

## Bb

**b.** *Symbol.* Standing for: (1) **barn**; (2) **bel**.

**B.** *Symbol.* Represents: (1) The chemical element **boron**; (2) **magnetic flux density**; (3) on pencils to signify the degree of softness of the lead, B, 2B, etc.

**Babinet compensator.** *Noun.* A crystal plate of variable thickness with faces cut parallel to the optic axis used to produce or analyse elliptically polarised light. **Quartz** crystal is commonly used.

**Babo's law.** *Noun.* The statement that the vapour pressure of a solution is reduced in proportion to the mass of solute added.

**bacile.** *Noun.* A deep ceramic dish or basin.

**back bond.** *Noun.* A chemical bond between an atom in the surface layer of a solid and an atom in the second layer.

**back draft.** *Noun.* A slight undercut in a mould that makes removal of the moulded part difficult.

**back emf.** *Noun.* An electromagnetic force appearing in an inductive circuit in an opposing direction to any change of current in the circuit.

**back emission.** *Noun.* The secondary emission of electrons from an anode.

**backer strip.** *Noun.* An asphalt-coated felt strip employed as a water-repellent backing for the vertical joint between asbestos-cement **shingles**.

**background.** *Noun.* In the detection of nuclear radiation, that part of the signal which arises from natural radioactivity or cosmic rays.

**background fluorescence.** *Noun.* The fluorescent residues observed on the surface of a test specimen during fluorescent-penetrant inspection.

**backing.** *Noun.* (1) The portion of a wall or structure installed behind a facing course to attain a particular property in the structure, such as strength, insulation, or economy. (2) A backing material such as cloth,

paper, fibre, etc., used as the backing for coated abrasives. (3) The flexible carrier for the magnetic oxide coatings employed on magnetic tapes.

**backing plate.** *Noun.* A plate used to support the cavity blocks and guide pins in injection moulding.

**backing sand.** *Noun.* In moulding it is any sand mixture used to fill the flask after the facing sand mixture is in place.

**back-off.** *Verb trans.* To remove a cutting tool or grinding wheel from contact with an item being processed.

**back pressure.** *Noun.* (1) The resistance to forward flow of plastic material in an extruder. (2) In moulding the viscous resistance encountered when the mould is closing.

**back scatter.** *Noun.* The scattering of particles or waves, such as x-rays, sound waves,  $\alpha$ -particles and electrons, by the structure through which they pass, in the backward direction. (2) The radiation or particles so scattered.

**back stamp.** *Noun.* A mark made on the back or bottom of a product to identify its origin or manufacturer; a hallmark.

**back wall.** *Noun.* The wall at the charging end of a glass-melting furnace.

**backwear.** *Noun.* A worn condition on the back of an abrasive belt caused by high speed, high pressure, or both that results in friction between the belt and its backup at the point of contact with a work piece.

**baddeleyite.** *Noun.*  $\text{ZrO}_2$ . Naturally occurring monoclinic form of **zirconia**; used in refractory and corrosion-resistant applications such as furnace linings and muffles and as an ingredient in low-expansion ceramic bodies but such use is limited to temperatures below 1,450 °C because of the monoclinic to tetragonal phase change that causes severe mechanical stress. Mp 2,850 °C; density 5,765 kg m<sup>-3</sup>.

**badging.** *Noun.* The marking of glassware and other ceramic products to identify the manufacturer, ownership, capacity, composition, or other information.

**baffle.** *Noun.* (1) A partition consisting of a panel, plate, screen, wall, or other device designed to check, regulate, or deflect the flow of something, such as a shield placed in a position to protect ware from combustion gases in a furnace or kiln during firing. (2) The part of a glass-forming mould designed to shut off the delivery of molten glass into the mould.

**baffle mark.** *Noun.* A mark or seam line visible on a bottle or other glass product caused by the joint between the mould and the **baffle**.

**baffle wall.** *Noun.* A wall constructed in a furnace or kiln to protect items being fired from flames and combustion gases.

**bagasse.** *Noun.* The crushed fibrous material remaining after the juice is extracted from sugar cane employed as a reinforcement and filler in plaster products, such as acoustic tile.

**bag filter.** *Noun.* An apparatus containing porous cloth, paper, or felt bags designed to collect dust from dust-laden gases passed through the apparatus.

