension: The property of a liquid which causes the surface to pull into the smallest area for a maximum volume, hence, drops are spherical. The fact that water drops on a wax surface do not spread out due to surface tension. If a wetting agent were to be added to the water the round droplet would spread out into a film because of the lowered surface tension.

Temperature, Curing: The temperature to which an adhesive or an assembly is subjected to cure the adhesive. Note: The temperature attained by the adhesive in the process of setting it may differ from the temperature of the atmosphere surrounding the assembly.

Tensile Strength: The pulling force necessary to break a given specimen divided by the cross sectional area. Units given in lbs./in² (P.S.I.). It measures the resistance of a material to stretching without rupture. Normally it is not used with reference to elastic materials which recover after elongation.

Surface Resistivity: The resistance to a current flow along the surface of an insulator material. Measure in ohms-cm.

Thermal Conductivity: A measure of how rapidly heat is conducted through a material.

Thermal Shock Resistance: The ability of a cured system to resist cracking or crazing under conditions of rapid and continuous thermal change. The 1/4 inch Olyphant Washer test is cycled over a temperature range of -55°C to +125°C, this temperature is normally used as the test condition unless otherwise stated.

Thermosetting: Describes the property of an epoxy, to set or become rigid and non-meltable when heated with or without pressure.

Thixotropy: False body. The property of a paste or fluid to thicken or set up to a paste or semi-gel when allowed to stand. Agitation breaks it down but further standing will again permit a viscosity rise.

Time, Curing: The period of time during which an assembly or part may be subjected to heat or pressure, to cure the epoxy. It is the time between the addition of curing agent to the resin, and completed polymerisation.

Viscosity: The property of resistance to flow exhibited within the body of a fluid. Usually measured in centipoise.

1 cps = Water
400 cps = #10 Motor Oil
1,000 cps = Castor Oil
3,500 cps = Karo Syrup
25,500 cps = Cadbury's Chocolate Syrup

Volume Resistivity: The ratio of the electrical resistance through a cross section A divided by the length through which the current flows. Measured in ohms-cm. Volume Shrinkage (%)

Amount of dimensional change during cure: Water Absorption (%)
% by weight water absorbed by material in 24 Hours @ RT.

Waviness, Surface: Wave-like unevenness, or out-of-plane in a surface.

Wetting: The thorough impregnation of a material by a liquid. The more viscous a fluid, and the higher its surface tension, the more difficult it is for the liquid to "wet" materials. Certain additives, for example, water softeners, reduce surface tension, or viscosity and improve wetting properties, allowing the material to flow out more.

Working life: The period of time during which an epoxy after mixing with a curing agent, remains workable and suitable for use.

Yield Strength: The load in pounds per square inch where the material under test begins to change dimensions and will not completely recover when the load is removed. Yield strength will normally be lower than ultimate strength. Generally speaking, the more rigid a material is, the closer will be yield and ultimate strengths. Furthermore, the more resilient a material is, the greater the spread between yield and ultimate strengths.