Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Satyanarayan Gangaram Pitroda
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”


“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartrhari—Nitisatakam
“Knowledge is such a treasure which cannot be stolen”
Indian Standard
PLASTICS — VOCABULARY
(First Revision)

ICS 83.080.01; 01.040.83
FOREWORD

This Indian Standard (First Revision) which is identical with ISO 472:1999 'Plastics — Vocabulary' issued by the International Organization for Standardization was adopted by the Bureau of Indian Standards on the recommendation of the Plastics Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard was first published in 1964 under the title 'Glossary of terms used in the plastics industry'. As the industry was progressed manifolds since then, a need was felt to revise the standard to bring in newer terms. This standard has been prepared with a view to eliminate the ambiguity arising from different interpretation of terms used in plastic trade and industry and to establish a generally recognized usage. These considerations led the Committee to revise the standard so as to align the same with corresponding International Standard namely, ISO 472 : 1999 'Plastics — Vocabulary' under dual numbering system. Consequently, the title of the standard has also been modified as 'Plastics — Vocabulary'. Since the International Standard is bilingual, only the English version has been retained in this standard.

The text of ISO standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard they should be read as 'Indian Standard'.

b) Comma (,) has been used a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this standard, Index of alphabetic list of French synonyms with corresponding preferred term (P 182-185), Index of all French terms, with English equivalents (P 186-198), Index of all English terms, with Russian equivalents (P 199-217) and Index of Russian terms with English equivalents (P 218-232) as given in ISO 472:1999 have been left out.
1 Scope

This International Standard defines terms used in the plastics industry, in English and French. The terms are listed alphabetically in English with definitions, and facing the French terms with definitions.

All terms are listed in a French-English index and, when available, in English-Russian and Russian-English indexes in normal word order; some terms are also listed in reverse word order.

When a term has one or more synonyms, the synonymous terms follow the preferred term. Furthermore, the synonyms are listed in the correct order of the alphabetical enumeration. Deprecated terms are indicated by "(deprecated)". The sign → is used after a term without definition to indicate where the definition may be found.

The abbreviation "cf." indicates, that the user may refer to another term (not a synonym), definition or note which contains information related to the term following the sign.

NOTE 1 For terms involving olefins, the (scientific) name approved by IUPAC is given in square brackets following the name used commonly in the plastics industry, for example polyethylene [polyethene].

NOTE 2 IUPAC rules for source-based names of polymers specify that when "poly" is followed by more than one word enclosing marks are used. The IUPAC practice is followed in this International Standard. In common use, the enclosing marks are often omitted.

NOTE 3 Some terms in this International Standard have information added, in parenthesis, to indicate specific limitation of the term to a particular field.

NOTE 4 In the English text, terms are indicated to be "noun", "verb" or "adjective".

NOTE 5 The sign → means: for definition, refer to.
2 Terms and definitions

absolute modulus, \(|M|\), (Pa)
absolute compliance, \(|C|\), (Pa⁻¹)

\[ |M| = \sqrt{\sigma^2 + M^{-2}} = \frac{\sigma_0}{\varepsilon_0} \]
\[ |C| = \sqrt{c^{-2} + C^{-2}} = \frac{\varepsilon_0}{\sigma_0} \]

where

\( \sigma_0 \) is the maximum stress  
\( \varepsilon_0 \) is the maximum strain

NOTE The measurement may be in tension, shear, bulk compression or longitudinal compression.

EXAMPLE Absolute value of complex shear modulus

\[ |G^*| = G^* = \sqrt{G'^2 + G''^2} \text{ (Pa)} \]

cf. modulus, complex compliance, complex modulus and compliance

acrylic plastic
plastic based on polymers made with acrylic acid or a structural derivative of acrylic acid, or their copolymers with other monomers, the acrylic monomer(s) being in the greatest amount by mass

acrylonitrile/butadiene/styrene plastic
ABS plastic
plastic based on terpolymers and/or blends of polymers and copolymers made with acrylonitrile, butadiene and styrene

acrylonitrile/methyl methacrylate plastic
A/MMA plastic
plastic based on copolymers of acrylonitrile and methyl methacrylate

activator
substance used in small proportion to increase the effectiveness of an accelerator

addition polymer
polymer made by addition polymerization

addition polymerization
polymerization by a repeated addition process

NOTE The repeated addition process takes place without the splitting off of water or other simple molecules.

cf. polyaddition

additive
substance added to polymers to improve or modify one or more properties

NOTE In a narrow sense, the term additive includes only ingredients added in small amounts; in such cases the term modifier is used for an ingredient added in relatively-large amounts.

acetone resin
resin made by polycondensation of acetone with another compound, for example formaldehyde or phenol

cf. condensation
adherence
state in which two surfaces are held together by interfacial forces

NOTE Adherence can be achieved with or without the use of an adhesive.

cf. adhesion and cohesion

adherend
body that is held, or is intended to be held, to another body by an adhesive

adhesion
state in which two surfaces are held together by chemical or physical forces or both, with the aid of an adhesive

cf. adherence and cohesion

adhesion failure
adhesive failure
rupture of an adhesive bond in which the separation appears visually to be at the adhesive/adherend interface

cf. cohesion failure

adhesive
-glue (deprecated)
substance capable of holding materials together by adhesion

NOTE The term glue was used originally for an adhesive prepared from a hard gelatin. Through general use, the term became synonymous with the term adhesive in referring to adhesives prepared from synthetic resins. The term adhesive now is the preferred general term.

adhesive line
-glue line (deprecated)
space filled with adhesive between two parts to be bonded or in a bonded product

cf. bond line and joint (in adhesive bonding)

afterflame
-persistence of flaming of a material, under specified test conditions, after the ignition source has been removed

afterflame time
-length of time for which a material continues to flame, under specified test conditions, after the ignition source has been removed

afterglow
-persistence of glowing of a material after cessation of flaming or after the ignition source has been removed

ageing
-entirety of all irreversible chemical and physical processes occurring in a material in the course of time

cf. deterioration

air-assist vacuum thermoforming
-vacuum thermoforming process in which partial preforming of a heated sheet is accomplished by air pressure before vacuum pulldown

air-slip vacuum thermoforming
-vacuum thermoforming process in which a male mould is enclosed in a box, providing an air cushion to keep the advancing mould from contacting a heated sheet until the end of its travel, at which point vacuum is applied to destroy the air cushion and pull the sheet against the mould

alloy
two or more immiscible polymers united, usually by another component, to form a polymeric composition having enhanced performance properties

allyl polymer
-polymer or resin made by polymerization of chemical compounds containing the allyl group

alpha loss peak
-first peak in the damping curve below the melting range, in order of decreasing temperature at constant frequency or increasing frequency at constant temperature
alternating copolymer
copolymer in which two species of monomeric units are distributed in alternating sequence

alternating copolymerization
polymerization in which an alternating copolymer is formed

alternating stress
vibrating stress with equal values but with opposite signs
cf. vibrating stress

amino resin
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
cf. condensation

aminoplast
crystalloid based on amino resins

amorphous, adjective
non-crystalline, or devoid of crystalline structure

amorphous regions
those regions within a polymeric material that, on the basis of X-ray diffraction or other suitable techniques, do not show any evidence of crystalline structure

anaerobic adhesive
adhesive that cures spontaneously in the absence of oxygen, the curing being inhibited by the presence of oxygen and catalyzed by metallic ions
cf. molar mass

angular velocity, \( \omega \) (rad-s\(^{-1}\))
\[ \omega = 2\pi f \]
where \( f \) is the frequency

aniline-formaldehyde resin
amino resin made by polycondensation of aniline with formaldehyde
cf. condensation

antiblocking agent (for films)
substance incorporated in or applied to films to prevent their sticking together during manufacture, storage or use

antioxidant
substance used to retard deterioration caused by oxidation

antistatic agent
substance added in small proportion to a material or applied to its surface to counteract the build up of an electrical charge on the material

apparent density
mass divided by the volume of a sample of material, including both permeable and impermeable voids normally present in the material

apparent molar mass
apparent relative molecular mass, \( M_{app} \)
molar mass calculated from experimental data without the application of appropriate corrections, such as for finite polymer concentration, association, preferential solvation, compositional heterogeneity or constitutional heterogeneity\(^1\)
cf. molar mass

angle-head
extruder head fixed at an angle to the axis of the extruder barrel
cf. crosshead

---

\(^1\) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1:1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
area burning rate
erate of burning (deprecated)
surface area of a material burned divided by time
under specified test conditions

cf. linear burning rate, mass burning rate and flame
spread rate

aromatic polyester
polyarylate
polyester derived from monomers in which all the
hydroxyl and carboxyl groups are linked directly to
aromatic nuclei

artificial weathering
exposure to cyclic laboratory conditions involving
changes in temperature, relative humidity and radiant
energy, with or without direct water spray, in an
attempt to produce changes in the material similar to
those observed after long-term, continuous, outdoor
exposure

NOTE The laboratory exposure conditions usually are
intensified beyond those encountered in actual outdoor
exposure in an attempt to achieve an accelerated effect.
This term does not cover exposure to special conditions,
such as ozone, salt spray, industrial gases, etc.

assembling
fabricating operations involved in fastening parts
together by mechanical devices, adhesives, heat
sealing, welding or other means

cf. fabricating and machining

assembly (for adhesives)
group of materials or parts, including adhesives, which
has been placed together for bonding or which has
been bonded together

assembly time
time interval between the end of application of the
adhesive on the adherend and the initiation of the
setting time

NOTE The assembly time is the sum of the open and
closed assembly times.

A-stage
early stage in the preparation of certain thermosetting
resins, in which the material is still soluble in certain
liquids, and fusible

cf. B-stage, C-stage and resol

atactic block
regular block that has equal numbers of the possible
configurational base units in a random sequence distri-
bution

atactic polymer
regular polymer, the molecules of which have equal
numbers of the possible configurational base units in a
random sequence distribution

attenuation constant, \( \alpha \ (m^{-1}) \)

\[
\alpha = \frac{1}{n} \times \frac{n \lambda}{d}
\]

where

- \( \lambda \) is the wavelength;
- \( d \) is the loss factor;
- \( n = 1 \) for longitudinal or torsional waves;
- \( n = 2 \) for bending waves

NOTE The attenuation constant determines the spatial
decay of a damped vibration:

\[
A = A_0 e^{-\alpha x}
\]

where

- \( A \) is the amplitude;
- \( A_0 \) is the initial amplitude;
- \( x \) is the spatial coordinate.

autothermal extrusion
adiabatic extrusion
method of extrusion in which the sole source of heat is
the conversion of the drive energy through viscous
resistance of the plastic mass in the extruder

average degree of polymerization, \( \bar{X}_P \)
average of the degree of polymerization for a polymer

cf. degree of polymerization
back draft
back taper
counterdraft
reverse taper
slight taper in a mould wall tending to impede removal of a moulding

beamed yarn
large and determined number of glass yarns wound parallel on to a large cylindrical carrier spool (beam)

benzyl cellulose
benzyi ether of cellulose

beta loss peak
second peak in the damping curve below the melting range, in order of decreasing temperature or increasing frequency

baffle
in a mould, a plug or other device fitted in a steam or water channel to divert the flow and direct it to a required path

binder (in adhesive compounds)
component of an adhesive composition that is responsible primarily for the adhesion

binder (glass)
binding agent (textile glass)
material(s) applied to staple fibres and to strands in order to hold them in a desired arrangement, for example, in glass mats, surfacing mats and veils or non-woven fabrics (non-wovens)

biodegradable plastic
degradable plastic in which the degradation process results in lower-molecular-weight fragments produced by the action of naturally occurring microorganisms such as bacteria, fungi and algae

bar mould
multi-impression mould in which the impressions are arranged in rows on separate bars which may be removed individually

cf. degradable plastic

bipolymer
polymer derived from two species of monomer

bag moulding
process of moulding reinforced plastics in which the consolidation of a material placed over or in a rigid mould is accomplished by the application of uniform pressure through a flexible membrane, for example a rubber bag

NOTE Also called autoclave moulding, pressure-bag moulding, vacuum-bag moulding, depending on the means used to force the bag against the material.

bipolymerisation
polymerisation in which the monomer is dispersed as relatively large droplets in water or other suitable inert diluent, resulting in a beadlike product

blister
elevation of the surface of varied contour and dimensions, with a cavity beneath it

cf. pimple

barrel
cylinder
tube of steel that forms the housing around (an) extruder screw(s) and injection screw(s) or plunger

blast finishing
process of removing flash from mouldings and/or dulling their surfaces by impinging media, such as steel balls, walnut shells or plastic pellets, against them with sufficient force to fracture the flash or to dull the surface
block
portion of a polymer molecule, comprising many constitutional units, that has at least one constitutional or configurational feature not present in the adjacent portions

NOTE The definitions that relate to polymer may also be applied to block.

cf. block polymer

block copolymer
block polymer derived from more than one species of monomer

cf. block polymer

block copolymerization
polymerization in which a block copolymer is formed

block polymer
polymer, the molecules of which consist of blocks connected linearly

NOTE The blocks are connected directly or through a constitutional unit that is not part of the blocks. In the polymer molecule

\[ A_1 - B_1 - A_2 - B_2 \]

A, B, A_n and B_n are blocks, and the individual blocks are regular. In this block polymer molecule, A and B may be for example:

(A) \(-\text{CHCH}_2\text{OOCCH}_3\)
(B) \(-\text{CHCH}_2\text{OOCCH}_3\)

The block polymer of which the molecules consist of these blocks is a block copolymer because A and B arise from different monomer species. On the other hand, A and B may be, for example:

(A) \(-\text{C}_3\text{H}_2\text{CO}_2\text{CH}_3\)
(B) \(-\text{C}_3\text{H}_2\text{CO}_2\text{CH}_3\)

These blocks are stereoblocks and the block polymer with molecules consisting of these blocks is not a block copolymer because A and B arise from the same monomer species.

cf. block copolymer

block polymerization
polymerization in which a block polymer is formed

block press
press to prepare thicker sheets from thin ones

blocked curing agent
curing or hardening agent temporarily rendered unreactive, which can be reactivated as desired by physical or chemical means

blocking
unintentional adherence between materials

bloom
visible exudation or efflorescence on the surface of a plastic

NOTE Bloom may be caused by lubricant, plasticizer, etc.

blow moulding
method of forming hollow objects by inflating a parison into a mould with compressed gas

blowing agent
substance used to cause expansion in the manufacture of hollow or cellular articles

NOTE Blowing agents may be compressed gases, volatile liquids or chemicals that decompose or react to form a gas.

blow-up ratio

1) in blow moulding, the ratio of the diameter of the parison to the maximum diameter of the cavity in which it is to be blown;

2) in tubular extrusion blowing of film, the ratio of the extrusion die diameter to the diameter of the blown tube
bole (of a calender)
one of a set of rolls forming the essential part of a calender

bond (in adhesion), noun
attachment at the interface between an adhesive and an adherend

bond (in adhesion), verb
to unite surfaces of materials by means of an adhesive

NOTE: The bonding operation may involve several stages: application of the adhesive, open assembly time, closed assembly time and curing or setting time.

cf. adhere

bond line
interface between an adhesive and an adherend

bond strength (in adhesion)
force required to break a bonded assembly, with failure occurring in or near the adhesive/adherend interface

boss
functional raised area on the surface of a moulding

braid
planar or tubular fabric structure made by interlacing several textile or glass yarns in such a manner that all yarns lie at an angle other than 0° or 90° to the length direction of the fabric

branch
oligomeric or polymeric offshoot from a macromolecular chain

branched polymer
polymer composed of molecules having a branched structure, chainlike either between branch junctions or between each chain end and a branch junction

NOTE: The branches are composed of mers.

breakaway torque, $T_{BA}$
initial torque required to break the bond measured at the first movement between the nut and the bolt, when unscrewing an unseated assembly

breaker plate (in an extruder)
perforated plate which may support a screen pack

breaking stress
stress at the moment of rupture of a specimen

breakoff torque, $T_{BL}$
initial torque required to decrease or eliminate the axial load in a preloaded assembly

breathing
operation of opening of a mould or press for a very short period of time at an early stage in the process of cure

NOTE: Breathing allows the escape of gas or vapour from the moulding material and reduces the tendency of thick mouldings to blister.

bristle
relatively thick, short section cut from a monofilament

brittleness temperature
temperature at which there is a 50% probability of brittle failure in a specimen when tested by the method specified in ISO 974

B-stage
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 dissolve or fuse entirely

cf. A-stage, C-stage and resitol
bulk compression
volume compression
isotropic compression, \( \chi \) (dimensionless)
relative decrease in volume caused by hydrostatic pressure

\[
\chi = -\frac{\Delta V}{V}
\]

bulk density
apparent density of powders, pellets, granules, etc.

burning behaviour
fire behaviour
all the physical and/or chemical changes that take place when a material, product and/or structure burns and/or is exposed to fire

butt joint
joint made by bonding two surfaces that are perpendicular to the main surfaces of the adherends

cf. lap joint and scarf joint

butylene [butene] plastic
plastic based on polymers made by the polymerisation of butylene [butene] or copolymerisation of butylene [butene] with other monomers, the butylene [butene] units being in the greatest amount by mass in the copolymer

cabled yarn (textile glass)
two or more folded yarns (or alternatively folded and single yarns) twisted together in one or more folding operations

calender
machine that has a series of rolls (boles), of which each adjacent pair turns in opposite directions

NOTE The machine is used to produce film, sheeting, coated substrates, or laminates with thickness determined by adjustment of the gap between the last pair of heated rolls.

cf. bole (of a calender)

calendering
process of making film, sheeting, coated substrates, or laminates by passing thermoplastics through a calender

capacitance of a capacitor
charge on one of the capacitor plates divided by the potential difference between them, the influence of any other conductor being negligible

IUPAP symbol: \( C \)
carbon fibre
fibre containing at least 90% by mass of carbon, obtained by pyrolysis of organic-fibre precursors

NOTE Carbon fibres are traditionally categorized according to their mechanical properties, with particular reference to their tensile strength and modulus, as follows:

general-purpose fibre: fibre used for the reinforcement of plastics to confer improved electrical, electrostatic, electromagnetic, thermal or tribological properties. This type has lower tensile properties.

high-tenacity (HT) fibre: fibre with a tensile strength exceeding 2,500 MPa and a tensile modulus between 200 GPa and 280 GPa. This type is also known as "high-strength (HR)", "high-strain (HS)" or "standard-grade fibre".

intermediate-modulus (IM) fibre: fibre with a tensile modulus between 280 GPa and 350 GPa. In this category, there are also fibres of very high tenacity equal to or greater than 5,000 MPa.

high-modulus (HM) fibre: fibre with a tensile modulus between 350 GPa and 600 GPa.

ultra-high-modulus (UHM) fibre: fibre with a tensile modulus in excess of 600 GPa.

casein CS
protein material precipitated from skimmed milk by the action either of rennet or dilute acid

cast film
film made by depositing a layer of plastic, which is molten in a solution or in a dispersion, on to a surface, solidifying, and then removing the film from the surface

cf. film casting

casting
process in which a liquid or viscous material is poured or otherwise introduced into a mould or on to a prepared surface to solidify without the use of external pressure

casting resin
resin in liquid form that can be poured or otherwise introduced into a mould and shaped without pressure into solid articles

catalyst
substance used in small proportion, that augments the rate of a chemical reaction, and in theory remains unchanged chemically at the end of the reaction

cf. accelerator, activator, inhibitor, initiator, regulator and retarder

carbon fibre precursor
organic fibres which can be converted to carbon fibres

NOTE Precursors are usually in the form of continuous yarn, but can be woven or knitted fabric, braid, mat or felt.

cf. PAN-based carbon fibre, pitch-based carbon fibre and viscose-based carbon fibre

carbonization
heat treatment in an inert atmosphere to convert a carbon fibre precursor into carbon fibre

carboxymethyl cellulose
CMC
glycolic acid ether of cellulose

cavity (of a mould)
space within a mould to be filled to form the moulded product

cf. impression

cell
single small cavity surrounded partially or completely by its walls
cellular adhesive
foamed adhesive
adhesive the density of which is reduced by the presence of numerous small cavities (cells) dispersed throughout its mass
cf. foaming adhesive

cellular plastic
expanded plastic
foamed plastic
plastic the density of which is reduced by the presence of numerous small cavities (cells), interconnecting or not, dispersed throughout the mass
NOTE A cellular plastic (foamed plastic) often is called simply a foam.

cellular striation
layer within cellular plastics that differs from the characteristic cell structure

cellulose acetate
CA
acetic acid ester of cellulose

cellulose acetate butyrate
CAB
mixed acetic and butyric acid ester of cellulose

cellulose acetate propionate
CAP
mixed acetic and propionic acid ester of cellulose

cellulose nitrate
CN
nitric acid ester of cellulose

cellulose propionate
CP
propionic acid ester of cellulose

cellulosic plastic
plastic based on derivatives of cellulose

centrifugal casting
process of forming hollow cylindrical products by rotating about one axis at high speed a mould containing a fluid monomer, prepolymer, or polymer dispersion and maintaining the rotation while solidifying the polymeric material by suitable means, such as heating
NOTE: cf. centrifugal moulding, rotational casting and rotational moulding

centrifugal moulding
process of forming hollow cylindrical products by rotating about one axis at high speed a mould containing a dry fusible powder and maintaining the rotation while fusing the polymer by the application of heat
NOTE: cf. centrifugal casting, rotational casting and rotational moulding

chain length
total length of a chain molecule measured from atom to atom along the chain
NOTE: This term should not be used for the direct distance between the ends of the molecule.

chain transfer
chemical reaction usually occurring during chain polymerization, in which an active macromolecule transfers the reactive functional species to another molecule and becomes itself inactive

chain-transfer polymerization
chain polymerization in which the chain-growth reaction frequently proceeds through a chain-transfer process

chalking
deterioration evidenced by the appearance of a powdery residue on the surface

chase
bolster
frame
that part of the structure of a mould which secures the impression or the punch
NOTE: Chase, impressions and punches may be so designed that a standard chase may be used to hold a variety of impressions and punches.
**chemically-foamed plastic**
Cellular plastic in which the cells are formed by gases generated from thermal decomposition or chemical reaction of the constituents

*cf. mechanically- and thermally-foamed plastic*

**chill roll extrusion**
Process of extruding film and sheeting in which a molten extrudate is cast on to a cooled roll

**chirality**
Property of non-identity of a molecule with its mirror image

*NOTE* A molecule in a given configuration or conformation is termed chiral when it is not identical with its mirror image. All asymmetric molecules are chiral; however, not all chiral molecules are asymmetric, since some molecules having axes of rotation are chiral. Chiral and prochiral atoms are sites or potential sites, respectively, of stereoisomerism.

