



Designation: D 883 – 07

Standard Terminology Relating to Plastics¹

This standard is issued under the fixed designation D 883; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

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

1.2 When a term is used in an ASTM document for which Committee D20 is responsible it is included only when judged, after review, by Subcommittee D20.92 to be a generally usable term.

1.3 Definitions that are identical to those published by another standards body are identified with the abbreviation of the name of the organization; for example, IUPAC is the International Union of Pure and Applied Chemistry.

1.4 A definition is a single sentence with additional information included in discussion notes. It is reviewed every 5 years; the year of last review is appended.

1.5 For literature related to plastics terminology, see Appendix X1.

2. Referenced Documents

2.1 ASTM Standards:²

C 162 Terminology of Glass and Glass Products

D 638 Test Method for Tensile Properties of Plastics

D 747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D 882 Test Method for Tensile Properties of Thin Plastic Sheeting

D 907 Terminology of Adhesives

D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics

D 1566 Terminology Relating to Rubber

D 4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets

E 308 Practice for Computing the Colors of Objects by Using the CIE System

3. Terminology

3.1 Definitions:

A-stage, n —an early stage in the preparation of certain thermosetting resins in which the material is still soluble in certain liquids, and may be liquid or capable of becoming liquid upon heating.

DISCUSSION—Sometimes referred to as Resol. (See also **B-stage** and **C-stage**.) (1978)³

acetal plastics, n —plastics based on polymers having a predominance of acetal linkages in the main chain. (See also **polyoxymethylene**.) (1985)

acrylic plastics—plastics based on polymers made with acrylic acid or a structural derivative of acrylic acid. (1982)

addition polymerization—polymerization in which monomers are linked together without the splitting off of water or other simple molecules. (1983)

adiabatic extrusion—a method of extrusion in which, after the extrusion apparatus has been heated sufficiently by conventional means to plastify the material, the extrusion process can be continued with the sole source of heat being the conversion of the drive energy, through viscous resistance of the plastic mass in the extruder. (1978)

aging, n —(1) the effect on materials of exposure to an environment for an interval of time. (2) the process of exposing materials

¹ This terminology is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.92 on Terminology. Current edition approved May 1, 2007. Published June 2007. Originally approved in 1946. Last previous edition approved in 2000 as D 883 - 00.

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 Date indicates year of introduction or latest review or revision.

*A Summary of Changes section appears at the end of this standard.

to an environment for an interval of time. (1973)

alkyd plastics—plastics based on alkyd resins. (1980)

alkyd resin—a polyester convertible into a crosslinked form; requiring a reactant of functionality higher than two, or having double bonds. (1982)

alloy, *n* (in plastics)—two or more immiscible polymers united, usually by another component, to form a plastic resin having enhanced performance properties.

allyl plastics—plastics based on allyl resins. (1978)

allyl resin—a resin made by polymerization of chemical compounds containing the allyl group. (1978)

amino plastics, *n*— plastics based on amino resins. (1978)

amino resin, *n*— a resin made by polycondensation of a compound containing amino groups, such as urea or melamine, with an aldehyde, such as formaldehyde, or an aldehyde-yielding material. (1985)

apparent density—See **density, apparent**.

aromatic polyester, *n*—a polyester derived from monomers in which all the hydroxyl and carboxyl groups are linked directly to aromatic nuclei. (1986)

artificial weathering—exposure to laboratory conditions, which may be cyclic, involving changes in temperature, relative humidity, radiant energy, and any other elements found in the atmosphere in various geographical areas.

DISCUSSION—The laboratory exposure conditions are usually intensified beyond those encountered in actual outdoor exposure in an attempt to achieve an accelerated effect. (1980)

average injection velocity, *n*—the mean value of the velocity of the molten plastic flow front within a cavity during the injection time that is calculated from the shot volume and injection time.

DISCUSSION—The average injection velocity is calculated as follows:

$$V_{av} = \frac{V_s}{t_i \times A_c \times n}$$

where:

V_{av}	=	average injection velocity, mm/s,
V_s	=	shot volume, mm ³ ,
t_i	=	injection time, s,
A_c	=	cross section of the cavity, mm ² , and
n	=	number of cavities.