**baghouse.** *Noun.* A chamber containing an arrangement of bag filters for the removal of airborne particles from air or gas streams emanating from furnaces, dry mixers, or other dust-producing equipment or operations.

**baghouse dust.** *BHD. Noun.* The fine particulate matter collected in the **baghouse**. It contains a mixture of starting materials in a form suitable for use in the manufacture of **cement clinker**.

**Bagley plot.** *Noun.* **Extrusion die** pressure plotted against length of die capillary divided by capillary diameter for a series of pre-set **extrudate** velocities. The lines this produces are used to compensate for die entry and exit effects.

**bag moulding.** *Verb trans.* A process whereby a flexible bag is used to apply uniform pressure over the surface of a ceramic fibre laminate during matrix impregnation.

**bag wall.** *Noun.* A refractory wall in a furnace or kiln designed and placed to deflect a flame to prevent it from striking ware being fired.

**baidunzi.** *Noun.* Small white bricks formed by dry pressing **porcelain stone**.

**Bailey meter.** *Noun.* A flow meter of helical vane construction used to measure the weight of powdered or granular materials passing through an essentially vertical shaft or other enclosed passage.

**bainite.** *Noun.* A composite of iron carbide,  $\text{Fe}_3\text{C}$ , and iron present in incompletely hardened steels annealed at temperatures between the **pearlite** and **martensite**

**range**, 250–550 °C. An austenitic transformation product found in some steels and cast irons. The microstructure consists of  $\alpha$ -**ferrite** and a fine dispersion of **cementite**.

**bait.** *Noun.* A tool dipped into a bath of molten glass to start a drawing operation.

**baked core.** *Noun.* A moulded mass of a sand mixture that has been baked to be used as a core in a sand moulding operation.

**baking.** *Noun.* Heat processing sufficient to promote bond formation of binder constituents.

**balance.** *Noun.* A weighing device consisting essentially of a horizontal beam having a fulcrum at the centre with a pan suspended from each end, one holding the object being weighed and the other holding equivalent weights.

**balanced design.** *Noun.* In a filament wound composite it is a winding pattern for the ceramic fibre so designed that all filaments have equal stresses.

**balanced-in-plane contour.** *Noun.* The contour of the head in a filament wound composite in which filament orientation within a plane and the radii of curvature are adjusted to balance the stresses along the filaments with loading pressure.

**balanced laminate.** *Noun.* A composite laminate in which all lamina angles except 0° and 90° occur only in + or – pairs symmetrically about a centre plane.

**balanced runner.** *Noun.* A runner system from an injection moulders made to place all cavities at the same distance from the **sprue**.

**balance, dynamic.** *Noun.* See **dynamic balance**.

**balance, material.** *Noun.* See **material balance**.

**balance, static.** *Noun.* See **static balance**.

**balancing.** *Noun.* Testing for balance by adding or subtracting weight to put a grinding wheel or other rotating part into either static or dynamic balance. See **static balance**, **dynamic balance**.

**balas.** *Noun.* A red variety of **spinel** often called **balas ruby**.

**balas ruby.** *Noun.* A mixed oxide of aluminium, iron, and manganese with the **spinel** structure having a pale red or orange colour. Found in Afghanistan; prized as a gemstone.

**ballas.** *Noun.* Diamond with a morphology of ball-shaped aggregates with a radial structure. It is formed when grains grow simultaneously and impinge while growing to produce grain boundaries that are disordered variants of the cubic diamond structure.

**ball charge.** *Noun.* Volume of balls loaded in a ball mill. Commonly one-third the total mill volume.

**ball clay.** *Noun.* Clay that has been transported by water from where it was formed to give secondary deposits in sedimentary **lenses**. Mainly **kaolinite** contaminated with organic matter but not with iron during deposition. Formed by superheated steam passing through granite fissures, which caused **feldspar** to become kaolinite. This process is known as **hydrothermal alteration**. Ball clay is characterised by high plasticity, fine-grained particles, high dry strength, long vitrification range, and a white to cream colour after firing; employed in ceramic bodies to provide plasticity during forming and to induce vitrification during firing, as a suspension agent in porcelain-enamels and glazes, and as a bonding agent in non-plastic refractories. The colloquial name is believed to come from the fact that plastic clay was mined by hand spade in Devon in lumps or balls weighing 14 kg.