**chlorinated poly(vinyl chloride)**
**PVC-C**
Poly(vinyl chloride) modified by chlorination of the polymer

**chlorinated polyethylene**
**PE-C**
Polyethylene modified by chlorination of the polymer

**chopped fibre**
Short fibre cut from yarn, not held together by any means

*NOTE* The chopped fibre may be sized for incorporation in injection-moulding powders.

**chopped strand mat** (textile glass)
Mat formed of strands cut to a short length, randomly-distributed, without intentional orientation, and held together by a binder

**chopped strands** (textile glass)
Short strands cut from continuous filament strands, not held together by any means

**closed assembly time** (in adhesive bonding)
Time between the assembling of adhesive-coated surfaces and the application of heat and/or pressure to cure or set the adhesive

*NOTE* During closed assembly time, the assembly may be under relatively low pressure to ensure intimate contact of the adhesive-coated surfaces and the adhesive may undergo partial curing or setting to attain mechanical characteristics permitting handling of the assembly.

*cf. open assembly time, cure time and setting time*

**closed cell**
Cell enclosed totally by its walls and hence non-interconnecting with other cells

**closed-cell cellular plastic**
Cellular plastic in which almost all the cells are non-interconnecting

**coated fabric**
Fabric with an adherent layer of polymeric material on one or both sides, the coated product remaining flexible

**coating** (product)
Thin layer of a material applied by a coating process

**coating** (process)
Process of applying a thin layer of a material in the form of a fluid or powder upon a substrate

*NOTE* Laminating is not considered to be coating.
Coefficient of friction
ratio of the frictional force to the normal force, acting perpendicular to the two surfaces in contact.

cold moulding
special process of compression moulding in which the moulding is formed at room temperature and baked subsequently at elevated temperatures.

Coefficient of linear thermal expansion
reversible change in length of a material per unit length per degree change in temperature.

NOTE The value may vary for different temperature ranges.

IUPAC symbol: α

cold pressing (in adhesion)
bonding operation in which an assembly is subjected to pressure without the application of heat.

cold setting
curing a thermosetting material at room temperature.

cold-setting adhesive
adhesive that sets without the application of heat.

Coefficient of twist contraction (as applied to glass fibre)
change in length of a yarn attributable to the twist, expressed as a percentage of the length of the untwisted yarn.

cf. hot-setting adhesive

cold-setting adhesive
adhesive that sets without the application of heat.

Cohesion
state in which the particles of a single substance are held together by intermolecular forces.

cf. adhesion failure

cold-slug well
slug well
space provided directly opposite the sprue opening in an injection mould to trap the material injected initially (cold slug) that has cooled below the effective moulding temperature.

collapse (of cellular plastics)
 inadvertent densification of cellular plastics during manufacture, resulting from breakdown of cell structure.

colour bleeding
movement of colorants or coloured constituents out on to a surface as a result of blooming, exudation or migration.

cf. bloom, exudation and migration

colour fading
colour change that involves a lightening or weakening of the colour.

cf. colour-fastness on exposure to light and discolouration
colour-fastness on exposure to light
light fastness (of colour)
resistance to colour changes due to exposure to light, without direct atmospheric effects (therefore, not "weather resistance")

NOTE Colour-fastness commonly is evaluated by visual assessment using standard reference colour standards (or by instrumental assessment).

cf. colour fading and discoloration

colour heterogeneity
unintentional variation of colour in the same piece

comb chain
macromolecule consisting of a main chain from which, at regular intervals, linear chains, all of comparable length, emanate

comb polymer
polymer, the molecules of which are comb chains

combination reinforcement
combination of several forms of one reinforcement that are bonded mechanically or chemically

NOTE Generally such reinforcements include a reinforcement with chopped strands and another with unchopped strands.

combustible
capable of burning

combustion
exothermic reaction of a substance with an oxidizer, accompanied by flames and/or glowing and/or emission of smoke

compatibility
state in which a substance in admixture in plastics will not exude, bloom, or separate in similar manner
**complex viscosity,** \( \eta_c \text{ (Pa·s)} \)
the quotient of complex stress \((\sigma^*)\) to complex rate of strain \((\dot{\varepsilon}^*)\) in the forced oscillation of a material

\[
\eta_c = \sigma^*/\dot{\varepsilon}^*
\]

**NOTE 1** The strain \((\varepsilon)\) and stress \((\sigma)\) of the forced oscillation are given by the expressions:

\[
\varepsilon = \varepsilon_0 \sin \omega t
\]
and

\[
\sigma = \sigma_0 \cos (\omega t + \delta)
\]
and the rate of strain

\[
\dot{\varepsilon} = \omega \varepsilon_0 \cos \omega t
\]

**NOTE 2** The complex rate of strain \(\dot{\varepsilon}^*\) is given by

\[
\dot{\varepsilon}^* = \dot{i}\varepsilon_0 e^{i\omega t}
\]
\[
= i\omega \varepsilon_0 (\cos \omega t + i \sin \omega t)
\]
where

\[
i = \sqrt{-1}
\]

**NOTE 3** The complex stress \(\sigma^*\) is given by

\[
\sigma^* = \sigma_0 e^{i(\omega t + \delta)}
\]
\[
= \sigma_0 [\cos (\omega t + \delta) + i \sin (\omega t + \delta)]
\]

**NOTE 4** The complex viscosity is related to the dynamic and out-of-phase viscosities by the equations:

\[
\eta_c = \sigma^*/\dot{\varepsilon}^*
\]
\[
= \sigma_0 (\cos \delta + i \sin \delta)/i\omega \varepsilon_0
\]
\[
= \eta^* - i\eta^*
\]

**NOTE 5** The dynamic and out-of-phase viscosities are related to the storage modulus \((M')\) and the loss modulus \((M'')\) by the equations:

\[
\eta_c = \eta^* - i\eta^*
\]
\[
= M'/i\omega
\]
\[
= (M' + i M'')/i\omega
\]
so that

\[
\eta^* = M'/i\omega
\]
and

\[
\eta^* = M'/i\omega
\]

**NOTE 6** The complex viscosity may alternatively be expressed as

\[
\eta_c = \sigma^*/\dot{\varepsilon}^*
\]
\[
= (\sigma_0 e^{i\delta})/i\omega \varepsilon_0
\]
\[
= M'/i\omega
\]
where \(M'\) is the complex modulus.

**compliance,** \( C \text{ (Pa}^{-1}\text{)} \)
quotient of strain by stress:

\[
C = \varepsilon/\sigma = 1/M
\]
\(D\) is the tensile compliance; \(J\) is the shear compliance;
\(B\) is the bulk compliance; \(\sigma\) is the longitudinal compression compliance

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

**NOTE** Examples: moulding material containing reinforcing fibres, particulate fillers or hollow spheres.

2) solid product consisting of two or more layers (often in a symmetrical assembly) of plastic film or sheet, normal or syntactic cellular plastic, metal, wood, composite according to definition 1), etc., with or without adhesive interlayers

**NOTE** Examples: film composites for packaging, sandwich cellular composite for structural applications, laminates made with paper, fabric, etc.

**composite mould**
multicavity mould containing dissimilar impressions with a common chase

**compound**
intimate admixture of a polymer or polymers with other ingredients such as fillers, plasticizers, catalysts and colorants

**compression moulding**
process of moulding a material in a confined cavity by applying pressure and usually heat

**compression-moulding pressure**
in compression moulding, the fluid pressure applied to the material in the mould

cf. moulding pressure
compressive strain
quotient of the reduction in thickness of a specimen under compressive stress, by its initial thickness

compressive strength
maximum compressive stress carried by the test specimen during a compressive test

compressive strength of cellular plastics
quotient of the maximum compressive force reached when the relative deformation is less than 10 %, by the initial surface area of the cross-section of the test specimen according to ISO 844

NOTE: If the value of the maximum stress corresponds with a relative deformation of less than 10 %, it is noted as the "compressive strength". Otherwise, the compressive stress at 10 % relative deformation is calculated and its value noted as the "compressive stress at 10 % relative deformation".

compressive stress
normal stress arising from a compressive force applied perpendicular to the plane in which it acts

conditioning
whole series of operations intended to bring a sample or specimen into a reference state with regard to temperature and humidity

conditioning atmosphere
atmosphere in which a sample or test specimen is kept before being subjected to test

cf. reference atmosphere and standard atmosphere(s)

configurational base unit
constitutional repeating unit the configuration of which is defined at one or more sites of stereoisomerism in the main chain of a polymer molecule

NOTE In a regular polymer, a configurational repeating unit corresponds to the constitutional repeating unit. In the regular polymer molecule

\[ [\text{CH}(\text{CH}_3)\text{CH}_2]^n \]

\[ (\text{polypropylene}) \]

the constitutional repeating unit is \[ -\text{CH}(\text{CH}_3)\text{CH}_2- \] and the configurational base units are:

\[ \text{H} \quad \text{C} \quad \text{CH}_3 \quad \text{CH}_2 \quad \text{H} \]

These two configurational base units are enantiomeric to each other.

configuration polymer
polycondensate
polymer made by condensation polymerization

condensation polymerization
polycondensation
polymerization by a repeated condensation process (i.e. with the elimination of simple molecules)

configurational repeating unit
smallest set of one two, or more successive configurational base units that prescribes configurational repetition at one or more sites of stereoisomerism in the main chain of a polymer molecule

cf. notes to isotactic polymer and syndiotactic polymer

configurational sequence
defined portion of a macromolecule comprising configurational units with relative or absolute configuration of one or more types at the sites of stereoisomerism in the constitutional units
configurational unit
constitutional unit having one or more sites of defined stereoisomernism

constitutional repeating unit
smallest constitutional unit of the repetition of which describes a regular polymer

NOTE: The polymer chain
\[ \text{CH}_2 - \left( \text{CH}_2 \right)_n \text{CH}_2 - \]
can provide the following constitutional units:
\[ \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - etc. \]
The first and the second constitutional units are the smallest describing completely this polymer chain. Either of these two constitutional units is a constitutional repeating unit and the polymer, the molecules of which can be described by the polymer chain shown above is a regular polymer.

constitutional sequence
defined portion of a macromolecule comprising constitutional units of one or more types

constitutional unit
species of atom or group of atoms present in a chain of a polymer or oligomer molecule

cf. constitutional repeating unit

contact adhesive
adhesive that is applied to both adherends and allowed to become dry, and then develops a bond when the adherends are brought together without sustained pressure

cf. pressure-sensitive adhesive and dry tack

contact moulding
contact pressure moulding
process of making reinforced plastic mouldings in which minimal pressure is applied during the forming and curing operations

continuous-filament/staple-fibre woven fabric
glass fabric woven from filament yarns in one direction, usually the warp, and staple fibre yarns in the other

continuous-filament woven fabric
fabric woven from glass filament yarns in warp and weft

continuous strand mat (textile glass)
mat formed of uncut strands, without intentional orientation, and held together by a binder

co-oligomer
oligomer derived from more than one species of monomer

co-oligomerization
oligomerization in which a co-oligomer is formed

cooling jig
cooling fixture
shrinkage block
shrinkage jig
form on which mouldings are cooled for the purpose of obtaining controlled dimensions of specific parts

copolycondensation
polycondensation in which more than one species of monomer is involved

NOTE Polymers made by condensation polymerization of two ingredients (or "monomers"), each containing two identical reactive groups, can be visualized readily as reacting on a 1:1 basis to give an "implicit monomer" the homopolymerization of which would give the actual product. Such a polymer can be represented as possessing a single constitutional repeating unit and thus can be named as a homopolymer. Note that this rule is applicable only to cases in which the ratio of initial ingredients is 1:1. Poly(ethylene terephthalate) and polyamide 66 are examples of such polymers.
copolymers
derived from more than one species of
monomer

copolymerization
formation of a copolymer

cord
fibrous structure made by twisting, plying,
cabling, or braiding filament or staple fibre yarns

cored mould
mould incorporating passages for circulating heating or cooling media

cored screw
extruder screw incorporating lengthwise passages for circulating heating or cooling media

cosolvent
insoluble solvent of a polymer

coumarone resin
resin made by polymerization of one or more compounds of a type represented by coumarone, indene, their homologues, and their derivatives

coupling agent
substance that promotes or establishes stronger bond at the interface of the resin matrix and the reinforcement

NOTE  The coupling agent may be applied to the reinforcement, added to the resin, or both.

coupling size
size of a good bond between the resin and the reinforcement

plastic size (textile glass)
size of a good bond between the glass and the resin

Crack
fissure that may or may not penetrate the external surface of the material or its complete thickness, the polymeric material being separated completely between the crack walls

NOTE  This note does not concern the English version.

Craze
defect at or under the surface of a plastic attributable to apparent cracks, bridged by polymeric material of reduced (apparent) density

Crater
small shallow surface cavity

NOTE  In general this cavity is larger in dimensions than a pinhole and has a less-regular shape.

Crease
wrinkle in reinforced plastics
creep
cold flow (deprecated)
time-dependent strain resulting from stress

NOTE Instantaneous strain is excluded.

creep recovery
time-dependent decrease in strain following removal of stress

NOTE Instantaneous recovery is excluded.

cresol resin
resin of the phenolic type made by the poly-condensation of cresol with aldehydes or ketones

cresol-formaldehyde resin
CF resin
resin of the phenolic type, made by the polycondensation of cresol with formaldehyde

crosshead
extruder head fixed at a right angle to the axis of the extruder barrel

cf. angle-head

crosslink, verb
to form multiple intermolecular (covalent or ionic) bonds between polymer chains

crosslink, noun
constitutional unit connecting two parts of a macromolecule that were earlier separate molecules

cf. crosslink, verb and crosslinking

crosslinking
process of multiple intermolecular covalent or ionic bonding between polymer chains

crosslinking agent
substance that promotes or regulates intermolecular covalent or ionic bonding between polymer chains

NOTE Crosslinking also may be produced by radiation.

crosswise
the direction at 90° to the lengthwise direction

cf. lengthwise

crosswise laminate
laminate in which anisotropic layers are arranged at right angles to one another

crown (of a calender roll)
increased diameter at the centre of a calender roll to compensate for the deflection of the roll under pressure

crystalline polymer
polymer showing crystallinity

2) IUPAC Recommendations: 1987 Definitions of terms relating to crystalline polymers.

crystallinity
presence of three-dimensional order at the level of molecular dimensions

2) IUPAC Recommendations: 1987 Definitions of terms relating to crystalline polymers.

crystallite (polymer)
small crystalline domain

NOTE 1 A (polymer) crystal is a crystalline domain usually limited by well-defined boundaries.

NOTE 2 The definition is not identical with that used in classical crystallography.
C-stage  
final stage in the reaction of certain thermosetting resins, in which the material is practically insoluble and infusible

NOTE  The resin in a fully-cured thermoset moulding is in this stage.  

cf. A-stage, B-stage and resite

curing agent  
substance that promotes or regulates curing reaction

cf. cure and hardening agent

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

cycle ratio, $n/N$  
ratio of the number of applied cycles ($n$) to the service life ($N$)  

NOTE  This ratio is used in tests with load bearings, together with an $N$ curve (Woehler's curve).

damping (mechanical)  
measure of the energy dissipated as heat by a material or a material system subjected to an oscillatory load  

NOTE  In the case of free oscillation, damping is the decrease with time of the amplitude of a system.

damping coefficient, $\epsilon$  
component of applied force that is $90^\circ$ out of phase with the deformation, divided by the velocity of deformation

damping ratio, $\mu$ (dimensionless)  
ratio of actual to critical damping, where critical damping is that required for the borderline condition between oscillatory and non-oscillatory behaviour

NOTE  Damping ratio is a function of the logarithmic decrement, $\Lambda$:

$$\mu = \frac{\Lambda/2\pi}{\sqrt{1 + (\Lambda/2\pi)^2}} = \sin \arctan(\Lambda/2\pi)$$

For small values of $\Lambda$, $\mu = \Lambda/2\pi$.

cf. logarithmic decrement
daylight
distance, in open position, between the moving and
fixed platen of a press
NOTE In the case of a multiplaten press, daylight is the
distance between adjacent platen.

decay constant, $\beta$ (s$^{-1}$)
coefficient that determines the dependant decay of a
damped free vibration time $A(t)$:

$$A(t) = A_0 e^{-\beta t} \sin (\omega_d t - \phi)$$

where

- $A_0$ is the initial amplitude;
- $\omega_d$ is the angular velocity of the damped vibra-
tion;
- $\phi$ is the phase angle

NOTE $\beta$ is related to the loss factor $\eta$ by:

$$\beta = \omega_d \eta / 2$$

decorative laminate
laminating consisting of bonded layers of sheet material
(for example paper, film, foil or fabric), a layer or layers
on one or both sides having decorative plain or varie-
gated colours or designs

deep drawing
process of forming a thermoplastic sheet in a mould
involving a high draw ratio

deflashing
process of removing flash or sharp edges and corners
mechanically or manually from a moulding

cf. blast finishing

deflection temperature under load
temperature at which a test specimen will deflect a
given distance under a given load in flexure under
specified conditions of test

NOTE Formerly this property was called heat distortion
temperature, a term that now is deprecated.

deflocculation agent
substance that breaks down agglomerates into pri-
mary particles or prevents the latter from combining
into agglomerates

degate
in injection and transfer moulding, to separate the
sprue (and runner in a multicavity mould) from the
moulded part

degradable plastic
plastic designed to undergo a significant change in its
chemical structure under specific environmental con-
ditions, resulting in a loss in some properties that may
vary as measured by standard test methods appro-
priate to the plastic and the application in a period of
time that determines its classification

cf. deterioration, biodegradable plastic, hydrolyti-
cally-degradable plastic, oxidatively-degradable
plastic and photodegradable plastic

degradation
change in the chemical structure of a plastic involving
a deleterious change in properties

cf. deterioration

degree of polymerization
1) average number of base units per molecule of the
molecules are composed of regularly repeating units;

2) average number of mers (real or hypothetical) per
molecule if the molecules have been (or hypothetically
could be) produced by polymerization from identical
monomers

NOTE The two definitions are not necessarily equivalent;
for example, for polyethylene, the base unit is CH$_2$; the mer
is C$_2$H$_4$.

degree of polymerization of a molecule of a
polymer
number of monomeric units in a molecule of a polymer
degree of polymerization of a polymer
average value of the degree of polymerization of the molecules of a polymer

NOTE The method of averaging must be stated, for example number-average or mass-average degree of polymerization.

delamination
separation of layers in a laminate because of failure in or near the adhesive joint

dendrite
crystalline morphology produced by skeletal growth, leading to a "tree-like" appearance

depolymerization
reversion of a polymer to its monomer(s) or to a polymer of lower relative molecular mass

die cutting
process of cutting shapes from film and sheets by pressing a knife-edge die through one or several layers of plastics

die plate
main support plate for the punch or impression of a mould

dielectric dissipation factor
dissipation factor
loss tangent
tangent of loss angle
tangent of the loss angle (tan δ)

dielectric loss angle
angle by which the phase difference between applied voltage and resulting current deviates from π/2 rad, when the dielectric of the capacitor consists exclusively of the dielectric material

differential scanning calorimetry
DSC
technique in which the difference in energy inputs into a substance and a reference material is measured as a function of temperature while the substance and reference material are subjected to a controlled temperature programme

NOTE Two modes, power compensation differential scanning calorimetry (power compensation DSC) and heat flux differential scanning calorimetry (heat-flux DSC), can be distinguished, depending on the method of measurement used.

differential thermal analysis
DTA
technique in which the temperature difference between a substance and a reference material is measured as a function of temperature while the substance and reference material are subjected to a controlled temperature programme

NOTE 1 The record is the differential thermal or DTA curve; the temperature difference (ΔT) should be plotted on the ordinate with endothermic reactions downwards and temperature or time on the abscissa increasing from left to right.

NOTE 2 The term quantitative differential thermal analysis (quantitative DTA) covers those uses of DTA where the equipment is designed to produce quantitative results in terms of energy and/or any other physical parameter.
**diffusion of light**
light scattering (deprecated)
process by which the spatial distribution of a beam of radiation is changed when it is deviated in many directions by a surface or by a medium, without change of frequency of its monochromatic components

NOTE The frequency is unchanged only if there is no Doppler effect attributable to the motion of the materials from which the radiation is returned.

**diluent**
thinner (deprecated)
liquid additive, the sole function of which is to reduce the concentration of solids and the viscosity of a composition (e.g. adhesive, coating, varnish)

cf. extender and reactive diluent

**dimensional stability**
constancy of dimensions of a plastic part or specimen under environmental conditions

NOTE Dimensional stability of plastics is influenced by creep, post-cure, post-shrinkage, evaporation or migration of additives, and water sorption.

**dimer**
oligomer composed of two units of a single species of monomer

NOTE A dimer can be the product of oligomerization or of scission of a larger molecule.