This calculation is valid for molds containing a single cavity or those containing identical multi-specimen cavities only and not for family molds.

B-stage, *n*—an intermediate stage in the reaction of certain thermosetting resins in which the material swells when in contact with certain liquids and softens when heated, but may not entirely dissolve or fuse.

DISCUSSION—The resin in an uncured thermosetting molding compound is usually, in this stage, sometimes referred to as Resitol. (See also **A-stage** and **C-stage**.) (1978)

bag modeling—a method of molding or laminating which involves the application of fluid pressure, usually by means of air, steam, water or vacuum, to a flexible barrier material which transmits the pressure to the material being molded or bonded.

DISCUSSION—The process is usually employed for forming shapes from preformed laminates comprising a fibrous sheet impregnated with an A-stage or a B-stage thermosetting resin. (1986)

binder, *n*—in a reinforced plastic, the continuous phase which holds together the reinforcement.

DISCUSSION—During fabrication, the binder, which may be either thermoplastic or thermoset, usually undergoes a change in state. (1978)

biodegradable plastic, *n*— See **degradable plastic**.

blister, *n*—an imperfection, a rounded elevation of the surface of a plastic, with boundaries that may be more or less sharply defined, somewhat resembling in shape a blister on the human skin. (1983)

block copolymer—an essentially linear copolymer in which there are repeated sequences of polymeric segments of different chemical structure. (1982)

blocking, *n*—unintentional adhesion between plastic films or between a film and another surface. (1983)

bloom, *n*—a visible exudation or efflorescence on the surface of a material. (1972)

blowing agent—a compounding ingredient used to produce gas by chemical or thermal action, or both, in manufacture of hollow or cellular articles. (1983)

blow molding—a method of fabrication in which a heated parison is forced into the shape of a mold cavity by internal gas pressure. (1985)

branched polyethylene plastics, *n*—those containing significant amounts of both short-chain and long-chain branching and having densities in the 0.910 to 0.940 g/cm³ range.

DISCUSSION—These plastics, usually produced commercially by free radical polymerization, are subcategorized by density level; low density polyethylene plastic and medium density polyethylene plastic.

bulk density, *n*— the weight per unit volume of a loosely packed material, such as a molding powder or pellets.

DISCUSSION—This term should not be used synonymously with apparent density.

bulk factor, *n*— the ratio of the volume of a given mass of molding material to its volume in the molded form.

DISCUSSION—The bulk factor is also equal to the ratio of the density of the material to its apparent density in the unmolded form. (ISO) (1982)

bulk molding compound (BMC), *n*—a putty-like mixture of any thermosetting resin containing fillers, fiber reinforcements, catalysts and thickening agents, or thermoplastic polymers, often extruded into logs or ropes.

DISCUSSION—BMC is suitable for molding by any one of three matched-metal-mold processes—compression molding, transfer molding, or injection molding. (1983)

butylene plastics—plastics based on resins made by the polymerization of butene or copolymerization of butene with one or more unsaturated compounds, the butene being in greatest amount by weight. (1975)

C-stage, *n*—the final stage in the reaction of certain thermosetting materials in which they have become practically insoluble and infusible.

DISCUSSION—The resin in a fully cured thermoset molding is, in this stage, sometimes referred to as Resite. (See also **A-stage** and **B-stage**.) (1986)

cast film—a film made by depositing a layer of plastic, either molten, in solution, or in a dispersion, onto a surface, solidifying and removing the film from the surface. (1982)

cavity, *n*—in specimen preparation, the part of the hollow space of a mold that forms one specimen.

cell, *n*—a small cavity surrounded partially or completely by walls. (1983)

cell, closed—a cell totally enclosed by its walls and hence not interconnecting with other cells. (ISO) (See **cell** and **cell, open**.) (1983)

cell, open—a cell not totally enclosed by its walls and hence interconnecting with other cells. (See **cell** and **cell, closed**.) (1983)

cellular plastic—a plastic containing numerous cells, intentionally introduced, interconnecting or not, distributed throughout the mass. (See also **syntactic cellular plastics**.) (1983)

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

cellulosic plastics, *n*—plastics based on cellulose compounds, such as esters (cellulose acetate) and ethers (ethyl cellulose). (1985)

chalking, *n*—(plastics) a powdery residue on the surface of a material resulting from degradation or migration of an ingredient, or both.

