



## Standard Terminology of Glass and Glass Products<sup>1</sup>

This standard is issued under the fixed designation C 162; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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

### 1. Scope

1.1 This terminology defines terms generally used in the glass industry.

1.2 In some cases in which a usage is specific to a certain industry, that is spelled out within the definition. For completeness and historical purposes, terms that are outdated are listed as being archaic. The reader is cautioned that some companies or industries may define or use terms differently than the way these terms are defined within this terminology.

1.3 Other sources of glass glossaries are *Glass Association of North America's Glazing Manual*,<sup>2</sup> *Engineering Standards Manual for Tempered Glass*,<sup>2</sup> *Laminated Glass Design Guide*,<sup>2</sup> and ASTM Committee C-14 standards.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- C 148 Test Methods for Polariscopic Examination of Glass Containers<sup>3</sup>
- C 336 Test Method for Annealing Point and Strain Point of Glass by Fiber Elongation<sup>3</sup>
- C 338 Test Method for Softening Point of Glass<sup>3</sup>
- C 598 Test Method for Annealing Point and Strain Point of Glass by Beam Bending<sup>3</sup>
- C 1048 Specification for Heat-Treated Glass—Kind HS, Kind FT Coated and Uncoated Glass<sup>3</sup>
- C 1172 Specification for Laminated Architectural Flat Glass<sup>3</sup>

### 3. Terminology

**Abbé value**—the reciprocal dispersive power, a value used in optical design, expressed mathematically as:

$$\text{Abbé value} = (n_d - 1)/(n_F - n_C)$$

where  $n_d$  is the refractive index for the helium line at 587.6 nm and  $n_F$  and  $n_C$  are the refractive indices for the hydrogen

lines at 486.1 and 656.3 nm, respectively. See synonymous term **nu-value** and related term **dispersion**.

**acid polishing**—the polishing of a glass surface by acid treatment.

**air bells**—bubbles of irregular shape formed generally during the pressing or molding operations in the manufacture of optical glass.

**alabaster glass**—a milky-white glass that diffuses light without fiery color.

**alcove**—a narrow channel to convey molten glass from refiner to forehearth or to the revolving pot where it is gathered by the Owens machine.

**alkali**—an industrial term for the oxide of sodium or potassium; less frequently of lithium.

**ampoule**—a glass container designed to be filled and sealed by fusion of the glass neck.

**anneal**—to attain acceptably low stresses, or desired structure, or both, in glass by controlled cooling from a suitable temperature.

**annealing**—a controlled cooling process for glass designed to reduce residual stress to a commercially acceptable level and modify structure.

**annealing point (A.P.)**—that temperature corresponding either to a specific rate of elongation of a glass fiber when measured by Test Method C 336, or a specific rate of midpoint deflection of a glass beam when measured by Test Method C 598. At the annealing point of glass, internal stresses are substantially relieved in a matter of minutes.

**annealing range**—the range of glass temperature in which stress in glass can be relieved at a commercially practical rate. For purposes of comparing glasses, the annealing range is assumed to correspond with the temperature between the annealing point (A.P.) and the strain point (St.P.).

**antimony**—an industrial term for an oxide of antimony.

**arch, n**—a part of a melter; a crown.

**arch, v**—to heat a pot in a pot arch.

**arrest mark**—See **dwell mark**.

**arsenic**—an industrial term for an oxide of arsenic.

**aventurine**—glass containing colored, opaque spangles of nonglassy material.

**back wall**—the wall at the charging end of a melter.

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.01 on Nomenclature and Definitions.

Current edition approved July 10, 2003. Published August 2003. Originally approved in 1941. Last previous edition approved in 1999 as C 162 – 99.

<sup>2</sup> Glass Association of North America, 3310 S.W. Harrison, Topeka, KS 66611-2279.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 15.02.



**baffle**—a mold part used to close the delivery or baffle hole in a blank mold.

**baffle mark**—a mark or seam on a bottle resulting from a mold joint between blank mold and baffle.

**baffle wall**—a wall used to deflect gases or flames in a melter. See **shadow wall**.

**baghouse**—a chamber containing bag filters for the removal of particles from a process exhaust stream.

**bait**—the tool dipped into molten glass to start any drawing operation.

*barrel, glass container*—{archaic} See **sidewall, glass container**.

**base**—{archaic} the bottom of a bottle.

**basic fiber**—unprocessed glass fibers directly from the forming equipment.

**batch**—(1) the recipe of batch ingredients.

(2) the raw materials weighed but unmixed.

(3) the raw materials, properly proportioned and mixed, for delivery to the furnace.

**batch charger**—a mechanical device for introducing batch to the melter.

*batch feeder*—See **batch charger**.

**batch house**—the place where batch materials are received, handled, weighed, and mixed.

**bath**—synonymous with **float bath**.

**bead**—(1) an enlarged, rounded raised section on a glass article.

(2) a small piece of glass tubing bonded around a wire lead.

(3) in fiber glass, a tear drop-shaped glass mass which forms as a result of the interruption of the fiber forming process below an orifice.

*bearer arch*—See **rider arch**.

**bearing surface**—the outside surface of an item of glassware on which it rests when in its normal upright position.

*beltmarks*—See **chain marks**.

*bench*—See **siege**.

**bending stress**—a stress system that simultaneously imposes a compressive component at one surface, graduating to an imposed tensile component at the opposite surface of a glass section.

**bent glass**—flat glass that has been shaped while hot into a body having curved surfaces.

**beveling**—the process of edge finishing flat glass to a bevel angle.

**bicherox process**—{archaic} an intermittent process for making plate glass, in which the glass is cast between rolls, onto driven conveyer rolls, or a flat moving table.

**binder**—(1) for a continuous filament process, a constituent of a fiber glass sizing that couples the fiber to the composite matrix.

(2) for insulation, material applied to glass fibers to hold them in a desired arrangement.

**blank**—(1) a preliminary shape from which a finished article is further formed, molded, or cut.

(2) a semi-finished piece of glass for making an optical element, such as a lens or prism. Also known as a pressing.

**blanket feed**—a method for charging batch designed to produce an even distribution of batch across the width of the melter.

**blank mold**—the metal mold that first shapes the glass in the manufacture of hollow ware.

**blending-batch**—{archaic} stepwise changes in batch composition to arrive at the final change in finished glass.

**blister**—a relatively large gaseous inclusion in glass.

**bloach**—{archaic} an imperfection resulting from incompletely grinding plate glass, caused by a low place in the plate which retains part of the original rough surface.

**blocking**—(1) shaping a gather of glass in a cavity of wood or metal.

(2) *archaic*, promoting mixing and fining of glass by immersion of a wooden block or other object to create bubbles.

(3) reprocessing to remove surface imperfections.

(4) *archaic*, mounting of glass for grinding and polishing.

(5) *archaic*, idling a furnace at reduced temperatures.

See **hot hold**.

**block mold**—a one-piece mold.

**block reek, rake**—{archaic} a scratch imperfection caused by cullet lodged in the felt in the polishing operation.

**bloom**—(1) a visible surface film resulting from attack by the atmosphere or from the deposition of particulate or vapor condensates. (See also **smoked**.)

(2) a blemish in float glass appearing on the bottom (tin contact) surface after reheating as a result of the presence of tin diffused into the surface.

**blow-and-blow process**—the process of forming hollow ware in which both the preliminary and final shapes are formed by air pressure.

**blower**—one who forms glass by blowing. (See also **gaffer**.)

**blow head**—part of a forming machine serving to introduce air under pressure to blow any hollow glass article.

**blow-over**—the thin-walled bubble formed above a blow mold in hand-shop operation to facilitate bursting-off.

**blowpipe**—the pipe used by a glassmaker for gathering and blowing by mouth.

*blowing iron*—See **blowpipe**.

**blown glass**—glassware shaped by air pressure, as by compressed air or by mouth blowing.

**blow mold**—the metal mold in which a blown glass article is finally shaped.

**body**—the attribute of molten glass, associated with viscosity and homogeneity, which is conducive to workability.

**boil**—(1) {archaic} an imperfection; a gaseous inclusion larger in size than a seed.

(2) turbulence caused by gases escaping from the melting batch.