**ball, grinding.** *Noun.* See **grinding ball**.

**balling.** *Noun.* The tendency of a material to agglomerate or cluster, particularly during mixing.

**ballistic limit.** *Noun.* The maximum velocity of a projectile that a given amount of **ceramic armour** will defeat.

**ball mill.** *Noun.* A closed-end rotating cylinder, usually consisting of a steel jacket with an abrasion-resistant porcelain or porcelain-like lining and containing pebbles or porcelain balls as the grinding media, in which materials are wet or dry ground as a means of mixing or reducing the particle size. The mill and grinding media may be of steel or alloy compositions if contamination is not a factor.

**ball mill, air-swept.** *Noun.* See **air-swept ball mill**.

**ball milling.** *Verb trans.* Using a ball mill to prepare materials.

**ball mill, Krupp.** *Noun.* See **Krupp ball mill**.

**ball mill, vibrating.** *Noun.* See **vibrating ball mill**.

**ballotini.** *Noun.* Minute glass spheres, 1–60  $\mu\text{m}$  diameter, made to reflect light by flame-drawing and then allowing the molten glass to fall in an air jet. Used in the composition of reflective paints.

**ball test.** *Noun.* (1) A test in which a ball of specified size and weight is dropped or forced onto the surface of a body, glaze, porcelain-enamel, or other material under prescribed conditions as a means of evaluating a property such as resistance to impact, degree of adherence, etc. (2) An on-site test of the consistency of concrete.

**Balmer series.** *Noun.* The series of lines in the visible part of the spectrum of hydrogen which can be represented by the equation:  $J_n = R(0.25 - 1/n^2)$ , where  $n=3, 4, 5$ , etc.,  $J_n$  is the wave number, and  $R$  is the Rydberg constant for hydrogen.

**bamboo ware.** *Noun.* A type of brownish or cane-coloured **stoneware**.

**Banbury mixer.** *Noun.* A heavy-duty mixer consisting of two rotors, the faces of which turn in opposite directions; used in mixing viscous compositions and pastes.

**band.** *Noun.* A restricted range in which the energies of electrons in solids lie, or from which they are excluded, as understood in **quantum-mechanical** terms.

**band gap.** *Noun.* The energy difference from the top of the valence band to the bottom of the conduction band in semiconductor electron energy level diagrams. It is typically in the range 0.2–4.0 eV. The wider the gap, the more colourless the material, e.g., diamond 5.6 eV, SiC 3.1 eV is blue-green and Si 1.1 eV is opaque. Intrinsic materials electrons are forbidden to have energies within the energy range of the band gap.

**banding.** *Verb.* The application of a decorative line or band of colour to the edges, sides, and facial surfaces of chinaware, pottery, and similar products.

**band-pass filter.** *Noun.* (1) A filter passing only those currents having a frequency within specified limits. (2) An optical device consisting of absorbing filters, for transmitting electromagnetic waves of selected wavelength.

**bandwidth.** *Noun.* (1) The range of frequencies within a given wave band used for a particular radio frequency transmission. (2) The range of frequencies over which a receiver or amplifier should not differ significantly from its maximum value. (3) The width of a filament-wound band.

**bank kiln.** *Noun.* A kiln constructed on a slope or bank of earth, the incline serving in place of a flue for the removal of combustion gases.

**bank run.** *Noun.* Concrete aggregate in the condition as excavated from banks or pits.

**banks.** *Noun.* The sloping refractory section of an open-hearth furnace located between the hearth and the front and back walls.

**bank sand.** *Noun.* A sand of low clay content used in making casting cores.

**bannering.** *Verb.* The levelling of **saggers** in a kiln to facilitate stacking.

**bar.** *Noun.* A **cgs unit** of pressure equal to  $10^6 \text{ dyn cm}^{-2}$  or in the SI system  $10^5 \text{ N m}^{-2}$ ; approx. 0.987 atm.