DISCUSSION—Chalking may be designed-in characteristic. (1980)

chemically foamed polymeric material—a cellular material in which the cells are formed by gases generated from thermal decomposition or other chemical reaction. (1982)

chlorinated poly(vinyl chloride)—a poly(vinyl chloride) (PVC) polymer modified by additional chlorination. (2000)

chlorinated poly(vinyl chloride) plastics— plastics based on chlorinated poly(vinyl chloride) in which the chlorinated poly(vinyl chloride) is in the greatest amount by weight. (1978)

chlorofluorocarbon plastics—plastics based on polymers made with monomers composed of chlorine, fluorine, and carbon only. (ISO) (1983)

chlorofluorohydrocarbon plastics, *n*—plastics based on polymers made with monomers composed of chlorine, fluorine, hydrogen, and carbon only. (ISO) (1982)

circuit—in filament winding, the winding produced by a single revolution of mandrel or form. (1978)

closed-cell cellular plastics—cellular plastics in which almost all the cells are noninterconnecting. (1983)

cold flow—See **creep**. (1983)

cold molding—a special process of compression molding in which the molding is formed at room temperature and subsequently baked at elevated temperatures. (1982)

collapse, *n*—inadvertent densification of cellular material during manufacture resulting from breakdown of cell structure. (1982)

composite, *n*— a solid product consisting of two or more distinct phases, including a binding material (matrix) and a particulate or fibrous material.

DISCUSSION—Examples are moulding material containing reinforcing fibers, particulate fillers, or hollow spheres. (1991)

compost—the product of composting.

compostable plastic—a plastic that undergoes biological degradation during composting to yield carbon dioxide, water, inorganic compounds, and biomass at a rate consistent with other known compostable materials and leaves no visually distinguishable or toxic residues. (1996)

compound, *n*—an intimate admixture of (a) polymer(s) with all the materials necessary for the finished product. (1983)

compression molding—the method of molding a material already in a confined cavity by applying pressure and usually heat. (1986)

condensation polymer—a polymer made by condensation polymerization. (1983)

condensation polymerization—polymerization in which monomers are linked together with the splitting off of water or other simple molecules. (1983)

contact pressure molding, *n*—a method of molding or laminating in which the pressure, usually less than 70 kPa (10 psi), is only slightly more than necessary to hold the materials together during the molding operation. (1985)

cooling time, *n*— in molding, the time interval from the start of forward screw movement until the mold starts to open.

copolymer—See **polymer**. (1983)

copolymerization—See **polymerization**. (1983)

crater, *n*—a small, shallow surface imperfection. (1978)

crazing, *n*—apparent fine cracks at or under the surface of a plastic.

DISCUSSION—The crazed areas are composed of polymeric material of lower density than the surrounding matrix. (1978)

creep, *n*—the time-dependent part of strain resulting from stress. (1983)

cross laminate—a laminate in which some of the layers of material are oriented approximately at right angles to the remaining layers with respect to the grain or strongest direction in tension. (See also **parallel laminate**). (1982)

crosslinking, *n*— the formation of a three dimensional polymer by means of interchain reactions resulting in changes in physical properties. (1983)

cross section of the cavity, *n*—in a mold for test specimens, the area of a planar section perpendicular to the flow pattern during filling of the mold that forms the critical portion of the test specimen.

cure, *v*—to change the properties of a polymeric system into a more stable, usable condition by the use of heat, radiation, or reaction with chemical additives.