*boost melting*—See **electric boosting**.

**boot**—a suspended enclosure in the nose of a melter protecting a portion of the surface and serving as a gathering opening.

**borax glass**—vitreous anhydrous sodium tetraborate ( $\text{Na}_2\text{B}_4\text{O}_7$ ).

**borosilicate glass**—a silicate glass with  $\text{B}_2\text{O}_3$  content above 4 weight percent, characterized by a moderate to low thermal expansion, long in viscosity versus temperature, and low in density.

*bowl*—See **spout**.

**breast wall**—(1) the entire side wall of a melter between the flux block and the crown, but not including the ends.

(2) refractory wall between pillars of a pot furnace and in front of or surrounding the front of a pot.

**breezing**—{archaic} buckwheat anthracite coal or coarse sand spread on the sieve before setting of pots.

**bridge**—the structure formed by the end walls of the adjacent melter and refiner compartments of a melting furnace and the covers spanning the gap between the end walls.

*bridge cover*—See **bridge wall cover**.

**bridge wall cover**—refractory blocks spanning the space between the bridge walls.

**bridgewall**—that part of a melting furnace forming a bridge or separation between melter and refiner.

**bruise**—synonymous with **percussion cone**.

**bulb edge**—the heavy rounded edge or bead of flat glass.

**bull's eye**—(1) a tempered solid cylindrical sight glass.

(2) the glass left by the punty in the center of a flat disk of glass made by the hand blown crown process.

(3) in flat glass, an optical distortion that arises from a polishing depression or a solid inclusion trapped between layers of laminated glass.

*bump check*—See **percussion cone**.

**burner block**—a refractory block with one or more orifices through which fuel is admitted to a furnace.

**burn-off**—the process of severing an unwanted portion of a glass article by fusing the glass.

**burnt lime**—calcined limestone ( $\text{CaO} \cdot \text{MgO}$ , dolomitic), or  $\text{CaO}$  (calcitic), or a mixture of these.

**bursting-off**—the breaking of the blowover.

**bushing**—(1) a liner in the feeder orifice for molten glass.

(2) a precious metal or refractory/metal structure with single or multiple hole(s) through which glass flows and is attenuated into fiber(s).

*butterfly bruise*—See **percussion cone**.

**cabal glass**—a glass consisting primarily of the oxides of calcium, boron, and aluminum.

**campaign**—the working life of a melting furnace between major cold repairs.

**canal**—that part of a melting furnace leading from the fining area to the forming area. See **channel** and **forehearth**.

**cane**—solid glass rods.

**cap, n**—(1) another name for crown.

(2) a type of bottle closure.

**cap, v**—{archaic} to cut off the ends of a glass cylinder.

**carnival glass**—glass having an iridescent coloration obtained by firing metallic salts applied onto a colored glass body. See **lusters**.

**carry-in**—manual Lehr loading.

**cased glass**—glassware whose surface layer has a different composition from that of the main glass body.

**casehardened**—a term sometimes used for tempered glass. (See **tempered glass**.)

**casting**—a process of shaping glass by pouring molten glass into molds, onto tables, or between rollers.

**cat eye**—an imperfection; an elongated bubble containing a piece of foreign matter.

**cat scratch**—an imperfection; surface irregularities on glassware resembling the marks of a cat's claws.

**centering**—an operation on lens elements wherein the element is optically aligned with the axis of rotation and the edges ground concentric with the optical axis.

**ceramic glass enamel (also ceramic enamel or glass enamel)**—a decorative, usually colored, vitreous inorganic coating for bonding to glass at temperatures above  $425^{\circ}\text{C}$  ( $800^{\circ}\text{F}$ ).

**chain marks**—marks made on the bottoms of glass articles as they ride through a Lehr on a chain belt slightly overheated.

**channel**—(1) in container glass, that part of a forehearth which carries the glass from the melter to the flow spout and in which temperature adjustments are made.

(2) in fiber glass, the structure to deliver glass from the melter to the refiner or forehearth.

**charge, n**—See batch (3).

**charge, v**—to add batch to a melter.

*chatter sleek*—{archaic} See **frictive track**.

**check**—an imperfection; a surface crack in a glass article.

**checkers**—(1) an open structure of firebrick serving as a heat exchanger.

(2) slang for regenerators of this type.

(3) slang for refractory brick used in such a construction.

**chemical durability**—the lasting quality (both physical and chemical) of a glass surface. It is frequently evaluated, after prolonged weathering or storing, in terms of chemical and physical changes in the glass surface, or in terms of changes in the contents of a vessel.

**chemically strengthened**—glass that has been ion-exchanged to produce a compressive stress layer at the treated surface.

**chill mark**—a wrinkled surface condition on glassware resulting from uneven cooling in the forming process.

**chip**—an imperfection due to breakage of a small fragment out of an otherwise regular surface.

**chipped glass**—a glass article with chipped surface produced intentionally.

**chipping**—the process of removing thin extra glass prior to grinding.

**choke**—an imperfection consisting of an insufficient opening in the finish and neck of a container.

**chopped fiber**—fiber glass strand which has been chopped to specified lengths.

**chunk glass**—{archaic} optical glass obtained in breaking open a pot of transfer glass.

**cleavage crack**—damage produced by the translation of a hard, sharp object across a glass surface. This fracture system typically includes a plastically deformed groove on the damaged surface, together with median and lateral cracks emanating from this groove.

**Colburn sheet process**—{archaic} manufacture of sheet glass by bending the vertically drawn sheet over a roll which establishes the definition of draw.

**cold top melter**—an all electric melting furnace in which a thermally insulating layer of batch is maintained on top of the molten glass.

**compact**—to treat glass in a manner, such as by heat treatment, to approach maximum density.

**contact stress**—the tensile stress component imposed at a glass surface immediately surrounding the contact area between the glass surface and an object generating a locally applied force.

**continuous filament**—a single glass fiber of sufficiently small diameter to be flexible enough for textile uses and of great or indefinite length.

**continuous furnace**—synonymous with **melter**.

**cooling-down period**—{archaic} (1) the time elapsing after a covered pot is opened before the glass is cool enough to work.

(2) period between fining stage and the removal of the glass from the furnace.

**cooling rate**—See **setting rate**.

**cord**—a generally attenuated glassy inclusion with properties differing from those of the surrounding glass.

**corrugated glass**—glass rolled to produce a corrugated contour.

**crackled**—glassware, the surface of which has been intentionally cracked by water immersion and partially healed by reheating before final shaping.

**crack-off**—the process of severing a glass article by breaking, as by scratching and then heating.

**crescent crack**—damage having the appearance of a crescent, produced in a glass surface by the frictive translation of a hard, blunt object across the glass surface. The crescent shape is concave toward the direction of translation on the damaged surface.

**crizzle**—an imperfection in the form of a multitude of fine surface fractures.

**Crookes glass**—a glass having low transmission for ultraviolet light, and containing cerium and other rare earths.

**cross-fired furnace**—See **side-fired furnace**.

**crown**—the top or roof of a melter.

**crown optical glass**—See **optical crown glass**.

**crown process**—{archaic} a method of making flat glass by blowing a large bulb, opening it, and then spinning it flat.

**crush**—on flat glass sheets, a lightly pitted condition with a dull gray appearance.

**crystal glass**—(1) colorless, highly transparent glass which is frequently used for art or tableware.

(2) colorless, highly transparent glass historically containing lead oxide.

**cullet**—glass product or portions of product usually suitable for addition to raw batch.

(a)—foreign cullet—cullet from an outside source.

(b)—domestic cullet (factory cullet)—cullet from within the plant.

(c)—a portion of a glass article that will later be cut off and discarded or remelted.

**cullet cut**—synonymous with **block reek**.

**cut glass**—glassware decorated by grinding figures or patterns on its surface by abrasive means, followed by polishing.