**barbertonite.** *Noun.* See **stichite**.

**Bardeen-Cooper-Schrieffer theory.** *Noun.* A theoretical explanation of the theory of superconductivity formulated by Bardeen, Cooper and Schrieffer in 1976. An electron moving through a crystal creates a small distortion in a nearby atom position by coulombic interaction. The distortion persists long enough for a second electron to have its passage helped. Thus bound pairs carry the current; they are called

**Cooper pairs.** Pair formation involves creation of an energy gap in what would normally be a continuum of electron energy states in a partly filled band. The electrons in the pairs have opposite spin and momentum. Once excited above the energy gap, single electrons cannot decay to their normal states and they become free to move through the structure without scattering by ion cores.

**bare glass.** *Noun.* Glass fibre yarns, rovings, etc. from which the **sizing** or other surface finish has been removed.

**bar graph.** *Noun.* A graph consisting of vertical or horizontal bars whose lengths are proportional to amounts.

**baria.** *Noun.* Ceramic name for barium oxide. Not used much in ceramics because it is unstable and reacts with water. See **barium oxide**.

**barilla.** *Noun.* An impure mixture of **sodium carbonate** and **sodium sulphate** obtained from the ash of plants, such as kelp.

**barite.** *Noun.*  $\text{BaSO}_4$ . The American name for **barytes**. An orthorhombic mineral employed in glasses as a flux to reduce **seeds**, increase toughness, improve brilliance, and reduce annealing time. Mp 1,580 °C; density 4,300–4,600  $\text{kg m}^{-3}$ ; hardness (Mohs) 2.5–3.5. Also known as **blanc fixe**.

**barium aluminate.** *Noun.* (1)  $\text{Ba}_3\text{Al}_2\text{O}_6$ ; employed as a source of barium oxide in glass compositions to decrease the solubility and increase the brilliance of the glass; also used in cathode coatings for vacuum tubes. (2)  $\text{BaAl}_2\text{O}_4$  barium aluminium **spinel**; mp 1,998 °C; density 3,990  $\text{kg m}^{-3}$ . (3)  $\text{BaAl}_{12}\text{O}_{19}$ ; mp 1,860 °C density; 3,640  $\text{kg m}^{-3}$ .

**barium aluminium silicate.** *Noun.*  $\text{BaAl}_2\text{Si}_2\text{O}_8$ . Mp 1,716 °C; density 3,210–3,300  $\text{kg m}^{-3}$ .

**barium borate.** **BBO.** *Noun.*  $\text{BaB}_2\text{O}_4$  or  $\text{Ba}(\text{BO}_2)_2$ . A non-linear optical ceramic capable of second harmonic generation and so is used as an optical parametric oscillator.

**barium boride.** *Noun.*  $\text{BaB}_6$ . Mp 2,270 °C; density 4,320  $\text{kg m}^{-3}$ ; hardness (Vickers) approx. 30 GN  $\text{m}^{-3}$ .

**barium calcium silicate.** *Noun.*  $\text{BaCa}_2(\text{SiO}_3)_3$ . A chain **pyroxene**.

**barium carbide.** *Noun.*  $\text{BaC}_2$ . An acetylide containing  $(\text{C-C})^{2-}$  ionic units; source of acetylene. Mp > 1,760 °C; density 3,570  $\text{kg m}^{-3}$ .

**barium carbonate.** *Noun.*  $\text{BaCO}_3$ . Employed as a flux in porcelain-enamels and glazes to improve elasticity, brilliance, mechanical strength, acid resistance and to prevent scumming; used as an ingredient in flint glass, pressed tableware, television tubes, and laboratory glassware to lower the melting point, improve workability, improve brilliance and hardness, and to improve dielectric constants and resistivity; used to obtain

maximum flux density in hard core permanent magnets; used in structural clay products to prevent **scum** and **efflorescence**; and employed in **steatite**, **forsterite**, **zircon porcelain**, and titanate electronic components to reduce **dielectric loss**. Mp 1,360 °C; density 4,400  $\text{kg m}^{-3}$ . See **witherite** which is a ceramic name for this material.

**barium cerium oxide.** *Noun.*  $\text{BaCeO}_3$ . A **perovskite** oxide developed as a proton-conductor in the 200–900 °C range; used as a hydrogen sensor device.

**barium chloride.** *Noun.*  $\text{BaCl}_2$ . Used as a **set-up agent** and **scum** preventative in porcelain enamels by precipitating soluble sulphates as insoluble barium sulphate. Mp 960 °C; density 3,097  $\text{kg m}^{-3}$ .