**dip coating**
coating process in which a substrate is dipped into a fluid polymer, solution or dispersion, then withdrawn and subjected to heating and drying to solidify the deposited film

**direct roving (textile glass)**
roving obtained by winding directly from a bushing a large and predetermined number of filaments

cf. roving

**discoloration**
colour change that involves either lightening or darkening and/or change in hue

cf. colour fading and colour-fastness

**dished**
applied to a defect, a symmetrical distortion of a flat or curved section of a plastic object such that, as normally viewed, it appears concave

cf. domed and warp

**dispersion**
heterogeneous system in which a finely-divided material is distributed in another material

**disruptive voltage**
breakdown voltage
dielectric breakdown voltage
voltage necessary to produce a disruptive discharge between two conductors

**distribution function**
normalized function giving the relative amount of a portion of a polymeric substance with a specific value, or a range of values, of a random variable or variables

**doctor blade**
**doctor knife**
**doctor bar**
mechanism (bar or blade) on application equipment to spread a material evenly on the application rolls or on the surface being coated and to control its thickness

doctor roll
roller mechanism that revolves at a different surface speed and/or in a direction opposite to that of the spreader roll, resulting in a wiping action to control the amount of material supplied to the spreader roll

domed
as applied to a defect, a symmetrical distortion of a flat or curved section of a plastic object such that, as normally viewed, it appears convex or more convex
cf. dished and warp

double-skin sheet
DSS
sheet having two parallel external skins, differently spaced and jointed by ribs of different shapes

double-strand chain
macromolecule that can be described by constitutional units joined so as to form an uninterrupted sequence of rings through two atoms

double-strand copolymer
copolymer, the molecules of which are double-strand chains

double-strand polymer
ladder polymer
polymer, the molecules of which are double-strand chains

dowel bush
dowel bushing
hardened steel insert in the portion of a mould that receives the dowel pin
downstroke press
press in which the pressing device is situated above the moving platen, pressure being applied by a downward movement of this device
draft
amount of taper allowed for the purpose of facilitating the removal of a moulding from a mould
drape vacuum thermoforming
vacuum thermoforming process in which a sheet is clamped in a movable frame, heated, lowered to contact and hang over the high points of a male mould and then pulled against the mould by vacuum
draw ratio
measure of the degree of stretching during a drawing operation, expressed as the ratio of the cross-sectional area of the undrawn plastic to that of the drawn plastic
draw-down ratio
in extrusion, the ratio of the thickness of the die opening to the final thickness of the product
drawing
process of stretching a thermoplastic sheet, rod or filament to reduce its cross-sectional area and/or improve its physical properties by orientation
dry blend
dry blend
free-flowing mixture prepared without fluxing or addition of solvent
dry patch
dry spot
area where the reinforcement has not been wetted sufficiently with resin
cf. fibre streak and visible fibre
dry strength
strength of an adhesive joint determined after drying under specified conditions
cf. wet strength
dry tack
property of certain adhesives, particularly non-vulcanizing elastomeric adhesives, to adhere to themselves on contact at some stage in the evaporation of volatile constituents, even though they seem dry to the touch

cf. contact adhesive

drying temperature
temperature to which an adhesive or an assembly is subjected to dry the adhesive

cf. curing temperature and setting temperature

drying time
period of time during which an adhesive or an assembly is allowed to dry, with or without the application of heat or pressure, or both

cf. setting time and curing time

dwell
dwelling
pause in the application of pressure to a mould to allow the escape of gas

dynamic coefficient of friction, $\mu_D$

$$\mu_D = \frac{F_D}{F_p}$$

where

$F_D$ is the dynamic frictional force, expressed in newtons;

$F_p$ is the normal force acting perpendicular to the surfaces in contact, expressed in newtons

NOTE 1 The coefficient of friction of films usually ranges between 0.2 and 1.

NOTE 2 Ideally, the coefficient of friction is a characteristic independent of the test equipment and the test conditions. Since films generally do not behave ideally, all test parameters are specified in the appropriate international standard (for example, for films and sheeting see ISO 8295).

cf. frictional force

dynamic friction
friction which has to be overcome as a “threshold value” at the onset of sliding motion

dynamic mechanical analysis
DMA
technique in which either the modulus or damping, or both, of a substance is measured as a function of temperature, frequency and/or time, while either load or displacement is varied with time

dynamic resistance to cleavage
force per unit width, necessary to bring an adhesive joint to the point of failure by means of a stress applied by a wedge moving between the two substrates of the joint, and thus separating the adherends in a peeling mode; it is expressed in kilonewtons per meter

dynamic stress
stress resulting from forces the value of which and/or direction vary in the course of time

dynamic thermomechanical measurement
technique in which the dynamic modulus and/or damping of a substance under oscillatory load is measured as a function of temperature while the substance is subjected to a controlled temperature programme

NOTE Torsional braid measurement is a particular case of dynamic thermomechanical measurement in which the material is supported on a braid.

dynamic viscosity, $\eta^*$ (Pa·s)
quotient of the stress in phase with the rate of strain ($\varepsilon_0\delta\sin\delta$) to the amplitude of the rate of strain ($\omega\varepsilon_0$) in the forced oscillation of a material:

$$\eta^* = \frac{(\varepsilon_0\delta\sin\delta)}{(\omega\varepsilon_0)}$$

NOTE The strain ($\varepsilon$) and stress ($\sigma$) of the forced oscillation are given by the equations

$$\varepsilon = \varepsilon_0\sin\omega t$$

and

$$\sigma = \varepsilon_0\sin(\omega t + \delta)$$

so that

$$\varepsilon = \omega\varepsilon_0\cos\omega t$$

and

$$\sigma = \varepsilon_0\sin\delta\cos\omega t + \varepsilon_0\cos\delta\sin\omega t$$
ease of ignition
ease with which a material can be ignited under specified test conditions

cl. minimum ignition time

dual gate
very thin rectangular gate with a length equal to the width of the moulding, situated in the meeting surface of the mould

cl. tab gate

edgewise (of a laminate)
parallel to the layers of a laminate, a direction in which a load or electric stress may be applied in testing laminated plastics sheets

elastic deformation
part of the total strain of a stressed plastic which disappears upon removal of the stress

cl. creep recovery, elasticity and plastic deformation

elastic limit
greatest stress which a material is capable of sustaining without any permanent strain remaining upon complete release of stress

NOTE In practice, measurements of strain usually are taken using a small load rather than zero load as the initial and final reference.

elasticity
property of recovering original size and shape when deforming forces are removed

NOTE 1 If the strain is proportional to the applied stress, the material is said to exhibit Hookean or ideal elasticity.

NOTE 2 The mechanism may be either rubberlike elasticity (entropy elasticity) or steel-like elasticity (energy elasticity).

elastomer
macromolecular material which returns rapidly to its initial dimensions and shape after substantial deformation by a weak stress and release of the stress

NOTE The definition applies under room temperature test conditions.

electric strength
dielectric strength
property of a dielectric which opposes a disruptive discharge

NOTE It is measured by the intensity of the electric field which will break down the dielectric.

elongation
increase in length of a specimen under tension, usually expressed as a percentage of the original length

emanation thermal analysis
technique in which the release of radioactive emanation from a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme

embedding
process of encasing completely an article in a polymer by pouring a monomer, prepolymer, or polymer dispersion over it in a mould, curing or solidifying the polymer, and removing the encased article from the mould

NOTE In the case of electrical components, lead wires or terminals may protrude from the embedment.

cl. encapsulation and potting
**embossed sheet**
sheet with a textured pattern on one or both sides

**embossing**
process of producing contoured patterns on surfaces

**emulsifying agent**
emulsifier
surface-active substance that promotes and maintains the dispersion of two incompletely miscible liquids or a solid and a liquid by reducing the interfacial tension between the two phases

**emulsion**
heterogeneous system in which a liquid is distributed in fine drops in another liquid

**end group**
constitutional unit with only one attachment to a portion of a polymer chain

**energy loss**
unit damping energy, \( W \) (J·m\(^{-3}\))
energy that is lost in a deformation cycle divided by the volume of the material.

**emulsion polymerization**
suspension polymerization in which emulsifying agents are used to disperse and stabilize the monomer as very fine droplets, resulting in the production of a latex

**enantiomeric configurational unit**
either one of two configurational units that are mirror images at the plane containing the main-chain bonds

**encapsulated adhesive**
adhesive in which the particles or droplets of one of the reactive components are enclosed in a protective film (microcapsules) to prevent cure until the film is destroyed by suitable means

**encapsulation**
process of applying a thermoplastic or thermosetting protective or insulating coating to enclose an article by suitable means, such as brushing, dipping, spraying, thermoforming, or moulding

**cf.** dispersion and suspension

**epoxy plastic**
plastic based on epoxy resins

**epoxy resin**
resin containing epoxy groups capable of crosslinking

**ester plastic**
plastic based on polymers in which the repeated structural units in the chains are of the ester types, or on copolymers in which ester and other types of repeated structural units are present in the chains, the ester component(s) being in the greatest amount by mass

**ethylicellulose**
ethyl ether of cellulose

**ethylene [ethene] plastic**
plastic based on polymers of ethylene [ethene] or copolymers of ethylene [ethene] with other monomers, the ethylene [ethene] being in the greatest amount by mass
evolved gas analysis
EGA
technique in which the nature and/or amount of volatile product(s) released by a substance is (are) measured as a function of temperature while the substance is subjected to a controlled temperature programme

NOTE The method of analysis should always be stated clearly.

evolved gas detection
EGD
technique in which the evolution of gas from a substance is detected as a function of temperature while the substance is subjected to a controlled temperature programme

extendable plastic
plastic formulated in such a way that it can be transformed into a cellular plastic by thermal, chemical or mechanical means

extended-chain crystal
polymer crystal in which the chains are in an essentially fully extended conformation

extender
liquid or solid inert substance added to a resin, plastic or adhesive primarily to reduce cost

extendibility
extent to which fillers or extenders can be incorporated in a plastic compound without affecting adversely a given end property

cf. extensibility

extensibility
extent to which a material can be elongated under specified tensile loading conditions

cf. extendibility

extensional viscosity
elastogical viscosity, \( \eta_E \) (Pa·s)
quotient of the difference between the longitudinal stress (\( \tau_l \)) and the lateral stress (\( \tau_l \)) and the elongational strain rate (\( \varepsilon_l \)) in steady uniaxial flow

external plasticizer
plasticizer incorporated as an additive in a plastic compound

cf. internal plasticizer

extruder head
part of an extruder situated between the barrel and the die

NOTE In some cases the head may be part of the die.

extruder screw
shaft with one or more helical ribs often divided into different zones, with different depths of the channel and sometimes different pitch, usually having a cylindrical part at one end and a curved or pointed surface at the other, to drive the plastic mass along the barrel

cf. cored screw

extrusion
process whereby heated or unheated plastic forced through a shaping orifice becomes one continuously formed piece

extrusion coating
coating process in which a molten plastic is extruded continuously on to a moving substrate

exudation
bleed out (deprecated)
sweat out (deprecated)
migration of liquid constituents to the surface

cf. bloom
fabricating
fabrication
manufacture of products from moulded parts, rods, tubes, sheeting, extrusions or other forms, by appropriate operations such as machining and assembling

fancy yarn
novelty yarn (textile glass)
yarn that has been manufactured specially so that its appearance differs significantly from that of conventional yarn in order to give it a decorative effect

fatigue
process of progressive localized permanent structural change occurring in a material subjected to fluctuating stresses and strains, which may culminate in cracks or complete fracture

fatigue life
fatigue strength
number of cycles of stress or strain of a specified character that a given specimen sustains before failure of a specified nature occurs

fatigue limit, \( t_0 \)
limiting value which the stress amplitude \( t_s \) approaches when the number of cycles becomes very large, for a given mean stress \( t_m \) or stress ratio \( R \)

NOTE For some materials, stress amplitude versus the number of cycles does not reach a limiting value but decreases constantly on increasing the number of cycles. In this case it is useful to determine a limit of endurance.

feed (in extrusion or injection moulding)
material placed in the hopper

feeding (of plastics)
supplying of plastic material to a processing machine (for example in the form of powder, granules or pellets)

cf. volumetric feeding, weight feeding, feed

felt
structure characterized by the densely matted condition of most or all of the fibres of which it is composed

fibre
unit of matter of relatively short length, characterized by a high ratio of length to thickness or diameter

fibre streak
fibre whitening
accumulation of internal fibres incompletely wetted by resin in translucent reinforced plastics, appearing as a whitish defect

cf. dry patch and visible fibre

filament
single textile element of small diameter and very long length, considered as continuous

filament winding
method of forming reinforced plastic products by winding resin-coated continuous strands of reinforcing material on to a mandrel or mould under controlled tension and in a predetermined pattern

filler
relatively inert solid material added to a plastic to modify its strength, permanence, working properties or other qualities, or to lower costs

cf. reinforced plastic
filler rod
rod of thermoplastic material used in hot-gas welding to provide a source of softened material when it is necessary to fill a welded joint

film extrusion
process of making film by extruding a heated thermoplastic through a die

cf. film blowing and slot-die extrusion

filler sheet
sheet of deformable or resilient material which, when placed between an assembly to be bonded and the pressure applicator or when distributed between a stack of assemblies, aids in providing uniform application of pressure over the area to be bonded

finishing
process of developing desired surface characteristics on plastic products by appropriate operations such as tumbling, grinding, sanding, polishing, coating and electroplating

cf. blast finishing

fillet
portion of an adhesive that fills the corner or angle formed where two adherends are joined

finishing (in textiles)
application of a coupling agent to glass textile products, in order to improve the bond between the glass fibre surface and matrix

cf. size

fire resistance
ability of an element of building construction, component or structure, to fulfill for a stated period of time the required stability, integrity, thermal insulation and/or other expected duty, specified in a standard fire resistance test

first-order transition
change of state, associated with crystallization or melting in a polymer

film blowing
process of making film by extruding a thermoplastic tube kept inflated continuously by internal gas pressure during stretching and cooling

fish-eye
small globular mass that has not blended completely into the surrounding material

NOTE. This defect is apparent particularly in a transparent or translucent material.

film casting
process of making film by distributing a fluid polymer, polymer dispersion or solution on a suitable substrate and then solidifying the polymeric material by suitable means

fixed plate
plate that is fixed to a press frame, used to hold a part of a mould or being part of a multiplaten press

cf. floating platen and moving plate

cf. cast film
flaking
local breakage and detachment of the surface layer
cf. delamination

flame, noun
zone of combustion in the gaseous phase from which light is emitted

flame, verb
to undergo combustion in the gaseous phase with emission of light

flame retardance
property of a substance or treatment applied to a material of retarding markedly the propagation of a flame

flame retardant (product)
substance that retards markedly the propagation of a flame
NOTE Flame retardants may be incorporated in plastics as additives (external flame retardant) or as chemical groups in the base polymer by use of reactive intermediates in the polymerization process (internal flame retardant).

flame spray coating
coating process in which a powdered polymer is heated to fusing temperature in a cone of flame placed between the spray gun orifice and the substrate

flame spread
propagation of a flame front

flame spread rate
distance travelled by a flame front during its propagation, divided by time, under specified test conditions

flame spread time
time taken by a flame on a burning material to travel a specified distance or surface area under specified test conditions

flammability
ability of a material or product to burn with a flame under specified test conditions
NOTE Broadly, flammability includes characteristics that pertain to its relative ease of ignition and capacity of sustaining combustion.

flammable
capable of burning with a flame under specified test conditions

flash
1) that portion of the charge which escapes from the moulding cavity during moulding;
2) excess plastic that is formed between mating mould surfaces

flash groove (of a mould)
spew groove
groove in a mould designed to allow surplus material to escape during the moulding operation

flash line
spew line
raised line appearing on the surface of a moulding and formed at the junction of mould parts

flash mould
mould that is designed to allow the excess of the charge to escape in the form of a flash
NOTE This flash sustains part of the total applied pressure.

flash ridge
flash area
spew area
spew ridge
that part of a flash mould where clearance is provided between the mating surfaces through which excess material can escape, thus facilitating closing of the mould
flexural stress at conventional deflection
flexural stress at a deflection equal to 1.5 times the thickness of the specimen

floating platen
platen located between the main head and the press table in a multiplaten press and capable of being moved independently

Flory-Huggins theory
thermodynamic theory of polymer solutions, first formulated independently by Flory and by Huggins, in which the thermodynamic quantities of the solution are derived from a simple concept of combinatorial entropy of mixing and a reduced Gibbs-energy parameter, the "r" parameter (side parameter)\(^4\)

flow line
visible line in a moulding in the direction of, and caused by, flow

Fluidized bed coating
coating process in which either:

1) a part to be coated is preheated, dipped into a bed of powdered plastic particles kept in a state of flotation by an upward air current and usually heated subsequently to fuse the adhering particles, or

2) a part to be coated, which is at least slightly conductive electrically and earthed (grounded), is dipped cold into a fluidized bed of electrostatically-charged powdered plastic particles which adhere to the part, and is heated subsequently to fuse the particles

4) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
fluoroplastic
plastic based on polymers made with monomers containing one or more atoms of fluorine, or copolymers of such monomers with other monomers, the fluoro-
monomer(s) being in the greatest amount by mass

fractionation
process by means of which macromolecular species differing in some characteristic (chemical composition, relative molecular mass, branching, stereoregularity, etc.) are separated from each other

foam in situ
foam-in-place
preparation, deposition and curing of a cellular plastic mix at the site where it is used

free vibration measurement
technique for performing dynamic mechanical measurements in which the specimen is deformed, released and allowed to oscillate freely at the system's natural resonant frequency

NOTE The storage modulus is calculated from the natural resonance frequency, and the loss modulus from the rate of decay of amplitude of oscillation.

foaming adhesive
adhesive designed to foam in situ, after application, in order to provide extensive gap filling properties

cf. cellular adhesive

frequency profile
plot of the dynamic properties of a material, at a constant temperature, as a function of test frequency

folded-chain crystal
polymer crystal consisting predominantly of chains that traverse the crystal repeatedly by folding as they emerge at its external surfaces

friction
resistance that two surfaces lying in contact with each other build up against sliding; a distinction is made between static friction and dynamic friction

folded yarn
plied yarn (textile glass)
general term designating yarn formed by twisting two or more single yarns in one folding operation

friction welding
spin welding
pressure welding process in which the surfaces to be united are softened by heat generated by friction

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

cf. thermoforming

frictional force
force necessary to overcome friction; a distinction is made between the static frictional force $F_S$ and the dynamic frictional force $F_D$

5) IUPAC Recommendations: 1987 Definitions of terms relating to crystalline polymers.

6) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
fringed-micelle model
model for crystallinity in which the crystallized segments of a macromolecule belong predominantly to different crystals.\(^7\)

gas transmission rate
volume of gas which, under steady conditions, passes through a unit area of a specimen in unit time under unit pressure difference and at constant temperature

NOTE The rate depends on the thickness of the specimen.

gate (in injection and transfer moulding)
channel or orifice through which material is injected from the sprue (or runner in a multicavity mould) into a mould cavity

gauge length
original length of that portion of the specimen over which strain or change of length is determined

gauge marks
bench marks
reference marks
marks of known separation applied to a specimen, for example, to measure strain

gel, noun
initial jellylike solid phase that develops during the formation of a resin

gel coat
outer layer of resin, sometimes containing a colorant, applied to a reinforced plastic part to improve surface properties

gel point
stage at which a liquid begins to exhibit pseudoelastic properties

NOTE This stage may be observed conveniently from the inflection point on a viscosity-time plot.

gel strength
measure in arbitrary units of the rigidity modulus of a gel prepared and matured under standard conditions

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7) IUPAC Recommendations: 1987 Definitions of terms relating to crystalline polymers.
gel time
time required for a liquid material to form a gel under specified conditions of temperature

gelation
gelling
cconversion of a material to the gel state

cf. gel

glass transition
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

glass transition temperature
approximate midpoint of the temperature range over which the glass transition takes place

NOTE The glass transition temperature ($T_g$) varies significantly, depending upon the specific property and the test method and conditions selected to measure it.

cf. glass transition

glass veil
thin layer made from glass filaments (continuous or chopped) held together with a binder

NOTE This veil generally is stiffer and has often a higher mass per unit area than surfacing mat.

cf. surfacing mat

gloss
degree to which a surface approaches perfect optical smoothness in its capacity to reflect light

glowing combustion
combustion of a material in the solid phase without flame but with emission of light from the combustion zone

cf. incandescence

graft copolymer
graft polymer derived from more than one species of monomer

cf. note to graft polymer

graft copolymerization
polymerization in which a graft copolymer is formed

graft polymer
polymer, the molecules of which have one or more species of block connected to the main chain as side chains, these side chains having constitutional or configurational features different from the constitutional units comprising the main chain, exclusive of junction points

NOTE In the graft polymer molecule

\[
\begin{array}{c}
B_m \\
\hline
\hline
A \hline
\hline
B_n
\end{array}
\]

the A-chain, B, and B are regular blocks, the A-chain is the main chain, and B, and B are the side-chain grafts. The -A- units are junction points and are considered to be part of the main chain. Where A and B are derived from the same monomer, for example:

\[
\begin{align*}
&\text{CH}=\text{CHCH}_2\text{CH}=\text{CH} \quad \text{(A)} \\
&\text{CH} \quad \text{CH}_2 \quad \text{CH} \quad \text{CH}_2 \\
&\text{(B)}
\end{align*}
\]

the polymer is a graft polymer. The graft polymer with molecules consisting of

\[
\begin{align*}
&\text{CHCH}_2 \quad \text{and} \quad \text{CH}_2\text{CH} \quad \text{CO}_2\text{CH}_3 \\
&\text{and} \quad \text{CHCH}_2 \\
&\text{CO}_2\text{CH}_3
\end{align*}
\]

is a graft copolymer.

cf. graft copolymer

graft polymerization
polymerization in which a graft polymer is formed
granulator
machine for reducing large pieces of material or rejected moulded articles into a granular state

cf. granule and pelletizer

granule
relatively small particle produced in various sizes and shapes in operations such as cutting, grinding, crushing, precipitation and polymerization

NOTE These operations also yield material in the form of powder; in some precipitation and polymerization processes material in the form of beads is produced.

cf. pellet

graphitization
heat treatment in an inert atmosphere usually carried out after and at higher temperatures than carbonization

NOTE The process is known in the industry as "graphitization" as it has the effect of modifying the physical and chemical properties of the carbonized fibre even though graphitic structure rarely can be observed in practice.

hardness
resistance of a material to indentation or scratching

NOTE Different methods of evaluating hardness give different ratings because they are measuring somewhat different quantities and characteristics of the material. To express hardness quantitatively each type of test has its own scale of hardness defined arbitrarily. For example, Mohs' scale evaluates hardness by resistance to scratching with minerals (talc = 1 to diamond = 10). For ball indentation methods, see ISO 2039.

haze
cloudy appearance within or on the surface of a plastic

heat-activated adhesive
dry adhesive that is rendered tacky by application of heat

heat of combustion (mass)
calorific potential
calorific energy which could be released by the complete combustion divided by the mass of a material

heat mark
extremely shallow depression or groove in the surface of a plastic, having practically no depth (its area being very large compared with its depth) and visible because of a sharply-defined rim or a roughened surface

cf. sink mark

heat sealing
process of bonding two or more thin layers of materials, at least one of which is a thermoplastic film, by heating areas in contact with each other to the temperature at which fusion of the thermoplastic film(s) occurs, the bonding usually being completed by the application of pressure

heater band
heater blanket
heater strip
electrical heating devices for barrels, dies and moulds

NOTE Bands and strips are more or less flexible; blankets are rigid.
heating-curve determination

technique in which the temperature of a substance is measured as a function of the programmed temperature, while the substance is subjected to a controlled temperature programme in the heating mode.