DISCUSSION—Cure may be accomplished, for example, by removal of solvent or by crosslinking. (ISO) (1983)

cure cycle—the schedule of time periods, at specified conditions, to which a reacting thermosetting material is subjected to reach a specified property level. (1983)

cure time—the period of time that a reacting thermosetting material is exposed to specific conditions to reach a specified property level. (1983)

cut-layers—as applied to laminated plastics, a condition of the surface of machined or ground rods and tubes and of sanded sheets in which cut edges of the surface layer or lower laminations are revealed. (1978)

cycle time, *n*— in molding, the total time used to carry out a complete sequence of operations making up the molding cycle.

degradable plastic, *n*—a plastic designed to undergo a significant change in its chemical structure under specific environmental conditions resulting in a loss of some properties that may vary as measured by standard test methods appropriate to the plastic and the application in a period of time that determines its classification. (1991)

biodegradable plastic, *n*—a degradable plastic in which the degradation results from the action of naturally-occurring micro-organisms such as bacteria, fungi, and algae.

DISCUSSION—The level of biodegradability may be indicated as shown in subordinate definitions for biodegradable plastics. (1991)

hydrolytically degradable plastic, *n*—a degradable plastic in which the degradation results from hydrolysis.

DISCUSSION—The level of hydrolytic degradability may be indicated as shown in subordinate definitions for hydrolytically degradable plastic. (1991)

oxidatively degradable plastic, *n*—a degradable plastic in which the degradation results from oxidation.

DISCUSSION—The level of oxidative degradability may be indicated as shown in subordinate definitions for oxidatively degradable plastic. (1991)

photodegradable plastic, *n*—a degradable plastic in which the degradation results from the action of natural daylight.

DISCUSSION—The level of photodegradability may be indicated as shown in subordinate definitions for photodegradable plastic. (1991)

degradation, *n*— a deleterious change in the chemical structure, physical properties, or appearance of a plastic. (1980)

delamination, *n*— the separation of the layers of material in a laminate. (1978)

density, apparent—the weight in air of a unit volume of a material.

DISCUSSION—This term is sometimes used synonymously with bulk density. (1973)

density, bulk—the weight per unit volume of a material including voids inherent in material as tested.

DISCUSSION—This term is commonly used for material such as molding powder. (1973)

depth, *n*—in the case of a beam, the dimension parallel to the direction in which the load is applied. (1978)

dome, *n*—in reinforced plastics, an end of a filament-wound cylindrical container. (1985)

dry-blend, *n*— a dry compound prepared without fluxing or addition of solvent (also called powder blend). (1983)

dry-spot, *n*—an imperfection in reinforced plastics, an area of incomplete surface film where the reinforcement has not been wetted with resin. (1983)

durometer, *n*— an instrument for measuring indentation hardness.

elastomer, *n*— a macromolecular material that at room temperature returns rapidly to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of the stress. (1985)

engineered plastic, *n*—a material that has been made by specific design and through use of particular monomers and monomer sequences to produce a plastic with desired properties, possibly for a specific application. (1991)

engineering plastics, *n*—those plastics and polymeric compositions for which well-defined properties are available such that engineering rather than empirical methods can be used for the design and manufacture of products that require definite and predictable performance in structural applications over a substantial temperature range.

epoxy plastics, *n*— thermoplastic or thermosetting plastics containing ether or hydroxyalkyl repeating units, or both, resulting from the ring-opening reactions of lower molecular weight polyfunctional oxirane resins, or compounds, with catalysts or with various polyfunctional acidic or basic coreactants.

DISCUSSION—Epoxy plastics often are modified by the incorporation of diluents, plasticizers, fillers, thixotropic agents, or other materials. (1985)

ethylene plastics, *n*—plastics based on polymers of ethylene or copolymers of ethylene with other monomers, the ethylene being in greatest amount by mass. (ISO) (1982)

expandable plastic, *n*—a plastic in a form capable of being made cellular by thermal, chemical, or mechanical means. (1985)

expanded plastics— See **cellular plastic**. (1985)

extrusion, *n*— a process in which heated or unheated plastic is forced through a shaping orifice (a die) in one continuously formed shape, as in film, sheet, rod, or tubing. (1983)