**cut-off scar**—a mark on the base of a glass bottle caused by the cutting of the gob in the Owens process.

**cut sizes**—flat glass sheets cut to specific dimensions.

**cutter**—(1) a workman engaged in grinding designs on glass.

(2) one who cuts flat glass.

(3) the tool used in cutting glass.

**cutting**—(1) scoring flat glass with a diamond or a steel wheel, and breaking it along the scratch.

(2) producing cut glass.

**cycle**—the firing period in a regenerative furnace.

**cylinder process**—{archaic} manufacture of window glass wherein molten glass is blown and drawn into the form of a cylinder, which is subsequently split longitudinally, reheated in a flattening kiln, and flattened.

**Danner process**—a mechanical process for continuously drawing glass cane or tubing from a rotating mandrel.

**day tank**—a periodic melting unit, which supplies glass for small volume applications.

**DISCUSSION**—It is usually emptied each day.

**dead anneal**—jargon for a state of negligible residual stress.

**dead plate**—in automatic production of molded glass, a stationary plate receiving a glass article awaiting transfer.

**debiteuse**—a slotted, floating clay block through which glass issues in the Fourcault process.

**decolorizing**—the process of producing a colorless appearance in glass.

**deformation point**—See **dilatometric softening point**.

**delivery**—(1) the final act of any glass-forming unit on a particular article; consisting of motion to remove the article from the mold.

(2) the process or equipment used for directing charges or gobs of glass to a forming machine.

**dense**—a term used for optical glass having a high index of refraction.

**devitrification**—crystallization of glass.

**dice**—the more or less cubical fracture of tempered glass.

**digs**—deep, short scratches.

**dilatometric softening point**—the temperature at which the viscous sag of the glass specimen exactly counteracts the expansion as thermal expansion measurements proceed during heating.

**DISCUSSION**—This phenomenon generally occurs in the viscosity range of  $10^{10}$  to  $10^{11}$  Pa·s.

**direct-fired furnace**—a melting furnace having neither recuperator nor regenerator.

**dirt**—a small particle of foreign material imbedded in the surface of flat glass sheets.

**dispersion**—the variation of refractive index with wavelength of light. See related term **Abbé value**.

**distribution**—the thicknesses of the walls of a glass article over its entire area.

**document glass**—{archaic} an ultraviolet absorbing glass used for protecting documents.

**doghouse**—a protrusion in or near the back wall through which batch is introduced into the melter.

**dolomite**—a double carbonate of lime and magnesium having the general formula  $\text{CaCO}_3 \cdot \text{MgCO}_3$ . See also **limestone**.

**dope**—slang for mold lubricant.

**double-cavity mold**—see **multiple cavity mold**.

**double-cavity process**—see **multiple cavity process**.

**double glazing**—insulated glazing that incorporates two panes separated by an air gap.



**double glazing unit**—two panes of glass separated by a permanently sealed cavity.

**double-gob process**—See **double-cavity process**.

**down draw**—process of continuously drawing glass downward from an orifice.

**down-tank**—the direction in a melter from the batch feeding end toward the exit.

**dragade**—{archaic} see **drag ladle**.

**drag ladle**—{archaic} to produce cullet by ladling glass from the melt into water.

**draw**—See **pull**.

**draw bar**—a refractory member submerged in molten glass that defines the position of the sheet in a drawing process.

**draw gang**—{archaic} people employed to cut and handle glass as it comes from thelehr.

**drawn glass**—glass made by a continuous drawing operation.

**dropping**—{archaic} forming by heating in a mold without the use of pressure.

**drop throat**—See **submerged throat**.

**dross**—a mixture of metal oxide and metal on the surface of a float bath.

**dry chop**—dried fiber glass strand which has been chopped. See **chopped fiber** and **wet chop**.

**dry gage (drigage) v.**—to form cullet by running a stream of molten glass into a water bath. (See synonymous term **frit**, v.)

**dummy**—a mechanical device, operated by the blower's feet, for wetting, raising, opening and closing the paste mold in mouth-blowing glassware.

**durability**—See **chemical durability**.

**dwel mark**—a fracture surface marking representing the site of a fracture discontinuity caused by a sudden shift in the stress distribution or by a fracture stopping for some length of time; also known as an arrest line.

**edging**—grinding the edge of flat glass to a desired shape or size. See also **centering**.

**electric boosting**—an auxiliary method of adding heat to the glass in a gas- or oil-fired melter by passing electric current through the molten glass.

**end-fired furnace**—a melter with fuel supplied from the back wall.

**end-port furnace**—synonymous with **end-fired furnace**.

**engraving**—the process of carving figures, letters, etc., upon glass by abrasive means.

**etch**—to attack the surface of glass with hydrofluoric acid or other agent, generally for marking or decoration.

**etched**—(1) treated by etching.

(2) weathered so that surface is roughened.

**eye**—the opening in the bottom of a pot furnace through which the flame enters.

**fade**—{archaic} attack of the surface of glass causing an oily or whitish surface.

**feather**—See **striation**.

**feathers**—an imperfection consisting of clusters of fine seed caused by dirt or foreign material entering the glass at the time of casting or shaping.

**feeder**—a mechanical device for regularly producing and delivering gobs of glass to a forming unit.

**feeder process**—See **gob process**.

**fiber**—attenuated glass generally with a diameter of less than a millimetre and a length/diameter ratio of more than 5.

**fiber, optical**—a fiber with high transmittance, low scattering, and minimal transverse loss of light.

**fiberglass, reinforcement**—continuously formed fibers added to enhance the overall performance of a matrix. Fiber glasses used for specific chemical or physical properties, or both, include:

*A-glass*—compositions typically with lower electrical resistivity, strength, and durability than E-glass.

*AR-glass*—compositions resistant to corrosion by alkali.

*C-glass*—compositions resistant to corrosion by most acids.

*D-glass*—compositions with a low dielectric constant.

*E-glass*—compositions with electrical properties, strength, and durability appropriate for most applications.

*E-CR-glass*—E-glass compositions modified for improved resistance to corrosion by most acids.

*R-glass*—compositions with high tensile strength, resistant to corrosion by most acids.

*S-glass*—compositions with high tensile strength, elastic modulus and service temperature.

**figured glass**—flat glass having a pattern on one or both surfaces.

**filament**—a single glass fiber of indefinite length.

**fill**—the unit charge of batch into a melter or pot.

**filling point**—the level at which a glass bottle has the nominal capacity.

**fin**—(1) an imperfection caused by entrance of glass into a seam between mold parts during forming.

(2) the feather edge obtained when cutting flat glass.

**fine annealing**—to attain more uniform structure than ordinarily required, maximizing homogeneity of physical properties by minimizing prior thermally induced variations.

**fine hackle**—See **mist**.

**fining, also refining**—the process by which molten glass becomes relatively free of undissolved gases.

**finish**—(1) the part of a bottle for holding the cap or closure.

(2) stage in melting process after glass appears free of seeds.

(3) the quality of a glass surface as influenced by very fine pits and cracks remaining from a grinding and polishing process.

**finisher**—(1) person in charge of a day-tank during the melting and fining of the glass.

(2) the workman who does the final work, such as polishing or putting the handle or foot on a piece of ware.

**fire check**—a check resulting from localized thermal stress during forming.

**fire cracks**—see synonymous term **fire check**.

**fire over**—idling a melting unit at operating temperature.

**fire-polish**—to make glass smooth, rounded, or glossy by heating the glass surface.

**first side**—{archaic} the surface of plate which is ground and polished first.

**fishbone**—a striation that does not reach entirely across the fracture surface.

**flake-glass**—hot glass squeezed thin between two metal rolls or blown into a thin film, followed by fracturing into small particles.

**flashing**—applying a thin layer of opaque or colored glass to the surface of clear glass or vice versa. See also **striking**.

**flat glass**—a general term covering sheet glass, plate glass, float glass, and various forms of rolled glass. See related term **bent glass**.

**flexure stress**—the tensile component of the bending stress produced on the surface of a glass section opposite to that experiencing a locally impinging force.

*flint optical glass*—See **optical flint glass**.

**flint glass**—(1) a lead-containing glass.

(2) term used by container industry for colorless glass.