NOTE 1: Sample temperature should be plotted on the ordinate increasing upwards, and the programmed temperature or time on the abscissa from left to right.

NOTE 2: When the temperature programme is in the cooling mode, this becomes cooling-curve determination.

NOTE 3: Two derivative curves can be obtained: heating-rate curve (for (dT/dt) against T or t) and inverse heating-rate curve (for (dT/dT) against T or t).

high-pressure moulding

method of moulding or laminating in which the pressure used is greater than 5 MPa.

cf. low-pressure moulding

homopolymer

polymer derived from one species of monomer

homopolymers and copolymers of methyl methacrylate (MMA)

PMMA homopolymers and copolymers of MMA containing at least 80 % (m/m) of MMA and not more than 20 % (m/m) of acrylic ester or other suitable monomers.

NOTE: They include both unmodified materials and materials containing lubricants, processing aids, UV absorbers, pigments and colorants. They do not include PMMA modified with elastomers.

homopolymerization

polymerization in which a homopolymer is formed

high-frequency welding

pressure welding process in which the surfaces to be united are softened by heat produced by a high-frequency field.

high polymer

substance composed of polymers of high relative molecular mass.

NOTE: In general, a linear polymer of a given series is considered a high polymer if its physical properties (especially its viscoelastic properties) do not vary markedly with the relative molecular mass. Often this term is shortened to "polymer".

high-pressure decorative laminate(s)

HPDL or HPL

high-pressure laminate

HPL

sheet(s) consisting of layers of fibrous sheet material (for example, paper) impregnated with thermosetting resins and bonded together by means of heat and a pressure of at least 5 MPa, the outer layer or layers on one or both sides having decorative colours or designs.

cf. laminated sheet

hopper

funnel-like container placed on the feed opening of a moulding machine, e.g. an extruder.

cf. feeding (of plastics)

hot-gas welding

pressure welding process in which the surfaces to be united are softened by a jet of hot air or inert gas.

hot-melt adhesive

thermoplastic adhesive that is applied in a molten state and forms a bond on cooling to a solid state.

hot-runner mould

in injection moulding, a mould in which the runners are kept at a temperature that is higher than the solidification temperature of the material.
hot-setting adhesive
adhesive that sets only with the application of heat

cf. cold-setting adhesive

hot stamping
process of decorating or marking plastics in which a pigmented or metallized film is pressed against the plastic by a hot die, thereby transferring and bonding firmly the pigment or the metal to the plastic

hybrid
assembly manufactured with two or more different types of fibre materials (for example, glass and carbon)

hydrolytically-degradable plastic
degradable plastic in which the degradation results from hydrolysis

cf. degradable plastic

hysteresis loop (in dynamic mechanical measurement)
closed curve plot of stress against strain (or of functions of these) produced during cyclic deformation of a material

NOTE The area of each loop is proportional to the energy lost in each cycle.

ignite
1) transitive verb: to initiate combustion;
2) intransitive verb: to catch fire with or without the application of an external heat source

ignition
initiation of combustion

ignition temperature
minimum temperature of a material at which sustained combustion can be initiated under specified test conditions

cf. spontaneous ignition temperature

impact strength
in Charpy (ISO 179) and Izod (ISO 180) impact tests, the energy absorbed in breaking a specimen, under shock loading, referred to the cross-section of the specimen

NOTE The specimen may be unnotched or notched; in the latter case, the cross-section is that at the bottom of the notch.

cf. relative impact strength

impact value
energy absorbed by a specimen of standard design when sheared by a single blow of a testing-machine hammer; the impact value is expressed in joules per square metre

impregnation
process of incorporating polymers or monomers, in the form of liquids, melts, dispersions or solutions, into a substrate by way of pores or voids

impression
female portion of a mould

cf. cavity

impulse sealing
thermal impulse sealing
bonding process in which the surfaces to be united are subjected to non-continuous rapid heating, pressure being maintained after heating

incandescence
glowing produced without combustion or other chemical reaction, for example, glowing produced by electrical heating of a tungsten filament

cf. glowing combustion
inching
reduction in the rate of mould closing just before the mating surfaces touch each other

indentation hardness
ability of a material to resist indentation

NOTE The term "indentation hardness" has no quantitative meaning except in terms of a particular test in which the size and shape of the indenter, the indenting load, and other conditions of the test are specified.

inherent viscosity, \( \eta_{inh} \)
logarithmic viscosity number, \( \eta_{ln} \)
ratio of the natural logarithm of the relative viscosity to the mass concentration of the polymer \( c \)

\[
\eta_{inh} = \eta_{ln} = \frac{\ln \eta_r}{c}
\]

NOTE See notes to reduced viscosity.

cf. relative viscosity

inhibitor
substance used in small proportion to suppress a chemical reaction

cf. catalyst and retarder

initial stress in stress relaxation
stress immediately occurring upon straining a specimen in a relaxation test

NOTE Since it is nearly impossible to obtain stress readings at the instant of straining, the stress at a specified small increment of time after straining is a more reproducible value.

initiator
substance, used in small proportion, that starts a chemical reaction, for example, by providing free radicals

cf. catalyst

injection blow moulding
blow moulding process in which a parison is formed over a mandrel by injection moulding and blown to its final form and dimensions in a second mould

injection moulding
process of moulding a material by injection under pressure from a heated cylinder through a sprue (runner, gate) into the cavity of a closed mould

injection-moulding pressure
in injection moulding, pressure applied to the cross-sectional area of the barrel containing the moulding material

inorganic polymer
polymer without carbon atoms in the main chain

NOTE Examples: polydichlorophosphazene, polydimethylsiloxane. Organic group side chains may be present in inorganic polymers; in this case the polymers sometimes are referred to as "semi-organic".

input torque, \( T_{in} \)
torque applied to introduce or increase the axial load in the assembly

NOTE It is used to overcome friction in the thread and under the bolt head.

insert
part consisting of metal or other material which may be moulded into position or may be pressed into the moulding after the completion of the moulding operation

insert pin
pin used to locate and maintain an insert in position during moulding
instantaneous strain in creep
strain occurring immediately upon loading a specimen before any creep occurs

NOTE Since it is nearly impossible to obtain strain readings at the instant of loading, the strain at a specific increment of time after loading is a more reproducible value.

insulation resistance
insulation resistance between two electrodes which are in contact with, or embedded in, a specimen, is the ratio of the direct voltage applied to the electrodes to the total current between them at a given time after the application of that voltage.

NOTE It is dependent upon both the volume and surface resistance of the specimen.

internal friction, \(W/U\) (dimensionless)
the ratio of the energy loss \(W\) to the unit storage energy \(U\).

NOTE If the internal friction is small, it may be considered equal to twice the logarithmic decrement \(\gamma\):
\[
\frac{W}{U} = 2 \cdot \gamma
\]

cf. energy loss, logarithmic decrement and unit storage energy

internal plasticizer
chemical group incorporated by chemical reaction in a polymer to plasticize it

cf. external plasticizer

intrinsic viscosity
limiting viscosity number
limiting value of the reduced viscosity or the inherent viscosity at infinite dilution of the polymer:

\[
[\eta] = \lim_{c \to 0} \eta = \lim_{c \to 0} \eta_{inh}
\]

NOTE 1 See NOTES to reduced viscosity.

NOTE 2 This term is also known in the polymer literature as the Staudinger index.

cf. inherent viscosity

ionic polymerization
chain polymerization in which the reactive functional species is an ion

ionomer
polyelectrolyte with very few ionic groups

irregular block
block that cannot be described by only one species of constitutional repeating unit in a single sequential arrangement

irregular polymer
polymer, the molecules of which cannot be described by only one species of constitutional unit in a single sequential arrangement

NOTE The polymer with molecules consisting of a random arrangement of the constitutional units

\[
\text{as in the fragment}
\]

is an irregular polymer.

cf. regular polymer
**Isobaric mass-change determination**

Technique in which the equilibrium mass of a substance at constant partial pressure of the volatile product(s) is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

**NOTE** The record is the isobaric mass-change curve: the mass should be plotted on the ordinate decreasing downwards and temperature on the abscissa increasing from left to right.

**Isocyanate polymer**

1) Isocyanate resin: prepolymer of relatively low molecular mass, used for the production of (mostly thermoset) polyurethane polymers e.g. cellular plastics and casting resin articles;

2) In some countries, isocyanate plastic designates polymers made by reactions of polyfunctional isocyanates with other compounds.

**NOTE** 1 In other countries, these products are called polyurethanes and polyureas.

**NOTE** 2 Reaction of isocyanates with hydroxyl-containing compounds produces polyurethanes having the urethane group –NH–CO–O–. Reaction of isocyanates with amino-containing compounds produces polyureas having the urea group –NH–CO–NH–.

**Isotactic polymer**

Regular polymer, the molecules of which can be described in terms of only one species of configurational base unit (having chiral or prochiral atoms in the main chain) in a single sequential arrangement.

**NOTE** In an isotactic polymer molecule the configurational repeating unit is identical with the configurational base unit. In the polymer –[{\(CH(CO_2R)(CH(CH_3)_2)\)}_n]–, if only one main-chain stereoisomeric site of each constitutional repeating unit is defined, as in

\[
\begin{align*}
&H \\
\text{C–CH(CH_3)} & \text{CO_2R} \\
\end{align*}
\]

it is a configurational repeating unit, and the corresponding polymer

\[
\begin{align*}
&H \\
\text{C–CH(CH_3)} & \text{CO_2R} \\
\end{align*}
\]

is an isotactic polymer. It is not a stereoregular polymer because the configuration at the stereoisomeric centre –CH(CH_3)– is not defined. The following disotactic polymers are stereoregular:

\[
\begin{align*}
&\text{H} \quad \text{C} \quad \text{C} \quad \text{H} \\
&\text{CO_2R} \quad \text{CH_3} \quad \text{CO_2R} \quad \text{CH_3} \\
\end{align*}
\]

and

\[
\begin{align*}
&\text{H} \\
\text{C} \quad \text{C} \quad \text{C} \quad \text{CO_2R} \\
&\text{CO_2R} \quad \text{H} \quad \text{CH_3} \quad \text{H} \quad \text{CH_3} \\
\end{align*}
\]

cf. note to stereorepeating unit

cf. chirality and sequential arrangement
Isothermal mass-change determination

Technique of obtaining a record of the dependence of the mass of a substance on time (t) at constant temperature.

NOTE The record is the isothermal mass-change curve; it is normal to plot mass on the ordinate with mass decreasing downwards and t on the abscissa increasing from left to right.

Joint (in adhesive bonding)

Junction of two adjacent adherends held together by an adhesive.

Kiss roll (in coating)

Rotating cylinder of a coating machine, used for the deposition of a coating material, transferred to the cylinder's surface from another cylinder immersed in the coating fluid, on to a substrate to be coated.

Cf. reverse roll

Kneader

Machine for mixing materials intensively by severe shear action.

Knitted fabric (textile glass)

Planar or tubular structure made by the intermeshing of loops of glass yarns.

Ladder polymer

Double-strand polymer

Polymer that has a double-stranded main chain.

Lamellar crystal

Type of crystal with a large extension in two dimensions and a uniform thickness.

Laminate, noun

Product made by bonding together two or more layers of material or materials.

Laminated moulded rod (as applied to thermosets)

Rod formed by rolling impregnated layers of material on a mandrel, removing the mandrel, curing in a cylindrical or other suitable (see note) mould under heat and pressure, and then grinding to size.

NOTE In languages other than English, rod is used also for products with other than circular cross-sections e.g. square, rectangular, hexagonal, oval.

Laminated moulded tube (as applied to thermosets)

Tube formed by rolling impregnated layers of material on a mandrel, curing the assembly in a cylindrical or other suitable (see note) mould under heat and pressure, and then removing the mandrel.

NOTE In languages other than English, tube is used also for products with other than circular cross-sections e.g. square, rectangular, hexagonal, oval.

Laminated rolled tube (as applied to thermosets)

Tube formed by rolling impregnated layers of material on a mandrel between heated pressure rolls, curing in an oven, and then removing the mandrel.

Laminated sheet (as applied to thermosets)

Sheet consisting of superimposed layers of paper, fabric, veneer, or felt (mat) that have been impregnated substantially with a thermosetting or curable resin, and bonded together under pressure, with or without heat, to form a single piece.

NOTE Other ingredients, for example colouring matter, may be incorporated.

Laminating

Lamination (process)

Process of bonding two or more layers of material(s).

Lamination (of a laminate)

Layer of a laminate.

8) IUPAC Recommendations: 1987 Definitions of terms relating to crystalline polymers.
**land** (of a compression or injection mould)
*land area*
*mating surface*
surface of contact, perpendicular to the direction of application of the pressure, of the seating faces of the mould, i.e. those faces that come into contact with one another when the mould is closed

**land** (of an extruder die)
surface parallel to the flow of material in the die

**lap joint**
joint made by placing one adherend partly over another and bonding together the overlapped portions

*cf. butt joint and scarf joint*

**latex**
colloidal aqueous dispersion of a polymeric material

**lay-up, noun (as applied to reinforced plastics)**
assembly of layers of resin-impregnated material ready for processing

**lay up, verb (as applied to reinforced plastics)**
assemble layers of resin-impregnated material for processing

**lengthwise**
direction optionally specified or selected, for example:

1) the longer direction of the sample;

2) the machine direction, i.e. the direction in which the material is formed and travels in or on the machine during the process of manufacture;

3) the direction in which the sample is known to be stronger in a designated property;

4) a direction selected arbitrarily, particularly when the property to be measured is expected to be uniform in the plane of measurement

**let-go**
applied to a defect in laminated safety glass, an area over which an initial adhesion between interlayer and glass has been lost

**let-off (a device)**
**pay-off (a device)**
device used to suspend a coil or reel from which the material to be processed is fed under controlled tension to a machine, such as for a coating operation by calendering or extrusion

**lift (in moulding)**
complete set of mouldings produced in a single moulding cycle

**lignin plastic**
plastic based on lignin resins

**lignin resin**
resin made by heating lignin or by reaction of lignin with chemicals or resins, lignin being in the greatest amount by mass

**limit of endurance, \( f_0(N_F) \)**
shear stress determined at a specific number of fault test cycles, \( N_F \); it is expressed in megapascals (MPa)

**NOTE** Depending on whether the tests are carried out at a constant mean stress, \( \sigma_m \), or at a constant stress ratio, \( R_F \), the results should be presented in the form:

- \( f_0(N_F, \sigma_m) \) in megapascals (MPa)
- \( f_0(N_F, R_F) \) in megapascals (MPa)

*cf. fatigue limit*

**limiting oxygen index**
minimum concentration of oxygen in a mixture of oxygen and nitrogen that will just support flaming combustion of a material under specified test conditions

**linear burning rate**
linear distance of burning divided by time under specified test conditions
linear chain
polymer chain that contains no short-chain or long-chain branches

linear copolymer
copolymer, the molecules of which are linear chains

linear density (as applied to textile glass)
mass per unit length of desized oven-dried glass yarn or roving

linear expansion
the change in a dimension of a test specimen under specified test conditions

cf. volume expansion, swelling and coefficient of linear thermal expansion

linear polymer
polymer in which the mers are bound to each other in a chain having no branches

living polymerization
chain polymerization in which the reactive functional species is stable enough, under the appropriate conditions for synthesis, that a typical macromolecule is active for a period many times longer than the duration of the synthetic procedure

load-deflection curve
diagram in which corresponding values of load and deflection in a flexural test are plotted against each other

loading chamber
space in a mould additional to that occupied by the mould cavity provided to accommodate excess unpressed moulding material where the moulding material remains for an appropriate time to reach melt flow temperature

cf. transfer chamber

loading tray
device used to load the moulding compound simultaneously into each cavity of a multi-impression mould by the withdrawal of a sliding bottom from the tray

logarithmic decrement, $\Lambda$ (dimensionless)
natural logarithm of the ratio of any two (or more) successive amplitudes of like sign, in the decay of single frequency oscillations:

$$\Lambda = \frac{1}{k} \ln \frac{A_n}{A_{n+k}}$$

where

$A_n$ and $A_{n+k}$ are amplitudes (in radians of rotation) of two oscillations;

$k$ is the number of oscillations separating the two amplitude measurements

NOTE Provided that damping is not too large, $\Lambda$ is related to the loss factor $\eta$ by

$$\Lambda = \pi \eta$$

long chain
linear macromolecule or a linear portion of a macromolecule long enough to be considered as polymeric

long-chain branch
polymeric offshoot from a macromolecular chain

longitudinal shear strength
lap joint strength
force necessary to rupture an adhesive joint by means of stress applied parallel to the plane of the bond

9) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
longitudinal wave modulus, \( L \) (Pa)
modulus of longitudinal waves propagating through a laterally extended plate:
\[
L = \sigma \varepsilon
\]

NOTE A longitudinal wave normally is a compressional wave. With lateral extension or dilatation
\( \varepsilon_1 = \varepsilon_2 = 0 \)

loss angle (in damping), \( \delta \) (rad)
phase angle \( \phi \) between stress and strain, the tangent of which is the loss factor \( \eta \)
cf. loss factor (in damping)

loss factor (in damping), \( \eta \)
loss tangent
tan delta (dimensionless)

1) tangent of the loss angle \( \delta \) between stress and strain;

2) ratio of the loss modulus (loss compliance) to the storage modulus (storage compliance) measured in tension, shear, compression, or longitudinal compression:
\[
\begin{align*}
\tan \delta_E &= E''/E' \\
\tan \delta_G &= G''/G' \\
\tan \delta_K &= K''/K' \\
\tan \delta_L &= L''/L'
\end{align*}
\]

NOTE 1 It is given by the quotient
\[
\tan \delta = M''/M' = C''/C'
\]

NOTE 2 Commonly \( \eta = \tan \delta \) is used as a measure of the damping of a system subject to forced vibrations.

loss index, \( \varepsilon'' \)
with a dielectric material, it is equal to the product of its dielectric dissipation factor (tan \( \delta \)) and its relative permittivity (\( \varepsilon_r \))

loss modulus, \( M'' \) (Pa) (in damping)
imaginary part of the complex modulus [compliance]

NOTE It is a measure of the energy lost (dissipated) during a loading cycle.
cf. complex modulus and complex compliance

lot
definite quantity of some commodity manufactured or produced under conditions that are presumed uniform

low-pressure moulding
method of moulding or laminating in which pressure used is 5 MPa or less
cf. high-pressure moulding

lubricant
substance added in small proportion in the formulation of a plastic to facilitate processing or to prevent sticking

lubricant bloom
cloudy, greasy exudation of a lubricant on the surface of a plastic

machining
fabricating operations such as drilling, grinding, milling, punching, routing, sanding, sawing, tapping and threading
cf. fabricating and assembling

macrocycle
cyclic macromolecule or a cyclic portion of a macromolecule of high relative molecular mass

macromer
macromonomer
monomer that itself can be described as a polymer, or at least as an oligomer

macromolecule
very large molecule (organic or inorganic)
cf. polymer and high polymer
main chain
backbone
that linear portion of a macromolecule to which all other chains (long, short or both) may be regarded as being pendant, where two or more chains equally could be considered to be the main chain, the one selected leads to the simplest geometrical representation of the molecule

mandrel (in extrusion);
centre member of an extrusion die that determines the internal shape and dimensions of a hollow product

Mark-Houwink equation
Mark-Houwink-Sakurada equation
N-H-S equation
equation describing the dependence of the intrinsic viscosity of a polymer on its relative molecular mass and having the form

\[ [\eta] = K (M_t)^{\alpha} \]

where
- \( K \) and \( \alpha \) are constants, the values of which depend on the nature of the polymer and solvent as well as on the temperature;
- \( M_t \) usually is one of the relative molecular mass averages\(^{10} \)

mass-distribution function
weight-distribution function
distribution function in which the relative amount of a portion of a substance with a specific value, or a range of values, of the random variable(s) is expressed as a mass fraction\(^{10} \)

mass burning rate
mass loss of burning material divided by time under specified test conditions

mass per unit area (as applied to textile glass)
ratio of the mass of a specimen of mat or fabric of specified dimensions to its surface area

masterbatch
well-dispersed mixture of a polymer and high percentages of one or more component(s) (colorants and/or other additives) in known proportions for use in blending in appropriate amounts with the basic polymer in the preparation of a compound

mat
product made of filaments, staple fibres or strands, cut or uncut, oriented or not, held together in the form of a sheet

matt spot
local reduction in gloss of a part

maximum stress, \( \sigma_{\text{max}} \)
greatest algebraic value reached at regular intervals by the stress; it is expressed in megapascals (MPa)

mean stress, \( \sigma_m \)
algebraic mean of the maximum and minimum stresses; it is expressed in megapascal (MPa):

\[ \sigma_m = \frac{\sigma_{\text{max}} + \sigma_{\text{min}}}{2} \]

mechanically-foamed plastic
cellular plastic in which the cells are formed by the physical incorporation of gases

cf. chemically foamed plastic

melamine-formaldehyde resin
MF resin
amino resin made by the polycondensation of melamine with formaldehyde or a compound that is capable of providing methylene bridges