fabricating, *n*— the manufacture of plastic products from molded parts, rods, tubes, sheeting, extrusions, or other forms by appropriate operations such as punching, cutting, drilling, and tapping including fastening plastic parts together or to other parts by mechanical devices, adhesives, heat sealing, or other means. (1978)

fiber show, *n*— strands or bundles of fibers not covered by resin which are at or above the surface of a reinforced plastic. (1985)

filler, *n*—a relatively inert material added to a plastic to modify its strength, permanence, working properties, or other qualities, or to lower costs. (See also **reinforced plastic**.) (1978)

film, *n*—in plastics, an optional term for sheeting having a nominal thickness not greater than 0.25 mm (0.01 in.). (1985)

fish-eye, *n*—small globular mass that has not blended completely into the surrounding material. See **gel**. (1978)

fluorocarbon plastic, *n*—a plastic based on polymers made with perfluoromonomers.

DISCUSSION—When the monomer is essentially tetrafluoroethylene, the prefix TFE is sometimes used to designate these materials. It is preferable to use the accepted abbreviation, PTFE. TFE should not be used by itself to mean PTFE. When the resins are copolymers of tetrafluoroethylene and hexafluoropropylene, the resins may be designated with the prefix FEP. Other prefixes may be adopted to designate other fluorocarbon plastics. (ISO) (1983)

fluorohydrocarbon plastics, *n*—plastics based on polymers made with monomers composed of fluorine, hydrogen, and carbon only. (ISO) (1982)

fluoroplastic, *n*— a plastic based on polymers made from monomers containing one or more atoms of fluorine, or copolymers of such monomers with other monomers, the fluorine-containing monomer(s) being in greatest amount by mass.

DISCUSSION—For specific examples of fluoroplastic see **fluorocarbon plastic**, **chlorofluorocarbon plastics**, **fluorohydrocarbon plastics**, and **chlorofluorohydrocarbon plastics**. (1983)

foamed plastics, *n*— See **cellular plastics** (the preferred terminology). (1983)

forming, *n*—a process in which the shape of plastic pieces such as sheets, rods, or tubes is changed to a desired configuration.

DISCUSSION—The use of the term “forming” in plastics technology does not include such operations as molding, casting, or extrusion, in which shapes or pieces are made from molding materials or liquids. (1982)

furan plastics—plastics based on furan resins. (ISO) (1982)

furan resin, *n*— a resin in which the furan ring is an integral part of the polymer chain and represents the greatest amount by mass. (ISO) (1983)

gate, *n*—in an injection mold, a constriction in the flow channel between the runner and the mold cavity. (1983)

gel, *n*—(1) a semisolid system consisting of a network of solid aggregates in which liquid is held.

(2) the initial jelly-like solid phase that develops during the formation of a resin from a liquid.

(3) with respect to vinyl plastisols, gel is a state between liquid and solid that occurs in the initial states of heating, or upon prolonged storage.

DISCUSSION—All three types of gels have very low strengths and do not flow like a liquid. They are soft, flexible, and may rupture under their own weight unless supported externally. (1978)

(4) in plastic film and sheet, a nodule of plastic material composed of one or more of oxidized, high-molecular-weight, unmelted, non-solvated, or cross-linked material of the same composition as the matrix that, for a variety of reasons, has not blended with the matrix. See **fish-eye**.

DISCUSSION—Gel in the film or sheet is to be distinguished from contamination such as particles of dirt, carbon, or lint. (1992)

gel point, *n*— the stage at which a liquid begins to exhibit pseudo-elastic properties.

DISCUSSION—This stage may be detected as the inflection point on a viscosity-time plot. (See **gel (2)**.) (1985)

gel time, *n*—the period of time from the initial mixing of the reactants of a liquid material composition to the time when gelation occurs, as defined by a specific test method.

DISCUSSION—For a material that must be processed by exposure to some form of energy, the zero time is the start of exposure. (1983)

glass, *n*—an inorganic product of fusion which has cooled to a rigid condition without crystallizing.