**floater**—(1) a floating clay shape to skim foreign materials or control their passage in a melter.

(2) an object, generally a porous silica brick, introduced into a melting furnace, which will float on the surface of the molten glass for tens of minutes to several hours, thus revealing the surface flow.

**floater hole**—{archaic} an opening in a melter through which floaters are placed.

**float bath**—a pool of molten metal, commonly tin, contained within a refractory receptacle and protected from oxidation by an inert atmosphere, upon which molten glass is drawn into a flat sheet. See **float glass**.

**float glass**—flat glass that has been formed on molten metal, commonly tin.

*flow hole*—{archaic} See **throat**.

*flow process*—See **gob process**.

**flux**—an ingredient that reduces batch melting temperature.

**flux block**—a refractory furnace block used in contact with glass in melting.

*flux line*—See **metal line**.

**foam**—a layer of bubbles on the surface of molten glass.

**foam glass**—a thermally insulating material consisting of a high volume fraction of gaseous inclusions distributed throughout a glass matrix.

**foam line**—a boundary in a melting furnace beyond which foam no longer appears on the glass surface.

*fold*—See **lap**.

**forehearth**—a section of a melting furnace in one of several forms from which glass is taken for forming.

**forking**—a mechanism whereby a propagating fracture branches to form two new fractures separated by an acute angle.

**forming**—the shaping of hot glass.

**forming hood**—the partially enclosed volume in which individual glass fibers and groups of fibers are collected into a wool pack.

**forming rolls**—rolls used in forming flat glass.

**Fourcault process**—the method of making sheet glass by drawing vertically upward from a slotted debiteuse block.

**fracture surface markings**—fracture surface features that may be used to determine the fracture origin location and the nature of the stress that produced the fracture.

**fracture system**—that family of related fracture surfaces lying within an object, having a common cause and origin.

*free-blown*—See **offhand glass**.

**frictive track**—a series of crescent cracks lying along a common axis, paralleling the direction of frictive contact; also known as a chatter sleek.

**frit**, *n*—glass in particulate form, generally of controlled size distribution.

DISCUSSION—For decorations or sealing, it is commonly applied in combination with an organic vehicle.

**frit**, *n*—(1) the process of pouring molten glass into water or between cooled rollers. See **shrend**, **dry gage**.

(2) to decorate or seal with glass in particulate form.

**frosted**—surface treated to scatter light or to simulate frost.

*frosted area*—{archaic} See **hackle**.

**fully tempered glass**—flat glass that has been tempered to a high surface or edge compression to meet the requirements of Specification C 1048. See **heat-strengthened glass**.

**fused silica**—vitreous silicon dioxide produced by flame hydrolysis of silicon tetrachloride (or similar compounds) or by thermal consolidation of a silica gel. See related terms **vitreous silica** and **fused quartz**.

**fused quartz**—vitreous silicon dioxide produced by melting silica, generally in the form of granular quartz. See related terms **fused silica** and **vitreous silica**.

**gable wall**—{archaic} the charging end wall of a glass-melting furnace.

**gaffer**—head workman, foreman, or blower of a glass hand shop.

**gall**—layer of molten sulfates floating upon glass.

**gaseous inclusion**—a round or elongated bubble in the glass. See **blister** and **seed**.

**gate**—a shut-off device for flow of glass and combustion gases in a forehearth, more commonly a water-cooled member rather than a refractory body.

**gather**, *n*—the mass of glass picked up by the hand shop working on the punty or blowing iron.

**gather**, *v*—to get glass from a pot or day-tank on the pipe or punty.

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

DISCUSSION—Glass is typically hard and brittle, and has a conchoidal fracture.

A glass may be colorless or colored. It is usually transparent, but may be made translucent or opaque.

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

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

**glass blowing**—the shaping of hot glass by air pressure.

**glass ceramic**—solid material, partly crystalline and partly glassy, formed by the controlled crystallization of a glass.

**glass container**—general term applied to glass bottles and jars.

**glass paper**—a glass fiber product made by dispersing chopped glass fibers in a liquid medium followed by settling and drying to produce a thin sheet.

**glass redox**, **redox ratio**—a measure of the relative oxidation/

reduction state of a glass as indicated typically by any one of the ratios:  $\text{FeO}/\text{total iron}$  as  $\text{Fe}_2\text{O}_3$ ,  $\text{FeO}/\text{Fe}_2\text{O}_3$ ,  $\text{Fe}^{2+}/\text{Fe}^{3+}$ , or  $\text{Fe}^{2+}/(\text{Fe}^{2+} + \text{Fe}^{3+})$ .

**glass transition temperature**—on heating, the temperature at which a glass transforms from an elastic to a viscoelastic material, characterized by the onset of a rapid change in thermal expansivity.

**glazed pot**—generally, a new pot coated inside with a thin layer of glass to protect it from the raw batch.

**glory hole**—an opening exposing the hot interior of a furnace used to reheat the ware in hand-working.

**gob**—(1) a portion of hot glass delivered by a feeder.

(2) a portion of hot glass gathered on a punty or pipe.

**gob process**—a process whereby glass is delivered to a forming unit in “gob” form.

**graduated glassware**—glassware that is marked with one or more graduations for volumetric measuring purposes.

**gray area**—{archaic} See **mist**.

**hackle**—a finely structured fracture surface marking giving a matte or roughened appearance to the surface, having varying degrees of coarseness. Finely structured hackle is variously known as fine hackle, frosted area, gray area, matte, mist, and stippled area. Coarsely structured hackle is also known as striation.

**hackle marks**—fine ridges on the fracture surface of the glass, parallel to the direction of propagation of the fracture.

**hard glass**—(1) a glass of relatively high viscosity at elevated temperatures.

(2) a glass with a high softening point.

(3) commonly refers to a glass difficult to melt.

**head space**—the unfilled space in a glass container fitted with a closure device.

**heat-absorbing glass**—glass having the property of absorbing a substantial percentage of radiant energy in the near infrared of the spectrum.

**heat-resisting glass**—glass able to withstand a relatively high thermal shock, because of low expansion coefficient or a high mechanical strength, or both.

**heat-strengthened glass**—flat glass that has been tempered to a moderate surface or edge compression to meet the requirements of Specification C 1048. (See **fully tempered glass**.)

**heat-treated**—a term sometimes used for tempered glass. (See **tempered glass**.)

**heel contact**—the region on a glass container surface, located between the bearing surface and the sidewall sections, which normally contacts other similarly shaped and upright containers.

**heel tap**—an imperfection in which the base or bottom of a bottle is very thick in one area and very thin in another.

**Hertzian cone crack**—See **percussion cone**.

**Hertzian stress**—See **contact stress**.

**high-transmission glass**—glass that transmits an exceptionally high percentage of the visible light.

**hinge stress**—the tensile component of the bending stress generated on the same surface of a glass section as, but displaced from, the site of a locally impinging force.

**hot end**—those manufacturing operations concerned with hot glass, that is, melting, forming, annealing.

**hot hold**—maintaining the temperature of an idled melter below its operating temperature but above the liquidus temperature of the glass.

**hot mold**—the process of forming glassware in hot uncoated molds.

**hot spot**—the zone of highest temperature within a melter.

**ice**—a glass enamel frit which, when applied to glassware and fired, produces a textured surface.

**impact bruise**—See **percussion cone**.

**inclusion**—a foreign solid or gas within or bounded by the glass matrix.

**inside knuckle**—the juncture between the inside sidewall and the inside bottom surface of a glass article.

**interlayer**—a material used for bonding glass lites together. See related term **laminated glass**.

**I.S. process**—a bottle-making process using removable, individual forming sections, in which the gob enters the blank or parison mold by gravity.

**jamb**—the vertical structural member forming the sidewall of an opening or port in a furnace superstructure, supporting the crown load over that opening.

**joint line**—See **parting line**.

**jointing yard**—{archaic} place between the grinding and polishing operations in the continuous manufacture of plate glass, where the plaster joints are remade, sometimes called “middle yard.”