\(^{10} \) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
melamine plastic
plastic based on amino resins, melamine being the
amine present in the greatest amount by mass of the
amines or amides involved in the polymerization

 cf. aminoplastic and melamine-formaldehyde resin

melt flow rate
quantity of thermoplastic material extruded in a given
time under specified test conditions

melt flow rate

melting behaviour
phenomena accompanying the softening of a material
under the influence of heat (including shrinking, drip-
ing, burning of molten material, etc.)

 cf. softening temperature

microencapsulation
process of coating individual minute particles of matter
as a means of separating and storing them for later
release under controlled conditions

 cf. encapsulation

microgel
network of microscopic dimensions

migration
transfer, usually undesirable, of a constituent of a
plastic material to another contacting material

 cf. exudation

milled fibres
fibres broken into very short lengths by processing
through a size-reduction mill

minimum film-forming temperature (of dispersions)
limiting temperature above which a continuous, homo-
geneous film without cracks is formed

minimum ignition time
minimum time of exposure of a material to an ignition
source to obtain sustained combustion under specified
test conditions

 cf. ease of ignition

minimum stress, \( f_{\text{min}} \)
smallest algebraic value reached at regular intervals
by the stress; this stress shall always be positive and
is expressed in megapascals (MPa)

metallized plastic
plastic part or film on which a metal has been depos-
ited, generally by vacuum sublimation, but also by
chemical reaction

NOTE Metallizing by vacuum sublimation and chemical
reaction generally gives deposits about 0.1 \( \mu \)m thick, then
the metal thickness commonly is increased by electroplating.

metering device
device of a machine allowing a material or component
to be measured in predetermined quantities

metering zone
final zone of a screw, in which the melt is advanced at
a uniform rate to the breaker plate or die

11) IUPAC Recommendations: Physico-chemical defini-
tions relating to polymers — Part 1: 1986 Definitions of
terms relating to individual macromolecules, their assem-
bles and dilute polymer solutions.
modulus, \( M (\text{Pa}) \)
quotient of stress by strain:
\[
M = \sigma / \varepsilon
\]
- \( E \) is the tensile modulus;
- \( G \) is the shear modulus;
- \( K \) is the bulk modulus;
- \( L \) is the longitudinal compression modulus

molecular-mass distribution
relative amounts of molecules of different molecular mass that are present in a polymer

NOTE The molecules of commercial polymers do not have a single molecular mass; the molecular mass distribution follows statistical considerations. The distribution observed is dependent on the method of analysis used, which therefore needs to be stated. The ratio of the mass average molecular mass to the number-average molecular mass often is used as an indication of the distribution. The molecular-mass distribution may influence processing behaviour considerably.

monofilament
single filament that is strong enough to function as a yarn in commercial textile operations or as an entity in other applications

monomer
compound consisting of molecules each of which can provide one or more constitutional units

monomeric unit
mer
largest constitutional unit contributed by a single monomer molecule in a polymerization process

mould
die
assembly of parts enclosing the space (cavity) from which the moulding takes its form

mould clamping force
locking force
locking pressure
force which is applied to the mould to keep it closed during the moulding process

mould mark
blemish on the surface of a moulding, derived from the mould

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12) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
mould seam
line on a moulded or laminated piece, caused by the parting line of the mould, differing in colour or appearance from the general surface

multicavity mould
multi-impression mould
gang mould
mould permitting the production of several parts in a single cycle

multifilament
class of textile materials consisting of assembled filaments

moulding (process)
process of shaping a material with a die or mould by applying pressure and usually heat

multigated
entry provided to the mould cavity by more than one gate

moulding (product)
object produced in a closed mould (for example by compression moulding, transfer moulding, injection moulding)

multiplaten press
multidaylight press
press with floating platens between the upper and lower platens, thus providing more than one space for mould or laminate assemblies

moulding compound
compound that can be shaped by a moulding process

multiple wound yarn (textile glass)
yarn formed from two or more yarns wound together but not twisted together

NOTE Single, folded or cabled yarns are used to make multiple wound yarn.

moulding cycle
1) complete sequence of operations in the moulding process requisite for the production of one set of mouldings;
2) time to complete the operations described in 1)

multi-strand chain
macromolecule that can be described by constitutional units joined so as to form an uninterrupted sequence of polycyclic structures through more than two atoms

moulding pressure
pressure acting on the moulding material during the moulding process
cf. mould clamping force

narrow fabric with selvages
13)
textile glass fabric, with selvages, between 100 mm and 300 mm in width
cf. tape with selvages

narrow fabric without selvages
13)
textile glass fabric, without selvages, between 100 mm and 300 mm in width

cf. tape without selvages

13) "Selvedges" is the preferred spelling in the United Kingdom

cf. mould clamping force

cf. post-shrinkage

moulding shrinkage
difference in dimensions between a moulding and the mould cavity in which it was moulded, both the mould and the moulding being at normal room temperature when measured

cf. post-shrinkage

moving plate
moving table
plate that holds a part of the mould and moves to a fixed plate to close the mould

cf. fixed plate and floating platen
necking
striction localized reduction in cross-section that may occur in
a material under tensile stress

needled mat
mat formed of strands cut to a short length, felted
together in a needle loom, with or without a carrier

network
interlacing structure produced by crosslinking of poly-
mer chains

cf. network polymer

network polymer
polymer in which a three-dimensional structure is
formed by interchain covalent bonds

nip
line of tangency between two rolls in contact with one
another, or between either of the rolls and the surface
of an object passing between them

nominal diameter of filaments or staple fibres
filament or staple fibre diameter used in the designa-
tion of glass products, and corresponding approxi-
mately to the mean real diameter of the filaments or
staple fibres, expressed in micrometres and rounded
to a whole number

non-modified cast PMMA sheets
sheets based on homopolymers of MMA, or copoly-
mers of MMA with acrylic or methacrylic monomers,
produced by bulk polymerization in the presence of
suitable initiators

non-rigid plastic
plastic that has a modulus of elasticity in flexure or, if
that is not applicable, then in tension, not greater than
70 MPa under stated conditions

NOTE Materials usually are classified at standard tem-
perature and relative humidity in accordance with ISO 291.

non-uniform polymer
polydisperse polymer
polymer comprising molecules non-uniform with
respect to relative molecular mass, constitution or
both

non-woven scrim
non-woven open-mesh textile glass fabric in which two
or more layers of parallel yarns are bonded to each
other by chemical or mechanical means, the yarns in
successive layers lying at an angle to the yarns in pre-
ceding layers

normal force, \( F \)
force acting perpendicular to the surfaces in contact

normal stress, \( \sigma \) (Pa)
force, perpendicular to its original working area,
divided by the cross-section of the specimen meas-
ured in this area

IUPAP symbol: \( \sigma \)

NOTE A normal stress may be either a tensile stress or a
compressive stress, depending upon the direction of the
force.

no-twist roving (for over-end unwinding)
roving in which intentional twist was placed during
assembly, so that when pulled from a designated end
of the package the twist is removed

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14) IUPAC Recommendations: Physico-chemical defini-
tions relating to polymers — Part 1: 1986 Definitions of
terms relating to individual macromolecules, their assem-
bles and dilute polymer solutions.
novolak
phenolic resin containing less than a 1:1 ratio of formaldehyde to phenol so that normally it remains thermoplastic until heated with an appropriate amount of a compound (for example formaldehyde or hexamethylenetetramine) capable of giving additional linkages, thereby producing an infusible material

cf. resol

nozzle
device at the end of an injection or extruder barrel, through which the moulding material flows to the mould or die

NOTE A nozzle may have a valve for controlling the flow of the moulding material.

nucleation
formation of the smallest crystalline entity, the further growth of which is favoured thermodynamically\textsuperscript{15)}

offset yield point
point on a stress-strain curve that identifies the offset yield stress

offset yield stress
stress at which the stress-strain curve departs from linearity by a specified percentage of strain (offset)

NOTE It is essential to give the value of the offset when this property is reported.

oligomer
substance composed of molecules containing a few of one or more species of atoms or groups of atoms (constitutional units) repetitively linked to each other

NOTE The physical properties of an oligomer vary with the addition or removal of one or a few of the constitutional units from its molecules.

oligomer molecule
molecule of intermediate molecular weight, the structure of which can be described in terms of a number of constitutional units

oligomerization
process of converting a monomer or a mixture of monomers into an oligomer

on torque, $T_{ON}$
maximum torque required to screw the nut onto a bolt precoated with adhesive

open assembly time (in adhesive bonding)
time during which adhesive-coated surfaces are exposed to the air before being brought into contact

open cell
cell not enclosed totally by its walls and hence interconnected with other cells or with the exterior

open-cell cellular plastic
cellular plastic in which almost all the cells are interconnected throughout

optical density of smoke
measure of the degree of opacity, i.e. the negative common logarithm of the transmission of light

optical distortion
any apparent alteration of the geometric pattern of an object when seen either through a material or as a reflection from a surface of a material

orange peel
irregular surface of pock-marked appearance exhibited in the form of an accumulation of pimples, pinholes, and craters, somewhat resembling the surface of orange peel

\textsuperscript{15)} IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
organosol
suspension of a finely-divided polymer in a mixture of plasticizer and a volatile organic liquid

cf. plastisol

oscillating stress
stress with a value varying as a periodical function of time

cf. vibrating stress

out-of-phase viscosity, \( \eta'' \) (Pa s)
quotient of the stress 90° out of phase with the rate of strain (\( \sigma_0 \) \( \sin \delta \)) to the amplitude of the rate of the strain (\( \omega \epsilon_0 \)) in the forced oscillation of a material:

\[
\eta'' = (\sigma_0 \sin \delta) / (\omega \epsilon_0)
\]

NOTE The strain (\( \epsilon \)) and the stress (\( \sigma \)) of the forced oscillation are given by the equations

\[
\epsilon = \epsilon_0 \sin \omega t
\]
and

\[
\sigma = \sigma_0 \sin (\omega t + \delta).
\]
so that

\[
\epsilon = \omega \epsilon_0 \cos \omega t
\]
and

\[
\sigma = \sigma_0 \sin \delta \cos \omega t + \sigma_0 \cos \delta \sin \omega t.
\]

overcure
state of cure of a polymeric system when the curing conditions (time, temperature, radiation, amount of curing additives, etc.) have exceeded those that would produce a satisfactory cure

cf. undercure

oxidation
thermal treatment in air of PAN, pitch or viscose carbon fibre precursor designed to oxidize the fibre in order to make it suitable for subsequent carbonization and graphitization

oxidatively-degradable plastic
degradable plastic in which the degradation results from oxidation

cf. degradable plastic

package
yarn, roving, etc., in the form of units capable of being unwound and suitable for handling, storing, shipping and use

NOTE Packages may be unsupported as skeins or cakes, or prepared with various winding patterns on bobbins, cops, cones, pins, spools, tubes or beams.

PAN-based carbon fibre
carbon fibre produced from polyacrylonitrile (PAN) precursor

NOTE A range of tensile strengths and moduli of elasticity may be obtained by adjusting the conditions of carbonization.

cf. carbon fibre precursor

parallel laminated
pertaining to a laminate in which all the layers of material are oriented approximately parallel with respect to the grain or strongest direction in tension

parison
shaped plastic mass, generally in the form of a tube, used in blow moulding

peel strength
force per unit width necessary to bring an adhesive joint to the point of failure and/or maintain a specified rate of failure by means of a stress applied in a peeling mode

pellet
small mass of preformed moulding material, having relatively uniform dimensions in a given lot, used as feedstock in moulding and extrusion operations

NOTE This note does not apply to English text.

cf. granule
pelletizer
machine in which extruded rods or other shapes are cut into pellets of relatively uniform dimensions for use as feedstock in moulding and extrusion operations

cf. pellet

phenol-furfural resin
resin made by the polycondensation of phenol with furfural

phenolic plastic
plastic based on phenolic resins

phenolic resin
generally, a class of resins made by the polycondensation of phenol, its homologues and/or derivatives, with aldehydes or ketones

photodegradable plastic
degradable plastic in which the degradation results from the action of natural daylight
cf. degradable plastic

pimple
small hard protuberance of varied shape on the surface of a part
cf. blister

pinhole
hole of very small diameter in the surface of a material
NOTE In the case of films, the hole usually penetrates the entire thickness.
cf. crater

pin-point gate
injection channel or orifice of very small circular cross-sectional area, leaving almost no sprue on the moulded part

phases
in (polymerization)
phenomenon of the continuous and dispersed phases replacing one another when a given stage of conversion is reached in some types of heterogeneous phase polymerization, for example in the preparation of rubber-modified polystyrene

phenol-formaldehyde resin
PF resin
resin of the phenolic type, made by the polycondensation of phenol with formaldehyde
cf. tube, tubing and rigidity
pitch-based carbon fibre
carbon fibre produced from anisotropic or isotropic
pitch precursors

NOTE The carbon fibres produced from isotropic pitch
precursors have a lower modulus of elasticity than those
obtained from anisotropic pitch precursors, which can be
processed to give a high modulus of elasticity.

cf. carbon fibre precursor

plastic, noun
material which contains as an essential ingredient a
high polymer and which at some stage in its process-
ing into finished products can be shaped by flow

NOTE 1 Elastomeric materials, which also are shaped by
flow, are not considered as plastics.
NOTE 2 In some countries, particularly in the United King-
dom, it is a permitted option to use the term “plastics” as the
singular form as well as the plural form.

plastic deformation
that part of the strain in a stressed plastic which
remains after the applied stress has been removed

cf. creep, creep recovery and elastic deformation

plasticize

to render a polymeric material softer, more flexible
and/or more workable by the addition of a plasticizer
or by chemical modification of the polymer

cf. plasti cate

plasticizer

substance of low or negligible volatility incorporated in
a plastic to lower its softening range and to increase
its workability, flexibility or extensibility

plasticizer limit

maximum amount of plasticizer that is compatible with
a given material under specified conditions

cf. external plasticizer

plastigel

a gel-like suspension of a finely-divided polymer in a
plasticizer

plastisol

a suspension of a finely-divided polymer in a plastic-
izer

NOTE The polymer does not dissolve appreciably in the
plasticizer at room temperature but does so at elevated
temperatures to form a homogeneous plastic mass
(externally plasticized polymer).

cf. organosol

plastisol fusion

process in which, in the course of heating, the polymer
particles in plastisols (and organosols) are dissolved in
the plasticizer(s), so that, upon cooling, a homogene-
ous solid results

NOTE Plastisol gel refers to the state attained when, in
the course of heating or ageing, the plasticizer(s) in plasti-
sols (and organosols) has (have) been absorbed by the
polymer particles to an extent that a weak gel mass is
formed.

cf. organosol and plastisol
plate
smooth, flat piece of material of uniform limited thickness and area

plate mark
as applied to a defect, an imperfection in a pressed plastic sheet resulting from the surface of the pressing plate

plug-assist vacuum thermoforming
vacuum thermoforming process in which a male mould or plug is used to preform partially the heated sheet before forming, which is then completed by means of vacuum

Poisson’s ratio
absolute value of the ratio of the transverse strain to the corresponding axial strain resulting from uniformly-distributed axial stress within the proportional limit of the material

NOTE In the case of an anisotropic material, Poisson’s ratio varies with the direction of application of the stress. Above the proportional limit, this ratio varies with the stress and really should not be regarded as Poisson’s ratio; if this ratio nevertheless is reported, it is necessary to state the stress value for which it has been determined.

polyacrylate
polymer of an ester of acrylic acid or of esters of acrylic acid homologues or substituted derivatives

polyacrylic plastic
acrylic plastic based on polymers in which the repeated structural units in the chains are essentially all of the acrylate type

polyacrylonitrile
PAN
polymer of acrylonitrile

polyaddition
broadly, synonymous with addition polymerization; in a restricted sense, the chemical reaction in which polymers are formed by addition of monomers other than those containing carbon-carbon unsaturated bonds (for example, reactions of epoxy, isocyanate, or lactam monomers)

polyallyl plastic
alloy plastic
allyl resin
plastic based on allyl polymers

polyacetal
polymer in which the repeated structural unit in the chain is of the acetal type
cf. polyoxymethylene

polyacetal plastic
acetal plastic
plastic based on polymers in which the repeated structural units in the chains are of the acetal type, or on copolymers in which acetal and other types of repeated structural units are present in the chains, the acetal component(s) being in the greatest amount by mass
cf. polyoxymethylene plastic

polyamide
PA
polymer in which the repeated structural unit in the chain is of the amide type

polyamide plastic
PA plastic
plastic based on polymers in which the repeated structural units in the chains are essentially all of the amide type

polyaryletherketone
PAEK
polymer in which aryl groups are connected by one or more ether as well as one or more ketone linkages
polybutylene [polybutene] 
PB  
polymer of butylene [butene]

polybutylene [polybutene] plastic  
PB plastic  
butylene [butene] plastic based on polymers made with butylene [butene] as essentially the sole monomer

poly(butylene terephthalate)  
PBT  
polymer made by the polycondensation of butylene glycol and terephthalic acid or dimethyl terephthalate

polycarbonate  
PC  
polymer in which the repeated structural unit in the chain is of the carbonate type

polycarbonate plastic  
PC plastic  
plastic based on polymers in which the repeated structural units in the chains are essentially all of the carbonate type

polychlorofluorocarbon plastic  
chlorofluorocarbon plastic  
plastic based on polymers made with monomers composed of chlorine, fluorine and carbon only

polychlorofluorohydrocarbon plastic  
chlorofluorohydrocarbon plastic  
plastic based on polymers made with monomers composed of chlorine, fluorine, hydrogen and carbon only

polychlorotrifluoroethylene  
PCTFE  
polymer of chlorotrifluoroethylene

poly(diallyl phthalate)  
PDAP  
polymer of diallyl phthalate

polyelectrolyte  
macromolecule with a large number of ionic groups

polyester  
polymer in which the repeated structural unit in the chain is of the ester type

polyester plastic  
alkyd plastic (deprecated)  
plastic based on polymers in which the repeated units in the chains are of the ester type, or on copolymers in which ester and other types of repeated structural units are present in the chains, the ester component(s) being in the greatest amount by mass

polyether  
polymer in which the repeated structural unit in the chain is of the ether type

polyetheretherketone  
PEEK  
polymer in which the repeated structural unit in the chain is

polyethersulfone  
PES  
polymer in which the repeated structural unit in the chain is
polyethylene [polyethene]
PE
polymer of ethylene [ethene]

poly(ethylene oxide)
PEOX
polymer of ethylene oxide

polyethylene [polyethene] plastic
PE plastic
plastic based on polymers of ethylene [ethene] or copolymers of ethylene [ethene] with other monomers, the ethylene [ethene] being in the greatest amount by mass

poly(ethylene terephthalate)
PET
polymer made by the polycondensation of ethylene glycol and terephthalic acid or dimethyl terephthalate

polyfluorocarbon plastic
fluorocarbon plastic
plastic based on polymers made with monomers composed of fluorine and carbon only

definition 1
polyfluorohydrocarbon plastic
fluorohydrocarbon plastic
plastic based on polymers made with monomers composed of fluorine, hydrogen and carbon only

polyhalocarbon plastic
halocarbon plastic
plastic based on polymers from monomers composed only of carbon and a halogen or halogens
cf. polyfluorocarbon plastic

polyhydrocarbon plastic
hydrocarbon plastic
plastic based on polymers made with monomers composed of carbon and hydrogen only

polyisobutylene [poly-2-methylpropene]
PIB
polymer of isobutylene [2-methylpropene]

polyisocyanurate plastic
isocyanurate plastic
plastic based on polymers in which trimerization of isocyanates incorporates six-membered isocyanurate ring groups in a chain

NOTE In commercial polyisocyanurate cellular plastics, 10% to 30% of the available isocyanate groups are reacted with polyols to introduce urethane groups into the chain.

definition 2
polymer
substance composed of molecules characterized by the multiple repetition of one or more species of atoms or groups of atoms (constitutional units) linked to each other in amounts sufficient to provide a set of properties that do not vary markedly with the addition or removal of one or a few of the constitutional units

definition 3
polymer chain
portion of a polymer molecule bounded at each end by a terminal group or a branch

polymer morphology
1) form or shape, usually related to aspects of structure having dimensions larger than the unit cell, but requiring microscopic examination to be observed;
2) distribution of phases in a material; the shape and size of a line, an area or a volume; the texture or topography of a surface; or the habit of a crystal

polymerization
process of converting a monomer or a mixture of monomers into a polymer
polymer-poor phase
dilute phase
that phase of a two-phase equilibrium system, consisting of a polymer and low-molecular-weight material, in which the polymer concentration is lower

NOTE The use of the name “sol phase” is discouraged(16).

polymer-rich phase
concentrated phase
that phase of a two-phase equilibrium system, consisting of a polymer and low-molecular-weight material, in which the polymer concentration is higher

NOTE The use of the name “gel phase” is discouraged(16).

poly(methyl methacrylate)
PMMA
polymer of methyl methacrylate

poly(methyl methacrylate) plastic
PMMA plastic
acrylic plastic based on polymers made with methyl methacrylate as essentially the sole monomer

poly(4-methyl pentene)
PMP
polymer of 4-methyl-1-pentene

polyol
polyol alcohol
polyhydric alcohol
alcohol having many hydroxyl groups

NOTE In cellular plastics usage, the term polyol includes compounds containing alcoholic hydroxyl groups such as polyethers, glycols, polyesters and castor oil used in polyurethane cellular materials.

polyolefin
polymer of an olefin (or olefins)

polyolefin plastic
plastic based on polymers made with an olefin (or olefins) or copolymers of such monomers with other monomers, the olefin monomer (or monomers) being in the greatest amount by mass

polyoxymethylene
polyformaldehyde
POM
polymer in which the repeated structural unit in the chain is oxymethylene

NOTE Polyoxymethylene theoretically is the simplest member of the generic class of polyacetal.

polyoxymethylene plastic
POM plastic
polyacetal plastic based on polymers in which oxymethylene essentially is the sole repeated structural unit in the chains

cf. polyacetal plastic

poly(phenylene oxide)
PPO
polymer in which the constitutional repeating unit is phenylene oxide

NOTE 1 A commercial polymer of this type has a constitutional repeating unit of 2,6-dimethyl-1,4-phenylene oxide.
NOTE 2 The symbol PPO is not acceptable in the USA because it is a registered trademark. Consequently, the symbol PPE derived from the chemical name poly(phenylene ether) is used in the USA.