DISCUSSION—Term not defined by Committee D20. Definition approved by Committee C14 on Glass and Glass Products. See Terminology C 162.

(a) Glass is typically hard and brittle and has a conchoidal fracture. It may be colorless or colored, and transparent to opaque. Masses or bodies of glass may be made colored, translucent, or opaque by the presence of dissolved, amorphous, or crystalline material.

(b) When a specific kind of glass is indicated, such descriptive terms as flint glass, barium glass, and window glass should be used following the basic definition, but the qualifying term is to be used as understood by trade custom.

(c) Objects made of glass are loosely and popularly referred to as glass; such as glass for a tumbler, a barometer, a window, a magnifier or a mirror. (1978)

glass finish—a material applied to the surface of glass fibers used to reinforce plastics and intended to improve the physical properties of such reinforced plastics over that obtained using glass reinforcement without finish. (1982)

glass transition—the reversible change in an amorphous polymer or in amorphous regions of a partially crystalline polymer from (or to) a viscous or rubbery condition to (or from) a hard and relatively brittle one.

DISCUSSION—The glass transition generally occurs over a relatively narrow temperature region and is similar to the solidification of a liquid to a glassy state; it is not a phase transition. Not only do hardness and brittleness undergo rapid changes in this temperature region but other properties, such as thermal expansibility and specific heat also change rapidly. This phenomenon has been called second order transition, rubber transition and rubbery transition. The word transformation has also been used instead of transition. Where more than one amorphous transition occurs in a polymer, the one associated with segmental motions of the polymer backbone chain or accompanied by the largest change in properties is usually considered to be the glass transition. (1980)

glass transition temperature (*T_g*)—the approximate midpoint of the temperature range over which the glass transition takes place.

DISCUSSION—The glass transition temperature can be determined readily only by observing the temperature at which a significant change takes place in a specific electrical, mechanical, or other physical property. Moreover, the observed temperature can vary significantly depending on the specific property chosen for observation and on details of the experimental technique (for example, rate of heating, frequency). Therefore, the observed *T_g* should be considered only an estimate. The most reliable estimates are normally obtained from the loss peak observed in dynamic mechanical tests or from dilatometric data. (1978)

graft copolymer—a copolymer in which polymeric side chains have been attached to the main chain of a polymer of different structure. (1973)

gusset, *n*—(1) a piece used to give additional size or strength in a particular location of an object.

(2) the folded-in portion of flattened tubular film. (1972)

halocarbon plastics—plastics based on resins made by the polymerization of monomers composed only of carbon and a halogen or halogens. (1978)

haze—the cloudy or turbid aspect or appearance of an otherwise transparent specimen caused by light scattered from within the specimen or from its surfaces.

DISCUSSION—For the purpose of Test Method D 1003, haze is the percentage of transmitted light which, in passing through the specimen, deviates from the incident beam through forward scatter more than 2.5 deg on the average. (1983)

heat mark—extremely shallow depression or groove in the surface of a plastic visible because of a sharply defined rim or a roughened surface. (See also **shrink mark**.) (1978)

high density polyethylene plastics, (HDPE) *n*—those linear polyethylene plastics, g. v., having a standard density of 0.941 g/cm³ or greater.

DISCUSSION—These plastics are usually produced commercially by processes not employing free radical polymerization. Standard density refers to the density of the material molded to a thickness of 1.9 mm (0.075 in.) using Procedure C of Annex A1 of Practice D 4703.

high-pressure molding, *n*—a method of molding or laminating in which the pressure used is greater than 1400 kPa (200 psi). (1985)

hold pressure, *n*— in molding, the melt pressure during the hold time interval in injection molding.

homopolymer, *n*— a polymer resulting from polymerization involving a single monomer. (1983)

hydrocarbon plastics—plastics based on resins made by the polymerization of monomers composed of carbon and hydrogen only. (1985)

hydrolytically degradable plastics, *n*—See **degradable plastic**.

inhibitor, *n*— a substance used in low concentration which suppresses a chemical reaction.