**knockout**—(1) a portion of a piece of pressed ware which has been so designed that it can be knocked out to make a hole.

(2) in glass containers, a protrusion of glass caused by missing metal at a junction of mold parts.

**knot**—an imperfection; an inhomogeneity in the form of a vitreous lump.

**knurling**—in glass containers, a raised pattern of beads, ridges, crescents, or other shapes, molded on a glass surface for the purpose of decoration and/or improvement in the mechanical strength of the glass in service. Also known as **stippling**.

**ladle**—a long-handled, cup-shaped tool for transferring batch or molten glass.

**laminated glass**—(1) in flat glass, an assembly consisting of two or more lites of glass bonded together by an interlayer (see also Specification C 1172) and (2) in tableware, two or more distinct layers of glass fused together.

**lampworking**—forming glass articles from tubing and cane by heating in a gas flame.

**lance**—(1) see **hackle**.

(2) a piece of hardware used for introducing a controlled atmosphere gas flow into molten glass or into parts of the furnace structure.

**lap**—(1) an imperfection; a fold in the surface of a glass article caused by incorrect flow during forming.

(2) a tool used for polishing glass.

**laser glass**—a glass of special composition that emits amplified electromagnetic radiation upon proper electromagnetic stimulation.

**lateral crack**—a crack produced beneath and generally paralleling a glass surface during the unloading phase of mechanical contact with a hard, sharp object. (See **cleavage crack**.)





**layer**—{archaic} person who has charge of laying the glass in plaster on the grinding and polishing tables.

**laying yard**—{archaic} place where the rough glass is laid on grinding and polishing tables with plaster.

**lead glass**—pieces of glass fixed together at their edges with soldered strips of lead or other ductile metal.

**lehr, leer**—a long, tunnel-shaped oven for heat treating glass by continuous passage.

**lehr loader**—a device for properly placing and spacing glass articles on a continuous lehr belt.

*Libbey-Owens sheet process*—{archaic} See **Colburn sheet process**.

**light**—(1) a term used for optical glass having a low index of refraction. (2) an architectural term for a panel or sheet of glass. See also **lite**.

**light-reducing glass**—a term applied to flat glass having reduced light transmittance.

**lime**—calcium oxide (CaO), or a mixture of calcium oxide (CaO) and magnesium oxide (MgO).

**lime glass**—jargon for soda-lime-silicate glass.

**limestone**—either calcitic limestone (CaCO<sub>3</sub>) or dolomitic limestone (CaCO<sub>3</sub>·MgCO<sub>3</sub>).

**Lindemann glass**—a high X-ray transmittance glass composed of the oxides of lithium, beryllium, and boron. (No elements with an atomic number above 8.)

**lines**—fine cords or strings, usually on the surface of sheet glass.

**liquidus temperature**—the maximum temperature at which equilibrium exists between the molten glass and its primary crystalline phase.

**lite, light**—a panel or sheet of glass.

*load*—See **pull**.

**long**—a comparative term signifying a slow-setting glass.

**lubricant**—a solution that, when applied to glass fibers, facilitates their handling by reducing mutual abrasion. (See also **mold lubricant**.)

**lustres**—(1) dilute solutions of metallic salts that, when applied and fired to glass, produce an iridescent effect on the surface.

(2) solutions of metallic resins that, when applied and fired to glass, produce an opaque, mother-of-pearl iridescent effect.

**marver**—(1) a flat plate on which a hand gather of glass is rolled, shaped, and cooled.

(2) also the process of doing same.

**mat**—a glass-fiber product of felt-like nature.

**median crack**—damage produced in glass by the static or translational contact of a hard, sharp object on the surface. (See also **cleavage crack**.)

*Discussion*—The crack propagates into the glass perpendicular to the original surface.

**melt**—a specific quantity of glass made at one time.

**melter**—(1) a melting unit constructed of refractory materials, with a glass level maintained essentially constant by feeding batch to replace glass continuously withdrawn. Also known as a tank, continuous furnace, and glass melting furnace.

(2) {archaic} person in charge of the melting furnace during the early stages of filling and melting of batch.

**melter tender**—{archaic} person who regulates the temperature of a melting furnace in order that the glass will have the proper viscosity for casting.

**melting**—the thermal process by which the charge is completely converted into molten glass free from undissolved batch.

**melting area**—the area of a melter under fire. Usually the area up to the bridgewall or floater.

**melting furnace**—the complete unit of a glass melting assembly, including the melter, regenerators or recuperators, flues, refiners, forehearth, channels, throats, etc.

**melting temperature**—an arbitrarily defined reference point used for comparison purposes at which the glass viscosity is 10 Pa·s.

*meniscus*—See **onion**.

**metal**—slang for molten glass in a melter.

**metal line**—the line on the refractory of a melting furnace which marks the boundary between the glass and the atmosphere above it.

**milk glass**—a translucent or opaque white glass.

**milkiness**—a condition of pronounced cloudiness in glass.

**mist**—a finely structured fracture marking giving a matte or roughened appearance to a surface; having continuous degrees of coarseness. Mist is variously known as fine hackle, frosted area, matte, and stippled area.

**mix**—See **batch (3)**.

**moil**—(1) the glass remaining on a punty or blowpipe after a gob has been cut off or after a piece of ware has been blown and severed.

(2) the glass originally in contact with the blowing mechanism or head, which becomes cullet after the desired article is severed from it.

**mold**—a form (usually metal) in which glass is shaped.

**molded glass**—glass that is formed in a mold as distinct from cast, rolled, drawn, or offhand ware.

**mold lubricant**—a substance applied on or into molds to reduce friction or prevent adhesion.

**mold mark**—mark or seam on glassware resulting from a mold joint.

**moonstone glass**—a type of opal glass resembling the mineral moonstone.

**mud-up**—to seal a furnace structure with wet clay or castable refractory material.

**muffle**—an enclosure in a furnace to protect the ware from the flame and products of combustion.

**Murgatroyd belt**—{archaic} that portion of the sidewall of a bottle near the bottom.

**multiple-cavity mold**—a mold possessing multiple cavities for simultaneous fabrication of multiple articles of glass.

**multiple-cavity process**—a glass-molding process that uses multiple charges of glass and forms them simultaneously.

*multiple-gob process*—See **multiple-cavity process**.

**neck**—(1) the part of a bottle between finish and shoulder.

(2) {archaic} the structure that connects the melting and working chambers of a melting furnace.

(3) the structure connecting the uptake and port in a melting furnace.



**neck ring**—a metal mold part used to form the finish of a hollow glass article.

**needle**—the vertical, reciprocating, refractory part of a feeder which alternatively forces the glass through the orifice and pulls it up after shearing.

**nitre**—an industrial term for  $\text{NaNO}_3$ .

**nose**—{archaic} the working end or refining chamber of a tank.

**nu-value**—see synonymous term **Abbé value**.

**obsidian**—a highly siliceous natural glass.

**offhand glass**—glass produced by the offhand process.

**offhand process**—the process of forming glassware by a craftsman working without the aid of molds.

**offset**—an imperfection resulting from mold parts not properly matched, that is, a finish or base offset from the body or neck.

**onion**—(1) a term sometimes used for the bulklike mass of glass at the origin of the drawn sheet in the Fourcault process.  
(2) the spread of molten glass as it flows from a canal onto a tin bath.

**opal glass**—glass with fiery translucence; typically a nearly opaque white glass.

**open bubble**—a surface cavity formed by a gaseous inclusion which was vented to ambient atmosphere during processing.

**open pot**—a pot open to the flames and gases of combustion.

**ophthalmic glass**—glass used in eyeglasses.

**optic**, *adj*—having variations in wall thickness, producing refractive effects.

**optic**, *n*—a lens or prism in an optical instrument.

**optical crown glass**—optical glass with a low dispersion relative to its index of refraction, usually forming the converging element of an optical system. Generally, optical glasses possessing an Abbé value greater than 50.

**optical fiber**—See **fiber**, **optical**.

**optical flint glass**—optical glass with a high dispersion relative to its index of refraction, usually forming the diverging element of an optical system. Generally, optical glasses possessing an Abbé value less than 50.