poly(phenylene sulfide)
PPS
polymer in which the constitutional repeating unit is phenylene sulfide
poly(phenylene sulfone)  
PPSU  
polymer in which the constitutional repeating unit is phenylene sulfone

poly(styrene/butadiene) plastic  
styrene/butadiene plastic  
plastic based on copolymers of styrene and butadiene

polytetrafluoroethylene  
PTFE  
polymer of tetrafluoroethylene

polyphthalamide  
PPA  
polyamide in which the terephthalic group, the isophthalic group, or a combination of the two, is part of the repeating structural unit in the polymer chain

poly(terephthalate)  
thermoplastic polyester in which the terephthalate group is a repeating structural unit in the polymer chain

polypropylene [polypropene]  
PP  
polymer of propylene [propene]

poly(terephthalate plastic)  
thermoplastic polyester in which the terephthalate group is a repeating structural unit in the polymer chain, the terephthalate being present in greater amount than other dicarboxylates which may be present

polypropylene [polypropene] plastic  
propylene [propene] plastic  
plastic based on polymers of [propene] or copolymers of propylene [propene] with other monomers, the propylene [propene] being in the greatest amount by mass

polyurea  
polyureas  
polymers produced by the reaction of polyfunctional isocyanates with primary or secondary amines  
NOTE: Polyureas are mostly used for producing fibres.  
cf. isocyanate polymer

poly(propylene oxide)  
PPOX  
polymer of propylene oxide

polyurethane  
PUR  
polymer in which the repeated structural unit in the chain is of the urethane type  
cf. isocyanate polymer

poly(vinyl acetal)  
1) generically, a class of polymers derived from polyvinyl esters in which some or all of the acid groups have been replaced by hydroxyl groups and some or all of these hydroxyl groups have been reacted with aldehydes to form acetal groups;  
2) specifically, poly(vinyl acetal) made by the reaction of the hydroxyl group with acetaldehyde
poly(vinyl acetate)
PVAC
polymer of vinyl acetate

poly(vinyl acetate) plastic
PVAC plastic
vinyl acetate plastic based on polymers made with vinyl acetate as essentially the sole monomer

poly(vinyl alcohol)
PVAl
polymer of the hypothetical vinyl alcohol; in practice, it is prepared by the hydrolysis of polyvinyl esters, usually poly(vinyl acetate)

poly(vinyl butyral)
PVB
poly(vinyl acetal) made by the reaction of the hydroxyl groups with butyraldehyde

poly(vinylcarbazole)
PVK
polymer of vinylcarbazole

poly(vinyl chloride)
PVC
polymer of vinyl chloride

poly(vinyl chloride) plastic
PVC plastic
plastic based on polymers of vinyl chloride or copolymers of vinyl chloride with other monomers, the vinyl chloride being in the greatest amount by mass

poly(vinyl chloride-vinyl acetate)
PVC/PVAc
copolymer of vinyl chloride and vinyl acetate

poly(vinyl formal)
PVFM
poly(vinyl acetate) made by the reaction of the hydroxyl groups with formaldehyde

poly(vinylidene chloride)
PVDC
vinylidene chloride plastic based on polymers made with vinylidene chloride as essentially the sole monomer

poly(vinylidene fluoride)
PVDF
polymer of vinylidene fluoride

poly(vinyl pyrrolidone)
PVP
polymer of N-vinyl-2-pyrrolidone

poromeric, adjective
having properties similar to leather, essentially water-proof, but capable of transmitting water vapour to some practical degree

porosity
property of a material that contains very fine continuous holes which allow passage of gases, liquids and solids through one surface and out at another surface

NOTE Not to be confused with permeability.

cf. permeability

positive mould
mould in which the total applied pressure rests only and continuously on the moulding and in which there is no provision for escape of excess moulding material

postcure
after bake
heat treatment of articles moulded from thermosetting materials to complete the cure
postforming
forming cured or partially-cured thermosetting plastics
cf. forming

post-shrinkage
shrinkage of a plastic product after moulding during post-treatment, storage, or use
cf. moulding shrinkage

pot life
working life
period of time during which an adhesive or resin, prepared for application, remains usable

potting
embedding process in which the mould remains attached to the resin-encased article
cf. embedding and encapsulation

powder moulding
general term for pressureless moulding processes in which dry, fusible powders are caused to fuse into a uniform layer against a mould wall
cf. rotational moulding

power factor
ratio of the active power to the apparent power

power loss, ΔP (W·m⁻³)
energy that is transformed into heat through hysteresis, divided by the volume of the material
NOTE It is the product of energy loss W by frequency f.

precision
closeness of agreement between the results obtained by applying the experimental procedure several times under prescribed conditions

NOTE The smaller the random part of the experimental errors which affect the results, the more precise is the procedure. Repeatability and reproducibility are special cases of precision.

preform
coherent, shaped mass of powdered, granular or fibrous plastics moulding compounds, or of a fibrous filler material with or without resin

premix
admixture of resin, reinforcement, fillers, etc., not in web or filamentous form, usually prepared by the moulder shortly before use

prepolymer
polymer of degree of polymerization intermediate between that of the monomer or monomers and the final polymer

prepreg
admixture of resins (with or without fillers), additives, and reinforcements in woven or filamentous form, ready for moulding

pressure break
as applied to a defect, an apparent break in one or more outer sheets of the paper, fabric, or other base of a laminated plastic, visible through the surface layer of resin which covers it

pressure pad
device designed to reduce the pressure on the land areas of a mould when the mould is closed

NOTE Normally it consists of hardened steel blocks suitably located to bear a proportion of the pressure applied by the press.
pressure-sensitive adhesive
adhesive which in a dry (solvent-free) state is tacky permanently at room temperature and adheres tenaciously to diverse surfaces by simple contact under light manual pressure

NOTE Tapes coated with these adhesives are well-known commercial products.

cf. contact adhesive

pressure thermoforming
thermoforming process in which air pressure is used to form a heated sheet against the mould surface

cf. vacuum thermoforming

pressure welding
welding method depending essentially on using pressure and also applying heat, e.g. to produce thick plates or blocks from thermoplastic sheets

NOTE Unlike laminates, such plates show only a low anisotropy.

profile
extruded plastic product, excluding film and sheet, having a characteristic constant axial section

NOTE Profiles include only sections other than rectilinear or circular, such as U-shaped, T-shaped, L-shaped, etc.

proportional limit
greatest stress that a material is capable of sustaining without any deviation from proportionality of stress to strain (Hooke's Law)

pull-back ram
hydraulically operated ram that returns the main ram of a hydraulic press to the open position, or returns ejector gear to its normal position

pulled surface
as applied to a defect, imperfections in the surface of a laminated plastic ranging from slight breaking or lifting of surface in spots to pronounced separation

prevailing torque, $T_p$
torque measured after the initial breakage of the bond at a specified angle of rotation of the nut

NOTE 1 For testing against a specification, the angle is normally be 180°.

NOTE 2 A round-robin test programme, recently performed, showed there is no significant difference between prevailing torque measured at 180° and prevailing torque determined as the mean of the four torque readings determined at 90°, 180°, 270° and 360°.

NOTE 3 For quality control or purposes other than testing the adhesive against a specification, other angles may be agreed between the manufacturer and the purchaser of the adhesive.

pultrusion
process of making continuous lengths of reinforced plastic profiles with high unidirectional strength by pulling continuous strands of resin-impregnated reinforcing material through a heated die and then through a heating chamber if necessary, to postcure the resin

punch
force (deprecated)

1) male part of a mould;
2) tool used in punching

cf. die (in punching)

purgating
removal of one colour, type or grade of material from an injection or extrusion machine by forcing it out with the compound to be used in production subsequently, or with another suitable material
quality factor, $Q$ (dimensionless)
ratio of storage modulus to loss modulus, measured in
tension, shear, bulk compression or longitudinal com-
pression

NOTE The quality factor is the reciprocal of tan $\delta$.

quantitative differential thermal analysis
differential thermal analysis in which the equipment
used is designed to produce quantitative results in
terms of energy and/or other physical parameters

quasi-single-strand chain
linear chain that can be described by constitutional
units which are joined to each other through one single
common atom only on one of the two termini of the
unit

quaterpolymer
polymer derived from four species of monomer

radical polymerization
chain polymerization in which the reactive functional
species is a radical

ram
piston (of a press)
device that transforms hydraulic pressure into
mechanical force

random copolymer
copolymer in the molecules of which two or more spe-
cies of monomeric units are distributed in random
sequence

random copolymerization
polymerization in which a random copolymer is formed

reactive diluent
low-viscosity liquid added to a high-viscosity solvent-
free thermosetting adhesive which reacts chemically
with the adhesive during curing

NOTE The advantage of lowered viscosity is gained with
minimum loss of other properties.

cf. diluent

rebound resilience, $R$ (dimensionless)
after a succession of impacts, the ratio of the output to
the input energy of a moving mass that collides with
the specimen

recrystallization
process following melting by which
1) amorphous or poorly-ordered regions of a polymer
specimen become incorporated into crystals;
2) change to a more stable crystal structure takes
place;
3) defects within the crystals decrease;
4) any of the above occur in combination

recycled plastic
plastic prepared from discarded articles which have
been cleaned and ground

NOTE 1 In a broad sense the recycling of plastics covers
any re-use of scrap material or discarded articles, including
pyrolysis to recover useful organic chemicals.

NOTE 2 Recycled plastics may or may not be reformulated
by the addition of fillers, plasticizers, stabilizers, pigments,
etc.

cf. reprocessed plastic and reworked plastic

17) IUPAC Recommendations: 1987 Definitions of terms
relating to crystalline polymers.
reduced viscosity
viscosity number
ratio of the relative viscosity increment $\eta_r$ to the mass concentration of the polymer $c$:

$$\frac{\eta_r}{c}$$

NOTE 1 The unit must be specified; the unit cubic centimetre per gram (cm³/g) is recommended.

NOTE 2 Reduced viscosity, inherent viscosity and intrinsic viscosity are not viscosities or pure numbers. The terms are to be looked on as traditional names. Any replacement by consistent terminology would produce unnecessary confusion in the polymer literature.

cf. relative viscosity increment

reference atmosphere
agreed atmosphere with which test results determined in other atmospheres may be corrected or compared

cf. standard atmosphere(s) and test atmosphere

reinforced plastic
plastic with high-strength fibres embedded in the composition, resulting in some strength properties greatly superior to those of the base resin

reinforced-reaction injection moulding
RRIM
process of using solid reinforcements, such as glass fibre, mica or talc, in the reaction-injection moulding process

reinforcing filler
filler added to a plastic to improve one or more mechanical properties

NOTE As a reinforcing filler may or may not be made from contain fibres, the addition of a reinforcing filler to a polymer material does not necessarily lead to a reinforced plastic.

cf. reinforced plastic

relative impact strength
notch sensitivity (deprecated)
ratios of the impact strengths of notched and unnotched specimens or of specimens with two types of notch, for specimens of the same type

relative molecular mass, $M_r$
molecular weight, $M_w$
ratio of the average mass per formula unit of a substance to 1/12 of the mass of an atom of nuclide $^{12}\text{C}$

NOTE Relative molecular mass (molecular weight) is a pure number and is not to be associated with any units.

regular block
block that can be described by only one species of constitutional repeating unit in a single sequential arrangement

cf. note to block polymer

regular polymer
polymer, the molecules of which can be described by only one species of constitutional unit in a single sequential arrangement

cf. note to constitutional repeating unit and irregular polymer

regulator
substance used in small proportion to control relative molecular mass during polymerization

relative permittivity
dielectric constant (relative)
ratio of the capacitance of a capacitor in which the space between and around the electrodes is filled entirely and exclusively with the insulating material to the capacitance of the same configuration of electrodes in vacuum

IUPAP symbol: $\varepsilon_r$

NOTE The relative permittivity of air at normal atmospheric pressure is equal to 1,000.53, so that in practice, the capacitance of the configuration of electrodes in air normally can be used to determine the relative permittivity with sufficient accuracy.
relative rigidity (dimensionless)
ratio of modulus at any temperature, frequency, or
time to the modulus at a reference temperature, fre-
quency or time

relative viscosity, \( \eta_r \)
viscosity ratio
solution/solvent viscosity ratio
ratio of the viscosity of the solution \( \eta \) to the viscosity of
the solvent \( \eta_s \):
\[
\eta_r = \frac{\eta}{\eta_s}
\]

relative viscosity increment, \( \eta_i \)
viscosity ratio increment
specific viscosity (deprecated)
ratio of the difference between the viscosities of solu-
tion and solvent to the viscosity of solvent:
\[
\eta_i = \frac{\eta - \eta_s}{\eta_s}
\]

NOTE The use of the term specific viscosity for this
quantity is discouraged, because the relative viscosity
increment does not have the attributes of a specific quantity.

cf. relative viscosity

relaxation time, \( \tau_{rel} \) (s)
decay time of a relaxation process:
\[
A = A_0 e^{-\left(\frac{t}{\tau_{rel}}\right)}
\]

cf. retardation time

release agent (in moulding)
substance put on a mould or added to a moulding
material to facilitate removal of the moulded product
from the mould

relieve (in moulds), verb
to reduce the contact area between the sealing faces
of a mould to provide escape for gas or excess
moulding material

repeatability
 closeness of agreement between successive results
obtained with the same method on identical test ma-
terial, under the same conditions (same operator, same
apparatus, same laboratory and short intervals of
time)

reproducibility
 closeness of agreement between individual results
obtained with the same method on identical test ma-
terial but under different conditions (different operators,
different apparatus, different laboratories and/or different
times)

reprocessed plastic
thermoplastic prepared from scrap industrial plastic by
other than the original processor

NOTE Reprocessed plastics may or may not be reformu-
lated by the addition of fillers, plasticizers, stabilizers, pig-
ments, etc.

cf. recycled plastic and reworked plastic

resilience
ratio of energy output to energy input in a rapid (or
instantaneous) recovery of a deformed specimen

resin
solid, semisolid, or pseudosolid organic material that
has an indefinite and often high relative molecular
mass, exhibits a tendency to flow when subjected to
stress, usually has a softening or melting range, and
usually fractures conchoidally

NOTE In some countries, the term is used in a broad
sense to designate any polymer that is a basic material for
plastics.

resin pocket
accumulation of resin, localized in the interior of a rein-
forced plastic

resin streak
streak of excess resin in the surface of a reinforced
plastic

resistance to chemicals
chemical resistance
resistance to change of mass, dimensions or other
properties of plastics after immersion into chemicals,
when tested by the method specified in ISO 175
resite
phenol-formaldehyde resin in the final state of the curing process
NOTE In this stage it is insoluble in alcohol and acetone, and infusible.
cf. C-stage

resitol
phenol-formaldehyde resin in the transition state of the curing process
NOTE Under heating, it softens to rubberlike consistency, but without melting. It swells when it is immersed in alcohol or acetone, but does not dissolve.
cf. B-stage

resol
fusible, soluble, phenolic resin containing sufficient reactive methylol groups to enable the resin to become infusible on further reaction
cf. A-stage and novolak

retardation time, $r_{\text{ref}}$ (s)
decay time of a retardation process:
$$A = A_0[1 - e^{-t/r_{\text{ref}}}]$$
cf. relaxation time

retarder
substance used in small proportion to reduce the reaction rate of a chemical system
cf. catalyst and inhibitor

reverse roll (in coating)
rotating cylinder of a coating machine, used for the deposition of a coating material premetered to the surface of the cylinder, on to a substrate to be coated
NOTE The surface of the cylinder moves in the opposite direction to the substrate.
cf. kiss roll (in coating)

reworked plastic
thermoplastic prepared from trimmings or rejected mouldings that has been reprocessed in a fabricator’s plant after having been processed previously in that plant by moulding, extrusion, etc.
NOTE In many specifications the use of reworked material is limited to clean plastic that meets the requirements specified for the virgin material and yields a product essentially equal in quality to one made from only virgin material.
cf. recycled plastic, reprocessed plastic and virgin plastic

resonance curve, $A(f)$ (dimension of the amplitude $A$)
curve of frequency dependence of the amplitude of a damped system subjected to forced vibrations near the resonance frequency

resonance frequency, $f_R$ (Hz)
frequency of the maximum amplitude of the resonance curve
NOTE $f_R$ is proportional to the square root of the storage modulus $M'$ of a viscoelastic system.
cf. resonance curve

resonant forced vibration technique
technique for performing dynamic mechanical measurements in which the test specimen is oscillated mechanically at the natural resonant frequency of the system
NOTE The amplitude of oscillation is maintained constant through the addition of make-up energy. Storage modulus is calculated from the measured frequency. Damping is calculated from the additional energy required to maintain constant-amplitude oscillation.

rigid plastic
plastic that has a modulus of elasticity in flexure or, if that is not applicable, then in tension, greater than 700 MPa under stated conditions
NOTE Materials usually are classified at standard temperature and relative humidity in accordance with ISO 291.

rigidity
resistance to bending
NOTE Modulus of elasticity is an inherent property of a material which, in conjunction with thickness, determines rigidity.
cf. rigid plastic and semi-rigid plastic
ring gate
injection channel that extends around the whole periphery of the moulding

ring-opening polymerization
polymerization in which a cyclic monomer molecule is incorporated into the macromolecule, yielding a monomeric unit which is acyclic

rise time
time required for a free-rise cellular plastic to achieve its ultimate expansion under controlled conditions

roll coating
coating process in which a coating material is transferred to the substrate from a roll on which the fluid material is spread

room temperature
ambient temperature in the range of 15 °C to 35 °C

NOTE The term room temperature usually is applied to an atmosphere of unspecified relative humidity, atmospheric pressure, and air motion.

root-mean-square strain (dimensionless)
square root of the mean value of the square of the strain over one cycle of deformation

NOTE For a symmetrical sinusoidal stress, the root-mean-square strain equals the strain amplitude divided by \( \sqrt{2} \).

root-mean-square stress (Pa)
square root of the mean value of the square of the stress over one cycle of deformation

NOTE For a symmetrical sinusoidal stress, the root-mean-square stress equals the stress amplitude divided by \( \sqrt{2} \).

rotary moulding
process of moulding by injection, transfer, compression or blowing, in which multiple moulds mounted on a rotating table are cycled automatically through the moulding operations

rotational casting
process of forming hollow articles from fluid materials by rotating a mould containing a charge of the material about one or more axes at relatively low speed, until the charge is distributed on the inner mould walls by gravitational force and then solidified by suitable means

cf. centrifugal casting, centrifugal moulding and rotational moulding

rotational moulding
process analogous to rotational casting in which dry, fusible, finely-divided powders are distributed against the mould walls and fused

cf. centrifugal casting, centrifugal moulding and rotational casting

roving (textile glass)
collection of parallel strands (assembled roving) or parallel filaments (direct roving) assembled without intentional twist

cf. direct roving

rubber
elastomer which can be, or is already, modified to a state in which essentially it is insoluble (but can swell) in boiling solvent such as methyl ethyl ketone and ethanol-toluene azeotrope

NOTE A rubber in its modified state cannot be easily remoulded to a permanent shape by the application of heat and moderate pressure, free of diluents, it retracts within 1 min to less than 1.5 times its original length after being stretched at normal room temperature (18 °C to 29 °C) to twice its length and held for 1 min before release.
runner
1) secondary feed channel in an injection or transfer mould that runs from the inner end of the sprue to the cavity gate;
2) moulding material in this secondary feed channel

sample
small portion of a material or group of units taken from a larger quantity of material or collection of units, intended to be representative of the whole

selective solvent
medium that is a solvent for at least one component of a mixture of polymers, or for at least one block of a block or graft polymer, but a non-solvent for the other component(s) or block(s)\(^{18}\)

self-extinguishing (deprecated)
it is recommended that this term not be used because of risk of misunderstanding

NOTE It is the characteristic of a material ceasing to burn, under specified test conditions, when the external supporting source of ignition is removed. In lieu of this term report, where applicable, after flame time under the test conditions (specify).

self-heating
exothermic reaction within a material resulting in a rise in temperature in the material

semi-crystalline polymer
polymer containing crystalline and amorphous phases

semi-positive mould
mould designed to allow a small amount of excess moulding material to escape when it is closed

semi-rigid plastic
plastic that has a modulus of elasticity in flexure or, if that is not applicable, then in tension, between 70 MPa and 700 MPa under stated conditions

NOTE Materials usually are classified at standard temperature and relative humidity in accordance with ISO 291.

scarf joint
joint made by cutting identical angular segments at an angle less than 45° to the major axis of two adherends and bonding the adherends with the cut area fitted together to be coplanar

cf. butt joint and lap joint

screen pack
filter pack
wire gauze at the entrance to the extrusion head used for filtering molten plastics and/or building up back pressure

cf. heat sealing and solvent bonding

seizing (of a mould)
unwanted binding of two parts of a mould, preventing their separation

NOTE The binding may be because of cohesion between metal parts or adhesion to the moulding material.

\(^{18}\) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
**sequential arrangement** (in polymer molecules)
arrangement of constitutional units in a polymer chain

NOTE The constitutional unit

\[
\begin{array}{c}
\text{CH}_2 \\
\text{R}
\end{array}
\]

in the polymer molecule represented by the fragment

\[
\begin{array}{c}
\text{CH}_2 \\
\text{R} \\
\text{CH}_2 \\
\text{R} \\
\text{R} \\
\text{R} \\
\text{R}
\end{array}
\]

is in one sequential arrangement only (head-to-tail). In the polymer molecule represented by the fragment

\[
\begin{array}{c}
\text{CH}_2 \\
\text{R} \\
\text{CH}_2 \\
\text{CH}_2 \\
\text{CH}_2 \\
\text{R} \\
\text{R} \\
\text{R} \\
\text{R}
\end{array}
\]

there is more than one sequential arrangement of the constitutional unit.

**service life, \(N\)**
number of stress cycles applied to a specimen until it has reached the chosen end of the test

NOTE Where it has not failed, the service life is not defined but is termed greater than the test duration.