**optical glass**—glass of high quality having closely specified optical properties, used in the manufacture of optical systems.

**optical glass numerical designation**—the numerical designation in common usage is based on the index of refraction for the helium line ( $n_d$ ) and the Abbé value. The unity factor for the index is dropped (that is, 1.496 becomes 496) and the decimal point for the Abbé value is also dropped (Abbé value 64.4 becomes 644). Thus a glass with an index of refraction of 1.496 and an Abbé value of 64.4 is specified 496-644 without reference to chemical composition.

**orange peel**—a pattern of roughness or waviness on a vitreous or glassy surface which resembles the skin of an orange in texture.

**orifice**—an opening through which glass flows. In a feeder, an opening in the bottom of the spout formed by the orifice ring.

**orifice ring**—that ring that forms the hole through which glass flows in the feeder process. (See also **bushing**.)

**oven glass**—(1) glass suitable for manufacture of articles to be used in baking and roasting foods.

(2) glassware made from oven glass.

**overpress**—an imperfection; projecting excess glass resulting from imperfect closing of mold joints.

**Owens process**—{archaic} a bottle-making process in which the blank or parison mold is filled by suction and subsequently blown.

**oxidizing agent**—a batch ingredient that raises the state of oxidation of the melt.

**pack**—(1) the quantity of ware packed.

(2) the ratio of packed ware to theoretical.

**paddling, puddling**—{archaic} the rough shaping of a piece of glass in a furnace by means of paddles or tools preparatory to the pressing operation for making optical glass blanks.

**parison**—a preliminary shape or blank from which a glass article is to be formed.

*parison mold*—See **blank mold**.

**parting line**—line or seam on glassware resulting from the joint of two mold parts.

**pavers**—the glass-contact refractory blocks used in the bottom of a melter. See **tank block**.

**paste mold**—a mold lined with adherent carbon, used wet for blown ware.

**pearl ash**—{archaic} commercial potassium carbonate.

**peephole**—a small opening in a furnace wall for observation purposes.

**Penn-Vernon process**—see synonymous term **Pittsburgh sheet process**.

**percussion cone**—damage produced by contact stresses generated by mechanical contact of a hard, blunt object with a glass surface.

**DISCUSSION**—Typically, it has the appearance of a semicircular or circular crack on the damaged surface, propagating into the glass, flaring out with increasing depth into a cone-shaped crack; also called a bruise, impact bruise, butterfly bruise, bump check, or Hertzian crack.

**phase separation**—the formation of coexisting glassy phases as a result of thermal history within an originally homogeneous glass.

**pig**—a shaped object on which to rest a blowpipe or punty during the gathering operation.

**Pilkington process**—a process for making flat glass in which the glass continuously pours from a tank onto a spout and thence between forming rolls and is subsequently annealed as one continuous sheet.

**pitch polishing**—polishing operation in which pitch rather than felt is the resilient carrier for the polishing agent.

**Pittsburgh sheet process**—the method of making sheet glass by drawing vertically upward from a free bath surface wherein definition of draw is established by a submerged refractory member.

**plain**—{archaic} relatively free of gaseous inclusions.

**plaster**—{archaic} partially dehydrated gypsum used with water for bedding plates of glass to tables during the grinding and polishing of plate glass.

**plate glass**—flat glass formed by a rolling process, ground and polished on both sides, with surfaces essentially plane and parallel.

**plunger**—the reciprocating metal part that forces glass into the contours of a mold, or which, in a blank mold, forms the initial cavity for subsequent blowing. (See also **needle**.)

*polarimeter, Senarmount (Friedel)*—See **Senarmount (Friedel)** polarimeter.

**polariscope**—an optical device consisting of a light source, mutually perpendicular polarizing elements, and generally equipped with one or more retardation plates for qualitative observations of relative optical retardation by color differentiation.

*polished plate glass*—See **plate glass**.

**polished wire glass**—wire glass, ground and polished on both sides.

*pontil*—See **punty**.

**port**—an opening in a melting furnace designed for the passage of fuel, air/oxygen, flame, or exhaust gases or combination thereof.

**pot**—a one-piece refractory container for molten glass. Types of pots include:

*closed pot*—a pot having a crown protecting the glass from the furnace atmosphere.

*open pot*—a pot wherein the glass surface is not protected from the furnace atmosphere.

**pot arch**—a furnace for firing or preheating a pot.

**pot furnace**—a furnace for melting glass in pots.

**pot wagon**—a vehicle used for transferring a pot from a pot arch to a pot furnace.

**potash**—potassium oxide ( $K_2O$ ). Loosely, a carbonate of potassium.

**press-and-blow process**—a process of glass manufacture in which the finish and parison are pressed and the parison is subsequently blown to form the final shape.

**pressed glass**—glassware formed by pressure between a mold and a plunger.

**pressing (n)**—an as-pressed, oversized piece of glass used as the precursor for finishing to an optical element blank.

**pressing (v)**—the operation of forming pressed glass.

**pressure check**—an imperfection; a check or crack in a glass article resulting from too much pressure in forming.

*proof*—See **rod proof**.

**pull**—the quantity of glass delivered by a melting furnace in a given time, usually 24 h.

**punch ware**—handmade, thin, blown glassware, especially tumblers.

**punty**—(1) a gathering iron of solid cross-section.

(2) a device to which ware is attached for holding during fire polishing or finishing.

**putty**—{archaic} a white polishing compound.

**pyrolytic coating**—a thin coating produced by the decomposition of a volatile compound on a hot surface.

*quartz glass*—See **fused silica**.

**R-value**—a measure of the resistance to heat flow through a material calculated as  $R = t/k$ , where  $t$  is the thickness of the material and  $k$  is the thermal conductivity.

**raw batch**—a glass charge without cullet.

**raw cullet**—a glass charge made totally of cullet.

**ream**—in flat glass, layers of glass that are not homogeneous with the main body of the glass.

**reboil**—reappearance of bubbles in molten glass after it previously appeared plain.

**recuperative furnace**—a melting furnace having a recuperator.

**recuperator**—a continuous heat exchanger in which heat from exhaust gases is conducted through flue walls to incoming air.

**red edge**—{archaic} numerous rouge pits located around the edges of a large sheet of polished plate glass.

**reducing agent**—a batch ingredient that lowers the state of oxidation of the melt.

**refiner**—a component of a melting furnace, for the purpose of conditioning the glass. See **nose**.

*refining*—See **fining**.

**regenerative furnace**—a melting furnace having regenerators.

**regenerator**—a cyclic heat interchanger that alternately receives heat from gaseous combustion products and transfers heat to air or gas before combustion.

**reverse**—to reverse the direction of flow of gas and air in a regenerative furnace.

**revolving pot**—{archaic} a rotating circular container from which the Owens machine gathers glass.

**revolving tube**—a hollow cylinder, concentric with the needle of a feeder, revolving in the glass.

**ribbon**—a continuous strip of glass in process.

**ribbon machine**—a forming machine for the manufacture of blown glass products from a ribbon of molten glass.

**ribbon process**—a process whereby molten glass is delivered to a forming unit in a ribbon form.

**rider arch**—one of a series of arches that support the checkerwork in a regenerator.

**ring**—(1) a floating refractory body surrounding a glass surface from which gathers are made.

(2) a mold part that forms the rim of a pressed article.

**ringhole**—an opening in a melter through which glass is gathered.

**ring section**—narrow, peripheral section cut from a glass article for optical examination.

*ripple mark*—See **Wallner line**.

**rock crystal**—(1) transparent quartz.

(2) highly polished blown glassware, hand-cut or engraved.

**rocker**—an imperfection; a bottle with bottom deformed so it wobbles (rocks).

*rocker bottom*—See **rocker**.

**rod proof**—a test specimen taken from the melt on an iron rod.

**rolled glass**—(1) optical glass formed by rolling into plates at time of manufacture, as distinguished from transfer glass.

(2) flat glass formed by rolling.

**roller**—{archaic} a blown cylinder for making window glass by the hand process.

**rouge pits**—{archaic} an imperfection; traces of rouge remaining in an incompletely polished glass surface.

**rough glass**—(1) glass pieces obtained by cutting the original sheet of flat glass into workable sizes.

(2) rolled or patterned glass.

**round table**—{archaic} a type of laying table used for supporting plate glass for grinding and polishing.

**roving**, *n*—in glass textiles, a multiplicity of filaments or yarns gathered together into an approximately parallel arrangement without twist.

**rub**—abrasion of a glass surface producing a frosted appearance. Also known as a scuff.

**runner bar**—{archaic} iron casting attached to a circular grinding runner or head for abrasive grinding of plate glass.

**runner cut**—{archaic} an imperfection in plate glass resulting from fracture of the surface by the runner bar.

**running batch**—the regular batch formulated to produce the desired composition when used with its own cullet.

**safety glass**—flat (including bent) glass so constructed, treated, or combined with other materials that, if broken by human contact, the likelihood and/or severity of cutting and piercing injuries that might result from such contact is reduced. See related terms “laminated glass,” “fully tempered glass,” “tempered glass,” and “wired glass.”

**DISCUSSION**—One safety glass may be superior for protection against one type of hazard, whereas another may be superior against another type. Since accident conditions are not standardized, no one type of safety glass can be shown to possess the maximum degree of safety under all conditions against all conceivable hazards.

**sagging**—process of forming glass by reheating until it conforms to the shape of the mold or form on which it rests.

**salt cake**—an industrial term for sodium sulfate ( $\text{Na}_2\text{SO}_4$ ).

**salt water**—See **gall**.

**sand holes**—{archaic} small fractures in the surface of glass, produced by the rough grinding operation, that have not been removed by subsequent fine grinding.

**satin etch**—decorative glass surface that scatters light upon reflection, yielding a dull sheen finish.

**scale**—a small particle of foreign material embedded in the surface of molded glass articles.

**scratch**—damage on a glass surface in the form of a line caused by the relative movement of an object across and in contact with the glass surface.

**scratch-resistant coatings**—coatings applied to glass surfaces to reduce the effects of frictive contact.

**screen marks**—a mesh pattern left by a silk screen process in the applied ceramic glass enamel before or after firing.

**scuff**—See **rub**.

**scum**—a floating layer of unmelted material on the molten glass surface.

**sealing**—permanent joining by heating an interface to reduce the viscosity of glass(es) for geometrical accommodation and bonding.

**sealing glass**—a glass with special thermal expansion characteristics intended for sealing to another glass or solid.

**sealing surface**—that portion of the finish of a glass container which makes contact with the sealing gasket or liner. See **finish**.

**seam**, *n*—a mark on a glass surface resulting from the joint between matching mold parts.

**seam**, *v*—to slightly grind the sharp edges of a piece of glass.

**seat**—prepared position on the siege where the pot rests.

**second side**—{archaic} the final side of plate glass to be ground and polished.

**seed**—a relatively small gaseous inclusion in glass.

**Senarmont (Friedel) polarimeter**—an optical device for measuring relative optical retardation consisting of a light source, a polarizing filter, a retardation plate exhibiting one-quarter wave retardation with its optical axis perpendicular to the polarizing axis, and a rotatable polarizing element (the analyzer) whose angular position can be read on a scale.

**setting rate**—a comparative term referring to the time required for the glass surface to cool between the limits of the working range.

**DISCUSSION**—A short time implies a fast setting rate, and a long time implies a slow setting rate.

**settle mark**—See **chill mark**.

**shadow wall**—a structure built on top of the bridgewall or suspended from the crown to limit the flow of heat from the melter to the refiner.

**sharks teeth**—a term relative to the appearance of the cut edge of a glass sheet having dagger-like striations starting at the scored edge and extending toward the opposite surface.

**sharp fire**—combustion with excess air and short flame.

**shear cake**—a counterweighted refractory slab used as a gate or door to a small furnace or oven.

**shear mark**—a mark appearing in glass, caused by the action of the cutting shear.

**sheet glass**—flat glass made by continuous drawing.

**shielding glass**—a transparent glass containing oxides of heavy elements, such as lead, to absorb ionizing radiation.

**short**—a comparative term signifying a fast-setting glass.

**short-finish**—an imperfection resulting from incomplete polishing.

**shoulder contact**—the region on a glass container surface located between the neck and sidewall sections, which normally contacts other similarly shaped and upright containers.

**shrend**—{archaic} **term for dry gage**, *v*.

**side-fired furnace**—a furnace with fuel supplied from the side.

**side-port furnace**—a furnace with ports on the sides.

**sidewall, glass container**—the midsection of a glass container located between the heel and shoulder contact regions; also referred to as barrel.

**siege**—{archaic} floor of a pot furnace, often called “bench.”

**sight glass**—the glass window for a viewing port, generally for a pressurized system.

**silica glass**—See **fused silica**.

**silk screen process**—a decorating process in which a design is printed on glass through a silk mesh, woven wire, or similar screen.

**sintered glass**—glassware made by fusing glass particles.

**sizing, size**—an organic coating applied to glass fibers directly below a bushing to provide some or all of the following: abrasion resistance, lubricity, antistatic characteristics, and chemical bonding to a subsequent matrix.

**skimmer block**—a partially submerged object near the exit end of a melting furnace, designed to (1) keep foam,



unmelted batch, etc. from exiting the tank; (2) isolate atmospheres on either side; or (3) interrupt surface flow of glass from the melter, or combinations of these.

**skylight**—flat glass installed at an angle greater than 15° from the vertical in a building exterior.

**slab glass**—optical glass obtained by cutting or forming the chunk glass into plates or slabs.

**slag**—partially fused mixture of spilled batch, overflowed glass, breeze coal, and clay from the sieve.

**sleek**—an imperfection; a fine scratchlike mark having smooth boundaries, usually produced by a foreign particle in the polishing operation.

**sliver**—(sliver) a bundle of untwisted, substantially parallel glass fibers.

**slug**—any nonfibrous glass in an insulating glass fiber product.

**slugged bottom**—See **heel tap**.

**slumping**—See **sagging**.

**smoke**—in flat glass, streaked areas appearing as slight discoloration.

**smoked**—(1) a term applied to the discoloring of glass in a reducing flame.

(2) glass covered with smoky film from open-fired lehrs.

**smooth**—{archaic} finely ground surface prior to polishing.

**snake, snaking**—(1) progressive longitudinal cracking in continuous flat glass operation.

(2) *archaic*, variation in the width of the sheet during the sheet glass-drawing process.

(3) movement from side to side of the flat glass ribbon.

**snap**—{archaic} a device for gripping a piece of formed glass for fire polishing and finishing.

**soaking pit**—a conditioning furnace used to bring the glass in open pots to a uniform temperature for casting.

**soda**—an industrial term for sodium oxide (Na<sub>2</sub>O). Loosely, a carbonate of sodium.

**soda lime glass**—an abbreviated term for soda-lime-silicate glass.

**soda-lime-silicate glass**—glass compositions containing soda (Na<sub>2</sub>O), lime (CaO), and silica (SiO<sub>2</sub>) as the main ingredients.

**soft fire**—a flame with a deficiency of air.

**soft glass**—(1) a glass of relatively low viscosity at elevated temperatures.

(2) a glass with a low softening point.

(3) commonly refers to a glass easy to melt.

**softening point (S.P.)**—that temperature at which a glass fiber of uniform diameter elongates at a specific rate under its own weight when measured by Test Method C 338. The viscosity at the softening point depends on the density and surface tension. For example, for a glass of density 2.5 g/cm<sup>3</sup> and surface tension 300 dynes/cm, the softening point temperature corresponds to a viscosity of 10<sup>6.6</sup> Pa · s.

**solarization**—a change in appearance of glass as a result of exposure to sunlight.

**solder sealing glass**—a sealing glass characterized by a low softening point for use as an intermediate bonding material.