**set**
strain remaining after complete release of the load producing the deformation

NOTE Because of practical considerations, such as distortion in the specimen and slack in the strain-indicating system, measurements of strain at a small load rather than zero load often are taken. Set often is referred to as permanent set if it shows no further change with time. The time elapsing between removal of load and final reading of set should be stated.

cf. setting

**setting** (process)
set (of an adhesive)
process by which adhesive and/or cohesive strength is developed by chemical or physical action, for example polymerization, oxidation, gelation, hydration, cooling, or evaporation of volatile constituents

cf. setting time (of plastics)

**setting temperature**
temperature to which an adhesive or an assembly is subjected to set the adhesive

cf. cure temperature and setting

**setting time** (of adhesives)
period of time necessary for an adhesive in an assembly to set under specified conditions of temperature or pressure, or both

cf. setting

**setting time** (of plastics)
time taken for a plastic material to harden sufficiently for handling

**sewing thread** (textile glass)
strong smooth glass yarn made from filament and usually having a high twist

**shear modulus, \(G\) (Pa)**
quotient of shear stress by shear strain:

\[
G = \sigma_{ij} / \gamma
\]

**shear rate, \(\gamma\) \((s^{-1})\)**
time rate of change of shear strain:

\[
\dot{\gamma} = d\gamma / dt
\]

NOTE For a one-dimensional shear flow, it is the velocity gradient.

**shear strain, \(\gamma\) (dimensionless)**
tangent of the angular change, attributable to force, between two lines originally perpendicular to each other, through a point in a body

**shear strength**
maximum shear stress sustained by a specimen during a shear test

cf. shear stress
shear strength (adhesives)
maximum shear stress sustained by an adhesive joint
during a shear test

shear stress, \( \sigma_y \) (Pa)
force, parallel to its original working area, divided by
the cross-section of the specimen measured in this
area

shear stress (adhesives)
force applied parallel to a flat adhesive joint, divided by
the bond area of the joint, it is expressed in megapas-
cals (MPa)

Shore hardness
arbitrary measure of hardness, in which the penetra-
tion of a specified indenter forced into the material is
determined under conditions specified in ISO 868

cf. indentation hardness

short (in a moulding)
incompletely filled-out condition in a moulding

short chain
linear oligomer molecule or a linear portion of a mac-
romolecule short enough to be considered oligomeric

short-chain branch
oligomeric offshoot from a macromolecular chain\(^{19}\)

shot
amount of material delivered to the mould assembly in
one moulding cycle

shot capacity
maximum quantity of a material that an injection
moulding machine can inject per cycle into a mould

shrink packaging
shrink wrapping
process of enclosing an article in a protective enve-
lope by heat sealing it within pre-stretched film and
then heating to cause the film to shrink tightly around
the article

shelf life
storage life
storage time under specified conditions during which a
material may be expected to retain its essential prop-
erties, for example working properties and specified
strength

shell moulding resin
resin used in admixture with sand or a ceramic powder
in the foundry industry to make thin-walled moulds in
which to cast metals

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\(^{19}\) IUPAC Recommendations: Physico-chemical defini-
tions relating to polymers — Part 1: 1986 Definitions of
terms relating to individual macromolecules, their assem-
bles and dilute polymer solutions.
shrinkage (of cellular plastics)
 inadvertent dimensional decrease of cellular plastics
 without breakdown of cell structure

size
 material applied to glass fibres or filaments during the
 course of their manufacture
 cf. finishing

side group
 offshoot from a macromolecular chain which is neither
 oligomeric nor polymeric

sieve retention
 in sieve analysis, the percentage of the mass of mate-
 rial remaining on the sieve after the test

silicone plastic
 Si plastic
 plastic based on polymers in which the main polymer
 chain consists of alternating silicon and oxygen atoms

single-strand chain
 linear chain that can be described by constitutional
 units which are always joined to each other through a
 single common atom

single-yarn
 simplest continuous strand of glass material com-
 posed of one of the following:
 1) a number of discontinuous fibres, held together by
 twist; such yarns are described as spun yarn or staple
 fibre yarn;
 2) a given number of continuous filaments (one or
 several strands), held together by twist; such yarns
 are described as continuous filament yarn or filament
 yarn
 NOTE The definition of single yarn a) and b) in ISO 1139
 provides that twist may be absent or present. In the glass
 industry, however, twist is always present in single yarn.

sink mark
 shrink mark
 depression in the surface of a moulding
 NOTE This defect occurs where the material has
 retracted from the mould, often in a region where there is a
 considerable change in thickness.

skin (of cellular plastics)
 relatively dense layer at the surface of cellular plastics

sleeving
 tubular structure of glass yarns with a collapsed width
 not exceeding 100 mm
 cf. tubing

slenderness ratio
 ratio of the length of a solid of uniform cross section
 (column) to its least radius of gyration
 NOTE Slenderness ratio is used for the calculation of
 dimensions of specimens in the determination of compres-
sive strength.

slip
 term denoting the ease with which two surfaces slide
 in contact with each other
 NOTE In a sense, slip is the antithesis of friction, in that
 high coefficient of friction denotes poor slip and low coeffi-
cient of friction good slip.
slip thermoforming
thermoforming process in which a sheet clamping
frame, provided with tensioned pressure pads, permits
the heated sheet to slip inwards as the part is being
formed

smouldering
slow combustion of a material without light being visi-
ble and generally evidenced by smoke and an
increase in temperature

slippage
movement of adherends with respect to each other
during the bonding process

SN curve
curve, allowing the resistance of the material to be
seen, which indicates the relationship observed exper-
perimentally between service life \(N\), shown conven-
tionally in abscissa (logarithmic scale) and the stress
amplitude \(T_a\) or the maximum stress \(T_{max}\) shown in
ordinates in linear scale or in logarithmic scale
NOTE This curve is established by keeping either mean
stress \(T_m\) or stress ratio \(R\) constant. The SN curve is
defined by the relationship between amplitude of stress and
service life.
On this curve we can distinguish
— the endurance zone where, for a given stress, failures as
well as non-failures for a number of fault test cycles \(N_F\) can
be identified;
— the fatigue zone where, for a given stress, all the speci-
mens fail at the end of a number of cycles less than the
number of conventional fault test cycles \(N_F\) mentioned
above.

slitting
conversion of a given width of plastic film or sheeting
to several smaller widths by means of knives

softening range
temperature interval over which a plastic changes
from a rigid to a soft state (glass transition) or under-
goes a rather sudden and substantial change in hard-
ness
NOTE Softening of plastics is measured under arbitrary
test conditions, for example by the Vicat softening tem-
perature test, the torsion pendulum test or the temperature of
deflection under load.
cf. glass transition

sliver
continuous assembly of slightly bonded staple fibres in
a practically parallel arrangement

softening temperature
temperature, measured under specified test condi-
tions, at which a material has a specified amount of
deformation

smoke
visible suspension of solid and/or liquid particles in
gases resulting from combustion or pyrolysis

solids content
percentage by mass of non-volatile matter, determined
under specified test conditions
solubility parameter (of a polymer), $\delta$
characteristic of a polymer used in predicting solubility
of that polymer in a given solvent\(^{20}\)

solution polymerization
polymerization in which the monomer, dissolved in a
solvent, reacts to form a polymer which may be soluble
or insoluble in the solvent

solvent-activated adhesive
dry adhesive on an adherend that is rendered tacky
just prior to use by application of a solvent

cf. solvent bonding

solvent bonding
solvent welding
process of bonding thermoplastic products by applying
a solvent capable of softening the surfaces to be
united, pressing the softened surfaces together, and
removing the solvent by evaporation, absorption, or
polymerization

solvent polishing
process for improving the gloss of thermoplastic arti-
cles by immersion in or spraying with a solvent to dis-
solve surface irregularities, followed by evaporation of
the solvent

specimen
test piece
piece or portion of a sample used to make a test

cf. sample

spectrum of relaxation times, $H(\tau)$ (Pa)
[spectrum of retardation times, $L(\tau)$ (Pa\(^{-1}\))]
$H(\tau)/\tau$ is the contribution of the time intervals between
$\tau$ and $\tau + d\tau$ to the elementary modulus of a continu-
ous model representing a viscoelastic material

NOTE $H(\tau)$ determines the time and frequency depend-
ence of the macroscopic moduli, $L(\tau)$ determines the time
and frequency dependence of the macroscopic compliance.

spherulite
polycrystalline, roughly spherical morphology consist-
ing of crystals emanating from a common centre\(^{21}\)

split mould
mould in which the cavity is formed of two or more
components (called splits) held together by an outer
chase during moulding, but separable for ejection

spontaneous combustion
combustion resulting from self-heating without exter-
nally applied heat

spontaneous ignition temperature
minimum temperature at which a material will ignite
under specified test conditions

spot welding
pressure welding process in which relatively small
areas of the surfaces to be united are softened at
spaced intervals by heat

spray (in injection moulding)
complete set of mouldings, with the associated solidi-
fied sprues and runners, from a multi-impression
injection mould

\(^{20}\) IUPAC Recommendations: Physico-chemical defini-
tions relating to polymers — Part I: 1986 Definitions of
terms relating to individual macromolecules, their assem-
bles and dilute polymer solutions.

\(^{21}\) IUPAC Recommendations: 1987 Definitions of terms
relating to crystalline polymers.
**spray gun**
device used for spray application of single or multi-component liquids to substrates or enclosed spaces

**NOTE** The components, with or without fillers, are conveyed separately to an impingement-type mixing chamber and dispensed in a fan or conical pattern. Reinforcing fibres also may be incorporated externally in the spray.

**spray-up**
1) in processing reinforced plastics, the simultaneous spraying of prepolymer, catalyst, and chopped fibres on to the mould or mandrel;

2) in processing cellular plastics, such as epoxy and polyurethane types, the spraying of fast-reacting resin-catalyst systems on to a surface where they react to foam and cure

**NOTE** In both processes, the resin and catalyst usually are sprayed through separate nozzles so that they are mixed during the spray-up operation.

**spread**
mass of adhesive or coating per unit of area applied on a substrate

**sprue**
1) primary feed channel that runs from the outer face of an injection or transfer mould, to the mould gate in a single cavity mould or to the runners in a multicavity mould;

2) moulding material in this primary feed channel

**sprue bush**
**sprue bushing**
hardened steel insert in an injection mould that contains the tapered sprue hole and has a suitable seat for the nozzle of the injection cylinder

**sprue lock**
undercut in a cold-slug well that allows the sprue to be pulled out of the bushing as the mould is opened

**sprue-puller anchor**
device in the mould provided with a recess for withdrawing the sprue positively from the sprue bush

**spun roving**
glass fibre strand repeatedly doubled back on itself to form a roving, sometimes reinforced by one or more straight strands

**stabilizer**
substance used in the formulation of some plastics to assist in maintaining the properties of the material at or near their initial values during processing and service life

**standard atmosphere(s)**
temperature(s) and humidity(ies) used for the conditioning and/or testing of test specimens or samples as specified in the appropriate international standards

**cf. reference atmosphere**

**staple fibre**
**discontinuous fibre**
single textile element of small diameter and short length

**NOTE** This forms the basis for glass staple fibre products.

**staple-fibre woven fabric**
fabric woven from glass staple fibre yarns in warp and weft

**staple yarn**
yarn spun from staple fibres, bound together by twist
star chain
macromolecule consisting of a constitutional unit from which linear chains of comparable length emanate

statistical copolymerization
copolymerization in which a statistical copolymer is formed

star polymer
polymer, the macromolecules of which are star chains

stereoblock
group that can be described by one species of stereorepeating unit in a single sequential arrangement

stereoblock polymer
polymer, the molecules of which consist of stereoblocks connected linearly
cf. note to block polymer

static coefficient of friction, $\mu_S$

$$\mu_S = \frac{F_S}{F_P}$$

where

$F_S$ is the static frictional force, expressed in newtons;

$F_P$ is the normal force acting perpendicular to the surfaces in contact, expressed in newtons

cf. frictional force

static friction
friction which has to be overcome as a "threshold value" at the onset of sliding motion

static shear strength, $\tau_S$
average static shear stress at rupture as determined in accordance with ISO 4587, and it is expressed in megapascals (MPa)

statistical copolymer
copolymer consisting of macromolecules in which the sequential distribution of the monomeric units obeys known statistical laws
stereoselective polymerization
polymerization in which a polymer molecule is formed from a mixture of stereoisomeric monomer molecules by incorporation of only one stereoisomeric species

stereospecific polymerization
polymerization in which a tactic polymer is formed

storage modulus, $M'$ (Pa)
[storage compliance, $C'$ (Pa$^{-1}$)]
elastic modulus (deprecated)
real part of the complex modulus

NOTE It is a measure of the energy stored and regained during a loading cycle.

cia. complex modulus and complex compliance

strain, $\varepsilon$ (dimensionless)
change, attributable to force, in the linear size or shape of a body, referred to its original size or shape

NOTE Strain at a point is defined by six components of strain: three normal components and three shear components referred to a set of coordinate axes.

stress amplitude, $\sigma_a$
alternating stress equal to half the algebraic difference between the maximum and minimum stresses:

$$\sigma_a = \frac{\sigma_{\text{max}} - \sigma_{\text{min}}}{2}$$

it is expressed in megapascals (MPa)

22) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assembles and dilute polymer solutions.
**stress crack**

external or internal crack in a plastic caused by stresses less than its short-time mechanical strength

**NOTE** Frequently the development of such a crack is accelerated by the environment to which the plastic is exposed. The stresses which cause cracking may be present internally or externally, or may be combinations of these stresses.

**stress cycle**

smallest part of the stress/time function which is repeated at regular intervals and is of sinusoidal form with undulating shear

**stress ratio,** $R_\sigma$

algebraic ratio of the minimum stress to the maximum stress in one cycle:

$$R_\sigma = \frac{\sigma_{\text{min}}}{\sigma_{\text{max}}}$$

**stress relaxation**

time-dependent decrease in stress

**stress-strain curve**

diagram in which corresponding values of stress and strain are plotted against each other

**NOTE** Values of stress usually are plotted as ordinates and values of strain as abscissa.

**stretch ratio**

1) in blow moulding, the ratio of the length of the parison to the length of the cavity in which it is to be blown;

2) in filament and film stretching, the ratio of the length of the stretched to the unstretched filament or film
cf. **blow-up ratio** and **draw-down ratio**

**stretch thermoforming**

thermoforming process in which the heated sheet is drawn over a mould and cooled subsequently

**stripper plate**

part of a mould that makes possible a special ejection, e.g. the removal of bottle caps with internal threads from the mould

**stripping**

removal of a moulding from a mould

**stroke**

travel of the ram of a press

**structural adhesive**

adhesive of proven reliability in engineering structural applications in which the bond can be stressed to a high proportion of its maximum failing load for long periods without failure

**structural foam moulding**

process of moulding articles with a cellular core and an integral solid (non-cellular) skin

**structures with twist** (textile glass)

general term designating a very long and relatively thin assembly of filaments (called continuous filament yarn or filament yarn) or staple fibres (called staple fibre yarn or spun yarn) to which twist has been applied intentionally

**NOTE** The yarn may be produced in one twisting operation (single yarn) or in several succeeding operations (folded yarn, cabled yarn). The twist in single yarns is capable of being removed by a single untwisting operation.

**styrrene/\(\alpha\)-methylstyrene plastic**

S/MS plastic

plastic based on copolymers of styrene and \(\alpha\)-methylstyrene
**Styrene-rubber plastic**
plastic based on styrene polymers and rubbers, the styrene polymers being in the greatest amount by mass

**Surface tack**
stickiness of the surface of a plastic

**Submarine gate**
*tunnel gate*
injection channel situated underneath the mating surface, so that the sprue is pulled off with the ejection operation

**Substrate**
object or semi-manufactured product (e.g. wire, extruded metallic section or plastic profile, sheet, film, paper, textile product) on which a coating or layer of another material is applied from the gas, liquid or solid phase by coating, laminating or generated by a chemical process

NOTE 1 In adhesion, substrate often is a synonym of adherend.

NOTE 2 The substrate or the applied layer or both may be of polymer material.

*cf.* coating, laminating and primer

**Surface burn**
combustion limited to the surface of a material

**Surface resistance**
quotient of the direct voltage applied between two electrodes in contact with the surface of a specimen, divided by that part of the current flowing through a thin layer on the surface of the specimen (for instance, moisture or other poorly-conducting materials)

**Surface resistivity**
quotient of the d.c. electric field strength, divided by the linear current density in the surface layer of the specimen

NOTE The surface resistivity of a material is equal to the surface resistance between two electrodes forming opposite sides of a square. The size of the square is immaterial.

**Surface treatment**
prebond treatment (deprecated)
treatment applied to the fibre to improve the adhesive bond between it and the resin component of the composite

NOTE Oxidation of the fibre surface carried out under controlled conditions is an example of such a surface treatment.

*cf.* primer

**Surfacing mat**
thin compact sheet of bonded staple fibres or continuous filaments, used as the surface layer of composites

NOTE The fibres may be of glass or organic material.

*cf.* glass veil

**Suspension**
dispersion of a solid in a liquid

*cf.* dispersion

**Suspension polymerization**
polymerization in which the monomer is dispersed as fine droplets in water or other suitable inert diluents

*cf.* bead polymerization

**Syneresis**
contraction of a gel accompanied by the separation of a liquid

**Swelling**
increase in volume of a test specimen immersed in a liquid or exposed to a vapour
syndiotactic polymer
regular polymer, the molecules of which can be described in terms of alternation of configurational base units that are enantiomeric

NOTE In a syndiotactic polymer, the configurational repeating unit consists of two configurational base units that are enantiomeric. An example is the configurational repeating unit:

\[
\begin{align*}
\text{H} & \quad \text{CO}_2\text{R} \\
\text{C} & \quad \text{CH(\text{CH}_3)} & \quad \text{C} & \quad \text{CH(\text{CH}_3)} \\
\text{CO}_2\text{R} & \quad \text{H} & \quad \text{H}
\end{align*}
\]

and the corresponding polymer is

\[
\left[ \begin{array}{c}
\text{H} \\
\text{C} \\
\text{CO}_2\text{R} \\
\text{H}
\end{array} \right] \quad \left[ \begin{array}{c}
\text{H} \\
\text{C} \\
\text{CO}_2\text{R} \\
\text{H}
\end{array} \right] \quad \cdots \quad \left[ \begin{array}{c}
\text{H} \\
\text{C} \\
\text{CO}_2\text{R} \\
\text{H}
\end{array} \right]
\]

It is not a stereoregular polymer because the configuration at the stereoisomeric centre "\text{CH(\text{CH}_3)}" is not defined. Similarly

\[
\left[ \begin{array}{c}
\text{OH}_2\text{C} \\
\text{CH}_3 \\
\text{H}
\end{array} \right] \quad \text{and} \quad \left[ \begin{array}{c}
\text{OH}_2\text{C} \\
\text{CH}_3 \\
\text{H}
\end{array} \right]
\]

are not stereoregular polymers because of the lack of knowledge about the configuration of the stereoisomeric centre "\text{CH(CO}_2\text{R)}". The following dis syndiotactic polymer is stereoregular:

\[
\left[ \begin{array}{c}
\text{CO}_2\text{R} \\
\text{CH}_3 \\
\text{H} \\
\text{H}
\end{array} \right] \quad \left[ \begin{array}{c}
\text{CO}_2\text{R} \\
\text{CH}_3 \\
\text{H} \\
\text{H}
\end{array} \right] \quad \cdots \quad \left[ \begin{array}{c}
\text{CO}_2\text{R} \\
\text{CH}_3 \\
\text{H} \\
\text{H}
\end{array} \right]
\]

cf. note to stereorepeating unit

tactic block
regular block that can be described by only one species of configurational repeating unit in a single sequential arrangement

tactic block polymer
polymer, the molecules of which consist of tactic blocks connected linearly

tactic polymer
regular polymer, the molecules of which can be described in terms of only one species of configurational repeating unit in a single sequential arrangement

cf. note to stereoregular polymer

tacticity
orderliness of the succession of configurational repeating units in the main chain of a polymer molecule

take-off
device for conveying extruded or calendered material away from the machine

take-up
device for winding extruded or calendered material

tape with selvages\(^{23}\)
glass fabric, with selvages, not exceeding 100 mm in width

cf. narrow fabric with selvages

tape without selvages\(^{23}\)
glass fabric, without selvages, not exceeding 100 mm in width

cf. narrow fabric without selvages

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\(^{23}\) "Selvedge" is the preferred spelling in the United Kingdom
tear, verb
  to divide or disrupt by the pull of contrary forces
  cf. tear strength

tear propagation force
  force required to continue the growth of an initiated tear in a plastic film

tear propagation resistance
  tear propagation force divided by the thickness of the specimen

tear strength
  tear resistance
  force required to tear a test specimen of a thin material

telomer
  polymer composed of molecules having terminal groups incapable of reacting with additional monomers, under the conditions of the synthesis, to form larger polymer molecules of the same chemical type

telomerization
  polymerization in which a telomer is formed

tensile strength
  maximum stress sustained by a material before failure in tension

  NOTE: When the maximum stress occurs at the yield point, it is designated tensile strength at yield. When the maximum stress occurs at break, it is designated tensile strength at break.

terpolymer
  polymer derived from three species of monomer

test atmosphere
  atmosphere to which a sample or specimen is exposed throughout the test

  cf. reference atmosphere and standard atmosphere(s)

textile glass
  generic term designating all products woven from glass and based on staple fibres and/or continuous filaments

textile glass multifilament products
  class of textile glass products, consisting of filaments (multifilaments)

textile glass staple fibre products
  class of textile glass products, consisting of staple fibres

  cf. staple fibre

textile size (product) (textile glass)
  size designed to facilitate subsequent operations (twisting, folding, weaving, etc.)

texturized yarn
  textile glass continuous filament yarn (single or folded) in which the filaments have been separated deliberately and permanently to increase the bulk of the yarn

thermal analysis
  group of techniques in which a physical property of a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme

  NOTE 1 The adjective corresponding to "thermal analysis" is "thermo-analytical" (for example: thermo-analytical techniques).

  NOTE 2 When two or more techniques are applied to the same sample at the same time, they should be identified as "simultaneous multiple techniques", for example, simultaneous thermogravimetry and differential thermal analysis. The term "combined multiple techniques" would indicate the use of separate samples for each technique.
thermal break
solid or cellular material or a combination of materials of low thermal transmission, placed between components of high thermal transmission in order to reduce heat flow across the assembly.

thermally-foamed plastic
 cellular plastic produced by applying heat to effect gaseous decomposition or volatilisation of a constituent
 cf. chemically- and mechanically-foamed plastic

thermal conductivity (of a homogeneous material not affected by thickness)
rage of heat flow under steady conditions through unit area, per unit temperature gradient in the direction perpendicular to the area
IUPAP symbol: $\lambda$

thermoacoustimetry
technique in which the characteristics of imposed acoustic waves are measured as a function of temperature after passing through a substance while the substance is subjected to a controlled temperature programme

thermoelasticity
rubberlike elasticity resulting from an increase in temperature

thermoelectrometry
technique in which an electrical characteristic of a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme
 NOTE The most common measurements are of resistance, conductance or capacitance.

thermoforming
process of shaping heated thermoplastic sheets or other profiles, generally on a mould, followed by cooling
 cf. forming
thermogravimetry
TG
Technique in which the mass of a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

NOTE The record is the thermogravimetric or TG curve: the mass should be plotted on the ordinate decreasing downwards and temperature (T) or time (t) on the abscissa increasing from left to right.

thermomagnetometry
Technique in which a magnetic characteristic of a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

thermomechanical measurement
Technique in which the deformation of a substance under non-oscillatory load is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

NOTE The mode, as determined by the type of stress applied (compression, tension, flexure or torsion), always should be stated.

thermoparticulate analysis
Technique in which the release of particulate matter from a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

thermoplastic, adjective
Capable of being softened repeatedly by heating and hardened by cooling through a temperature range characteristic of the plastic and, in the softened state, of being shaped by flow repeatedly into articles by moulding, extrusion or forming.

thermoplastic, noun
Plastic that has thermoplastic properties.

cf. thermoplastic, adjective

thermoplastic elastomer
Elastomer that remains thermoplastic when it is heated and cooled repeatedly within the temperature range characteristic for the material in processing and use.

thermoptometry
Technique in which an optical characteristic of a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme.

NOTE Measurement of total light, light of specific wavelength(s), refractive index and luminescence give thermophotometry, thermospectrometry, thermorefractometry and thermoluminescence, respectively. Observation under the microscope leads to thermomicroscopy.

thermoset, noun
Plastic which, when cured by heat or other means, changes into a substantially infusible and insoluble product.

NOTE This term includes both thermosetting plastics and thermoset plastics.

thermoset plastic
Plastic that has been cured by heat or by other means such as radiation, catalysts, etc., into a substantially infusible and insoluble state.

thermosetting
Capable of being changed into a substantially infusible and insoluble product when cured by heat or by other means such as radiation, catalysts, etc.

thermosetting plastic
Plastic that has thermosetting properties.

cf. thermosetting

thermosoniometry
Technique in which the sound emitted by a substance is measured as a function of temperature while the substance is subjected to a controlled temperature programme.
thickener
substance that increases the viscosity of a liquid polymeric system

thiourea-formaldehyde resin
amino resin made by the polycondensation of thiourea (thiocarbamide) with formaldehyde

time profile (in dynamic mechanical analysis)
plot of the modulus and/or damping of a material against time

ct. dynamic mechanical analysis

torpedo
streamlined metal device placed in the path of flow of the plastic material in the heating cylinders of injection moulding machines, extruders, or in extrusion dies, to spread the melt into thin layers and force it into contact with the heating areas

transfer chamber
transfer pot
heating chamber used in transfer moulding

ct. loading chamber

torsion pendulum
device for performing dynamic mechanical analysis in which the specimen is deformed torsionally and allowed to oscillate in free or forced vibration

NOTE Shear modulus is determined by the frequency of the resultant oscillation. Damping is determined by the decreasing amplitude of the oscillation (i.e., by the logarithmic decrement \( \eta \)).

cf. logarithmic decrement

torsional stress (Pa)
shear stress on a transverse cross section, resulting from a twisting action

total volume shrinkage (in resin casting)
sum of the shrinkage during curing of a resin compound and the shrinkage of the cured casting during the cooling from curing temperature to room temperature

toughness
that property of a material by virtue of which it can absorb energy, generally implying absence of brittleness and relatively high elongation to break

NOTE Toughness often is evaluated as the energy required to break a material, proportional to the area under the stress-strain curve.

tow
large number of filaments collected into a loose strand or assemblage substantially without twist

tracking
formation of a conducting path across the surface of an insulating material by current discharge or leakage

transfer moulding
process of moulding a thermosetting material by passage from a heated pot into the cavity of a closed, heated mould

transfer-moulding pressure
in transfer moulding, the pressure applied to the cross-sectional area of the transfer chamber

ct. moulding pressure

translucency
property of a material by which a large portion of the transmitted light undergoes scattering, making it difficult or impossible to distinguish objects beyond the material

cf. diffusion of light and transparency
transparency
property of a material by which a negligible portion of the transmitted light undergoes scattering, thereby enabling objects to be distinguished clearly through the material

cf. translucency

tramer
oligomer composed of three units of a single species of monomer

NOTE A tramer can be the product of oligomerization or of scission of a larger molecule.

triple-skin sheet
TSS
sheet having three skins, two of which are external and one internal; this latter is parallel and properly spaced by ribs from the external ones

true stress
stress calculated from the supporting area at the time of measurement rather than from the original area

tumble polishing
barrel polishing
removal of flash and sharp edges from mouldings and improvement of finish by allowing them to tumble in a loosely-packed condition in a rotating or vibrating container

turbidity
apparent absorbance of incident radiation attributable to scattering\(^{24}\)

ultrasonic welding
pressure welding process in which the surfaces to be united are softened by heat produced by intramolecular vibratory mechanical motion at ultrasonic frequencies

undercure
state of cure of a polymeric system when the curing conditions (time, temperature, radiation, amount of curing additives, etc.) have been insufficient to produce a satisfactory cure

cf. overcure

undercut
depression in the side wall of a moulding cavity that necessitates deformation of the moulding or the use of special mould construction for ejection

unidirectional fabric (for example unidirectional woven fabric, unidirectional woven roving fabric) fabric with a great number of glass yarns or roving in one direction (usually the warp) and fewer and generally finer yarns in the other direction, resulting in a fabric much stronger in the first direction than in the other

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\(^{24}\) IUPAC Recommendations: Physico-chemical definitions relating to polymers — Part 1: 1986 Definitions of terms relating to individual macromolecules, their assemblies and dilute polymer solutions.
uniform polymer
monodisperse polymer
polymer composed of molecules uniform with respect to relative molecular mass and constitution

unit storage energy
oscillation energy, $U (J m^{-3})$
energy stored during one loading cycle divided by the volume of the material

Note: The unit storage energy of a linear viscoelastic material subject to a sinusoidal load is

$$U = \frac{M}{2} \varepsilon_0^2 = \frac{C}{2} \sigma_0^2$$

In tensile deformation

$$U = \frac{D}{2} \sigma_0^2 - \frac{E}{2} \varepsilon_0^2$$

where

$\sigma_0$ is the maximum stress;
$\varepsilon_0$ is the maximum strain.

unplasticized poly(vinyl chloride)
poly(vinyl chloride) without any plasticizer

Note: Ingredients added to poly(vinyl chloride), such as stabilizers, lubricants, etc., are not considered as plasticizers in the usual technical sense.

unsaturated polyester
UP
polyester characterized by carbon-carbon unsaturation in the polymer chain, which permits subsequent crosslinking with an unsaturated monomer or prepolymer

untreated fibre
fibre that has not been subjected to the process of surface treatment

upstroke press
press in which the pressing device is situated below the moving table, pressure being applied by an upward movement of this device

urea-formaldehyde resin
UF resin
amino resin made by the polycondensation of urea (carbamide) with formaldehyde

urea plastic
plastic based on amino resins, urea being present in the greatest amount by mass of in amines or amides involved in the polymerization

cf. aminoplastics, urea-formaldehyde resin and polyureas

urethane plastic
plastic based on polymers in which the repeated structural units in the chains are of the urethane type, or on copolymers in which urethane and other types of repeated structural units are present in the chains

vacuum bag
flexible bag by which pressure may be applied to an assembly inside the bag by means of evacuation of the bag

cf. bag moulding

vacuum snap-back thermoforming
snap-back thermoforming
vacuum thermoforming process, particularly useful for very deep draws, in which a heated sheet is drawn into a concave shape by means of vacuum, a male plug is lowered into the concavity, and the sheet is pulled rapidly upward against the surface of the plug by means of vacuum drawn through the plug

vacuum thermoforming
thermoforming process in which a vacuum is used to form a heated sheet against the mould surface

cf. pressure thermoforming

veneer
thin wood sheeting used to make plywood or to serve as a decorative surface layer on a laminate

vent
hole, slot or groove provided in a mould or machine to allow air and gas to escape during moulding, extrusion or forming

vibrating stress
stress with a value varying as a function of time
cf. alternating stress and oscillating stress

vinyl acetate plastic
plastic based on polymers of vinyl acetate or copolymers of vinyl acetate with other monomers, the vinyl acetate being in the greatest amount by mass

vinyl chloride plastic
plastic based on polymers of vinyl chloride or copolymers of vinyl chloride with other monomers, the vinyl chloride being in the greatest amount by mass

vinyl resin
resin made by polymerization of monomers containing the vinyl group
NOTE In some countries vinyl resin also is used for non-resinous vinyl polymers.

vinylidene chloride plastic
plastic based on polymers of vinylidene chloride or copolymers of vinylidene chloride with other monomers, the vinylidene chloride being in the greatest amount by mass

virgin plastic
plastic material in the form of pellets, granules, powder, floc, etc. that has not been subjected to use or processing other than that required for its initial manufacture
cf. reworked plastic

viscoelasticity
stress response of a material acting as though it were a combination of an elastic solid and a viscous fluid with flow dependent on time, temperature, load, and rate of loading

viscose-based carbon fibre
carbon fibre produced from viscose precursor
NOTE Production of carbon fibre from viscose precursor has virtually ceased apart from small-scale production from viscose fabrics.
cf. carbon fibre precursor

viscosity
coefficient of viscosity
shear viscosity, \( \eta \) (Pa-s)
quotient of shear stress (\( \sigma_y \)) and shear rate (\( \dot{\gamma} \)) in steady, simple shear flow

NOTE 1 For non-Newtonian liquids, \( \sigma_y \) is directly proportional to \( \dot{\gamma} \) and \( \eta \) is constant.
NOTE 2 For non-Newtonian liquids, when \( \sigma_y \) is not directly proportional to \( \dot{\gamma} \), \( \dot{\gamma} \) varies with \( \dot{\gamma} \) and is termed the non-Newtonian viscosity.
NOTE 3 Some experimental methods, such as capillary flow and flow between parallel plates, employ a range of shear rates. The value of \( \eta \) at some nominal average value of \( \dot{\gamma} \) is termed the apparent viscosity and given the symbol \( \eta_{app} \).
NOTE 4 Extrapolation of \( \eta \) or \( \eta_{app} \) for non-Newtonian fluids to zero \( \dot{\gamma} \) gives the zero-shear viscosity and is given the symbol \( \eta_0 \).

viscosity coefficient (Pa-s)
shearing stress necessary to induce a unit velocity flow gradient in a material
NOTE In actual measurement, the viscosity coefficient of a material is obtained from the ratio of shearing stress to shearing rate. This assumes the ratio to be constant and independent of the shearing stress, a condition which is satisfied only by Newtonian fluids. Consequently, in all other cases, values obtained are apparent and represent one point of the flow curve.
cf. viscosity
viscosity/density ratio

$$\eta/\rho$$

where

$\eta$ is the viscosity of the polymer solution;

$\rho$ is the density of the polymer solution

volume resistivity

Volume resistivity of a material is the quotient obtained when the potential gradient is divided by the current density.

NOTE In the metric system, the volume resistivity of a material, in ohm centimetres, is equal to the volume resistance between opposite faces of a 1 cm$^3$ of the material.

visible fibre
fibre show
fibre wetted incompletely with resin, appearing on the surface of a reinforced plastic

cf. dry patch and fibre streak

void (in noncellular plastics)
enclosed cavity of an undefined shape, containing air or some other gas

NOTE 1 The term bubble refers to a more or less spherical void.

NOTE 2 In cable insulation, voids may contain water.

cf. void (in cellular plastics)

volumetric feeding
in moulding, the way of feeding in which the charge is controlled volumetrically

vulcanized fibre
nearly homogeneous material consisting of hydrated cellulose, made by subjecting cellulose to a parch-mentizing process

warp
warping
dimensional distortion of a plastic object after moulding or other fabrication

cf. dished and domed

void (in cellular plastics)
cavity formed unintentionally in cellular plastics and substantially larger than the characteristic individual cells

volume expansion
change in volume of a test specimen under specified test conditions

cf. linear expansion and swelling

water absorption
moisture absorption
amount of water absorbed by a material under specified test conditions

NOTE The conditions may be immersion in water or exposure to a humid atmosphere; in the latter case the process is also referred to as water vapour absorption

wear
cumulative action of all the deleterious mechanical influences encountered in use that tend to impair a serviceability of a material

weathering
effects of exposure of a material to outdoor conditions

cf. ageing and artificial weathering
web
assembly of thin fibres, with or without orientation,
held together by the adherence of the fibres and/or by
other appropriate physical means

width
in the case of a flexural test of a bar (beam) specimen,
the shorter dimension perpendicular to the direction in
which the load is applied
cf. depth

weight feeding
in moulding, the way of feeding in which the charge is
controlled gravimetrically

window
tiny, colourless, transparent area or speck in a sheet
of coloured or opaque plastic, which looks like a hole
when the sheet is held to the light
cf. fish-eye

weld line
knit line
weld mark
mark on a moulded plastic formed by the union of two
or more streams of plastic flowing together

woven fabric
glass fabric made by interlacing two sets of threads
(single, folded, or cabled yarns, rovings) perpendicular
to each other or at some other specified angle, such
interlacing being formed during weaving on a loom or
weaving machine

woven roving (textile glass)
fabric formed by the weaving of roving

woven scrim
woven open-mesh glass fabric in which both warp and
weft yarns are spaced widely

xylenol resin
resin of the phenolic type made by the polycondensa-
tion of a xylenol with an aldehyde or a ketone

yarn
general term covering specific types of structures, with
or without twist, made of staple fibres or filaments

NOTE Structures without twist include multifilament,
strand, sliver, roving (assembled or direct), no-twist roving,
and spun roving. Structures with twist include single yarn,
folded yarn, cabled yarn, multiple wound yarn, and fancy
yarn.
yield point
first stress in a material, which may be less than the
maximum attainable stress, at which an increase in
strain occurs without an increase in stress

Young's modulus, \( E \) (Pa)
modulus of elasticity in tension
quotient of stress and strain (secant modulus) or tan-
gent to the stress-strain curve (tangent modulus):

\[
E = \frac{\sigma}{\varepsilon}
\]

or

\[
E = \frac{d\sigma}{d\varepsilon}
\]

where

\( \varepsilon \) is the strain;
\( \sigma \) is the stress

NOTE 1 In general, both are time-dependent for
viscoelastic materials.

NOTE 2  \( E = \frac{\sigma_x}{\varepsilon_x} \)
or
\( \sigma_y = \sigma_z = 0 \);
and
\( \varepsilon_x = \varepsilon_y = -\mu \varepsilon_z \)
where \( \mu \) is Poisson's ratio.

zone (of an extruder screw)
part of an extruder screw where the pitch is designed
in such a way as to perform a specific function, e.g.
feeding, compressing, venting, mixing, metering, etc.
Index of alphabetic list of English synonyms, 
with corresponding preferred term

A
absolute compliance \(1 \text{ (Pa}^{-1}\) \(\rightarrow\) absolute modulus
acetal plastic \(\rightarrow\) polyacetal plastic
adhesive failure \(\rightarrow\) adhesion failure
adiabatic extrusion \(\rightarrow\) autothermal extrusion
after-bake \(\rightarrow\) postcure
allyl resin \(\rightarrow\) polyallyl plastic
allyl plastic \(\rightarrow\) polyallyl plastic
anchor \(\rightarrow\) sprue-puller
apparent relative molecular mass \(\rightarrow\) apparent molar mass
autoclave moulding \(\rightarrow\) bag moulding

B
back taper \(\rightarrow\) back draft
backbone \(\rightarrow\) main chain
barrel polishing \(\rightarrow\) tumble polishing
bench marks \(\rightarrow\) gauge marks
binding agent (textile glass) \(\rightarrow\) binder (glass)
bleed out \(\rightarrow\) exudation
bolster \(\rightarrow\) chase
breakdown voltage \(\rightarrow\) disruptive voltage
bulk viscosity \(\rightarrow\) compressive viscosity

calorific potential \(\rightarrow\) heat of combustion
chemical resistance \(\rightarrow\) resistance to chemicals
chlorofluorocarbon plastic \(\rightarrow\) polychlorofluorocarbon plastic
coefficient of viscosity \(\rightarrow\) viscosity
cohesive failure \(\rightarrow\) cohesion failure
cold flow \(\rightarrow\) creep
concentrated phase \(\rightarrow\) polymer-rich phase
contact pressure moulding \(\rightarrow\) contact moulding
cooling-curve determination \(\rightarrow\) heating-curve determination
cooling fixture \(\rightarrow\) cooling jig
counterdraft \(\rightarrow\) back draft
curing temperature \(\rightarrow\) cure temperature
curing time \(\rightarrow\) cure time
cylinder \(\rightarrow\) barrel

die \(\rightarrow\) mould
dielectric breakdown voltage \(\rightarrow\) disruptive voltage
dielectric constant \(\rightarrow\) relative permittivity
dielectric sealing \(\rightarrow\) welding
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<thead>
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<td>heater blanket</td>
<td>heater band</td>
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heater strip → heater band
high-frequency sealing → welding
high-pressure laminate → high-pressure decorative laminate
hydrocarbon plastic → polyhydrocarbon plastic

inverse heating-rate curve → heating curve determination
isocyanurate plastic → polyisocyanurate plastic
isotropic compression → bulk compression

knife line → sheeter line
knit line → weld line

ladder polymer → double-strand polymer
lamination (process) → laminating
land area → land (of a compression or injection mould)
lap joint strength → longitudinal shear strength
light fastness → colour fastness on exposure to light
limiting viscosity number → intrinsic viscosity
linear thermodilatometry → thermodilatometry
locking force → mould clamping force
locking pressure → mould clamping force
logarithmic viscosity number → inherent viscosity
loss compliance → loss factor
loss modulus → loss factor
loss tangent → dielectric dissipation factor/loss factor

macromonomer → macromer
Mark-Houwink-Sakurada equation → Mark-Houwink equation
mating surface → land
mer → monomeric unit
modifier → additive
modulus of elasticity in tension → Young's modulus
moisture absorption → water absorption
molecular weight → relative molecular mass
molecular weight average → molar-mass average
monodisperse polymer → uniform polymer
moving table → moving plate
multidecklight press → multiplaten press
multi-impression mould → multicavity mould

N-H-S equation → Mark-Houwink equation
novelty yarn → fancy yarn
olefin plastic → polyolefin plastic
oscillation energy → unit storage energy

pay-off → let-off
pearl polymerization → bead polymerization
piston → ram
pit → crater
plastic size → coupling size
plastisol gel → plastisol fusion, note
plied yarn → folded yarn
polyacrylate → aromatic polyester
polyalcohol → polyol
polyarylate → aromatic polyester
polycondensate → condensation polymer
polycondensation → condensation polymerization
polydisperse polymer → non-uniform polymer
polyformaldehyde → polyoxymethylene
polyhydric alcohol → polyol
powder blend → dry blend
prebond treatment (deprecated) → surface treatment
promoter → accelerator
propylene [propene] plastic → polypropylene [polypropene] (PP) plastic
propylene plastic → polypropylene plastic

rate of burning → area of burning rate
reference marks → gauge marks
relative molecular-mass average → molar-mass average
reverse taper → back draft

shear viscosity → viscosity
sheeting → sheet
shrink mark → sink mark
shrink wrapping → shrink packaging
shrinkage block → cooling jig
shrinkage jig → cooling jig
snap-back → vacuum snap-back thermoforming
snap-back thermoforming → vacuum snap-back thermoforming
split-die extrusion → slot-die extrusion
slug well → cold-slug well
slush moulding → slush casting
solution/solvent viscosity ratio → relative viscosity
solvent welding → solvent bonding
specific viscosity (deprecated) → relative viscosity increment
spectrum of retardation times → spectrum of relaxation times
spew area → flash ridge
spew groove → flash groove
spew line → flash line
spew ridge → flash ridge
spin welding → friction welding
sprue bushing → sprue bush
storage compliance → storage modulus
storage life → shelf life
striction → necking
styrene plastic → polystyrene [PS] plastic
styrene/acrylonitrile plastic → polystyrene/acrylonitrile plastic
support plate → backing plate
sweat out → exudation

tan delta → loss factor (in damping)
tangent of loss angle → dielectric dissipation factor
tear resistance → tear strength
tensile strength at break, at yield → tensile strength
test piece → specimen
thermal impulse sealing → impulse sealing
thermoforming → vacuum snap-back thermoforming
thermoluminescence → thermostometry
thermomicroscopy → thermostometry
thermophotometry → thermostometry
thermorefractometry → thermostometry
thermospectrometry → thermostometry
thinner (deprecated) → diluent
torsional braid measurement → dynamic thermomechanical measurement
transfer pot → transfer chamber
tunnel gate → submarine gate

ultrasonic sealing → welding
unit damping energy → energy loss

vacuum-bag moulding → bag moulding
viscosity-average molar mass → molar-mass average
viscosity number → reduced viscosity
viscosity ratio → relative viscosity
viscosity ratio increment → relative viscosity increment
volume compression → bulk compression
volume thermodilatometry → thermodilatometry

warping → warp
weight-distribution function → mass-distribution function
weld mark → weld line
working life → pot life
wrinkle → crease
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