**spandrel glass**—architectural glass that is used in a nonvision area or charting of a building.

**spider**—(1) a wheel-like casting consisting of a rim and radial spokes on which are mounted felt polishing pads.

(2) assembly of radiating tie rods on the top of a furnace.

**split**—an imperfection; a crack or check going from surface to surface of a glass article.

**spoon proof**—test ladle specimen taken during various stages of melting and fining.

**spout**—the part of a feeder that carries the orifice, revolving tube, needle, etc.

**spring zone**—that location within a melting furnace having the highest temperatures and an up-welling convective flow of molten glass due to density differences. See **hot spot**.

*spun glass*—See **fiber**.

**square-cut glass**—optical glass cut in small squares, separated and designated by weight.

**stability**—(1) resistance to devitrification.

(2) chemical durability, resistance to weathering.

*stacker*—See **lehr loader**.

**stain**—(1) an imperfection; chemical corrosion on the surface of glass.

(2) transparent coloration achieved by application of metallic ions on glass at an elevated temperature.

**staple fiber**—fibers produced in short, random lengths as distinguished from chopped fiber.

*step fracture*—See **striation**.

**sting-out**—the stream of hot air or flame, or both, driven by positive internal pressure, exhausted through openings in melting furnaces.

*stippled area*—{archaic} See **hackle**.

*stippling*—see synonymous term **knurling**.

**stone**—an imperfection; a crystalline inclusion in glass.

**straight throat**—a throat whose floor is at the same level as the floor of the melter.

**strain**—jargon for optical retardation.

**strain disk**—a disk of glass having a calibrated amount of birefringence at a specified location, and used as a comparative measure of the degree of retardation.

**strain point (St.P.)**—that temperature corresponding to a specific rate of elongation of a glass fiber when measured by Test Method C 336 or a specific rate of midpoint deflection of a glass beam when measured by Test Method C 598.

DISCUSSION—At the strain point internal stresses are substantially relieved in a matter of hours.

**strand**—a multiplicity of continuous glass filaments combined in a single compact unit, without twist.

**strength**—a term to indicate relative thickness in sheet glass.

**strength, double**—sheet glass between 0.115 and 0.134 in. (2.92 and 3.40 mm) thick.

**strength, single**—sheet glass between 0.085 and 0.101 in. (2.16 and 2.57 mm) thick.

**stria**—a cord of low intensity generally of interest only in optical glass. (See also **cord**.)

**striations**—ridges or steps on the fracture surface parallel to the local direction of the crack front propagation, generally having the appearance of feathers.

**striking**—development of color or opacity during cooling or reheating.

**string**—an imperfection; a straight or curled line, usually

resulting from slow solution of a large grain of sand or foreign material.

**stripping yard**—{archaic} the place where glass plates are removed from tables after grinding and polishing.

**submerged throat**—a throat with its floor below the floor of the melter and its top below the metal line.

**suction process**—any process in which glass is gathered by vacuum into the mold.

*sump throat*—{archaic} See **submerged throat**.

**superstructure**—those parts of a melter above the sidewall tank blocks.

**sweet**—a term applied to easily workable glass.

**take-out**—a mechanical device for removing a finished article from any glass-forming unit.

**tank**—synonymous with **melter**.

**tank block**—a generic term for large refractory blocks used in the structure of melters. See **pavers**.

**tap**—(1) to drain a furnace.

(2) to remove excess slag from the floor of a pot furnace.

**tarnish**—a thin film of stain on the surface of glass.

**tear**—an imperfection; a small surface section of glass torn out by adherence to another hot solid.

**teaser**—the worker in direct charge of furnace operations who regulates the charging of batch and adjusts fires.

*teemer*—{archaic} the person who teems or casts the pot of glass.

*teeming*—See **casting**.

**temper**—(1) the degree of residual stress in annealed glass measured polarimetrically or by polariscopic comparison with a standard such as one or more strain disks. (See also **strain disk**.)

(2) term sometimes used in referring to tempered glass. (See also **tempered glass**.)

**tempered glass**—a general term for glass that has been subjected to a thermal treatment characterized by rapid cooling to produce a compressively stressed surface layer. See **fully tempered glass** and **heat-strengthened glass**.

**temper number**—a relative evaluation of the annealing process of glassware as determined with strain disks (see Test Methods C 148).

**thermal conditioning**—adjusting the average temperature and reducing the thermal gradients in glass.

**thermal endurance**—the relative ability of glassware to withstand thermal shock.

**thermal shock**—a rapid change in temperature imposed on a glass body.

**thermal stress**—the stress produced by a temperature differential within a glass body.

**thimble**—a refractory shape used for stirring a pot-made optical glass.

**throat**—a fully or partially submerged, narrow passageway between the melter and refiner of a tank.

**tint plate**—a retardation plate introduced into the polariscope, which adds one wave (565 nm) of retardation to the field which it covers, and which shifts the observed retardation color scale to more easily distinguishable tints.

**tit**—an imperfection; a small protrusion on a glass article.

**tongue tile**—*in a port*, the projecting partition between gas and air stream.

*toughened glass*—See **tempered glass**.

**transfer glass**—optical glass cooled in the pot in which it was melted.

**triple-cavity mold**—See **multiple-cavity mold**.

**triple-cavity process**—See **multiple-cavity process**.

*triple-gob process*—See **multiple-cavity process**.

**tuckstone**—blocks placed on top of flux blocks to protect them from flame and gases and as a seal between them and the supported side and end walls.

**tuck wall**—the series of tuckstones or a wall serving the same purpose made of courses of brick.

**twel, tuille**—a counterweighted furnace door, opening vertically.

**U-value**—the total heat transfer coefficient of a window at steady state and standardized conditions.

**updraw**—the process of continuously drawing glass of various cross sections, such as cane or tubing, by a method similar to the Fourcault process.

**vacuum-and-blow process**—a bottle manufacturing process whereby glass is gathered by vacuum and subsequently blown.

**Vello process**—a process for continuously drawing glass tubing (or cane) in which glass is fed downward to the draw through an annular orifice.

**vitreous silica**—a generic term for vitreous silicon dioxide. See related terms **fused quartz** and **fused silica**.

*volumetric glassware*—See **graduated glassware**.

**Wallner line**—a fracture surface marking, having a wavelike profile in the fracture surface. Such marks frequently appear as a series of curved lines, indicating the direction of propagation of the fracture from the concave to the convex side of a given wallner line. Also known as ripple mark.

**warming-in**—reheating glass to permit further working, also for striking.

**washboard**—an imperfection; ripples, waves, etc., on the surface of glassware.

**water dam**—synonymous with **water gate**.

**water-gate**—See gate. Also known as a water-dam.

**water glass**—sodium silicate glass that is readily soluble in water.

**wave**—an optical effect due to uneven glass distribution or to striae.

**weathering**—atmospheric attack on a glass surface.

**weir**—a submerged refractory wall within a melter to direct glass flow.

**welding glass**—colored glass to protect a welder's eyes from injurious radiation.

**Westlake process**—{archaic} an automatic process using vacuum gather for producing articles in paste molds.

**wet chop**—fiber glass strand which has been chopped directly after application of sizing. See **chopped fiber** and **dry chop**.

*whiskers*—See **striation**.

*window glass*—See **sheet glass**.

**wired glass**—flat glass with a layer of wire mesh completely embedded in the glass.



**wool**—a mass of staple fibers bonded into a three dimensional network, producing a low density material for thermal and/or acoustic insulation.

**workability**—a subjective term used to describe the ease of fabrication of molten glass.

**working end**—the compartment of a melting furnace from which glass is delivered for forming.

**working range**—the range of surface temperature in which glass is formed into ware in a specific process. The “upper

end” refers to the temperature at which the glass is ready for working (generally corresponding to a viscosity of  $10^2$  to  $10^3$  Pa · s), while the “lower end” refers to the temperature at which it is sufficiently viscous to hold its formed shape (generally corresponding to a viscosity greater than  $10^4$  Pa · s). For comparative purposes, when no specific process is considered, the working range of glass is assumed to correspond to a viscosity range from  $10^3$  to  $10^{6.6}$  Pa · s.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*