**barium chromate.** *Noun.*  $\text{BaCrO}_4$ . Used in the production of yellow and pale green overglaze colours. Density 4,500  $\text{kg m}^{-3}$ . Also known as **chrome yellow**.

**barium crown glass.** *Noun.* An optical crown glass containing barium oxide as a major component. See **optical crown glass**.

**barium diuranate.**  $\text{BaU}_2\text{O}_7$ . An orange-yellow powder used as a ceramic colourant, particularly for porcelain.

**barium ferrite.** *Noun.*  $\text{BaFe}_{12}\text{O}_{19}$ . A magnetic ceramic with the hexagonal **magnetoplumbite** structure; it has a high value of uniaxial anisotropy field and high coercive force which makes it stable in strong demagnetising fields; a high resistivity  $10^6 \Omega \text{ m}$ . Used as magnets in TV tubes. Several trade names: **Feroba**, **Magnadur**, **M-compounds**.

**barium flint glass.** *Noun.* An optical flint glass containing barium oxide as a major component. See **crown glass**, **optical**.

**barium fluoride.** *Noun.*  $\text{BaF}_2$ . Used as an opacifier and flux in porcelain-enamels. Mp 1,280 °C; density 4,832  $\text{kg m}^{-3}$ .

**barium fluosilicate.** *Noun.*  $\text{BaSiF}_6$ . Used as a flux and an opacifier in porcelain-enamels and glazes. Decomposes at 300 °C; density 4,300  $\text{kg m}^{-3}$ . Also known as **barium silicofluoride**.

**barium glass.** *Noun.* A glass in which part of the calcium oxide component is replaced by barium oxide.

**barium hydroxide.** *Noun.*  $\text{Ba}(\text{OH})_2$ . Used in some ceramic formulation as the source of barium oxide. Also known as **baryta**. See **barium octahydrate**.

**barium iron arsenide.** *Noun.*  $\text{BaFe}_2\text{As}_2$ . The **archetype** of a series of high temperature superconductors that do not contain  $\text{CuO}_2$  layers in the structure.  $\text{Sr}_{0.6}\text{K}_{0.4}\text{Fe}_2\text{As}_2$ , for example has a  $T_c$  value of 32 K.

**barium metaphosphate.** *Noun.*  $\text{Ba}(\text{PO}_3)_2$ . Used as a precoating treatment for metals to prevent primary **boiling** in sheet steel enamels, and as an ingredient in certain types of **bright** glass. Mp 849 °C.

**barium molybdate.** *Noun.*  $\text{BaMoO}_4$ . Used as an opacifier and adherence-promoting agent in porcelain-enamel compositions. Mp  $> 1,300^\circ\text{C}$ ; density  $4,652\text{ kg m}^{-3}$ .

**barium monohydrate.** *Noun.* Precipitated barium hydroxide used in the manufacture of **barium ferrite** magnets.

**barium niobate.** *Noun.*  $\text{Ba}_6\text{Nb}_2\text{O}_{11}$ . An electroceramic with various applications. Mp  $1,927^\circ\text{C}$ ; density  $5,982\text{ kg m}^{-3}$ .

**barium nitrate.** *Noun.*  $\text{Ba}(\text{NO}_3)_2$ . Used to improve homogeneity and opacity in porcelain-enamels and as an ingredient in optical glasses. Mp  $575^\circ\text{C}$ ; density  $3,244\text{ kg m}^{-3}$ . Also known as **nitrobarite**.

**barium octahydrate.** *Noun.*  $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$ . Used in ceramics as a source of high purity  $\text{BaO}$ . Loses water of crystallisation at  $78^\circ\text{C}$ ; mp of anhydrous  $\text{Ba}(\text{OH})_2$   $408^\circ\text{C}$ ; density  $1,656\text{ kg m}^{-3}$ . Also known as **barium hydroxide**.

**barium osumilite.** *Noun.*  $\text{BaMg}_2\text{Al}_6\text{Si}_9\text{O}_{20}$ . A refractory aluminosilicate **glass ceramic** with potential use in gas turbines for power generation.

**barium oxide.** *Noun.*  $\text{BaO}$ . A yellowish-white solid. Used as a fluxing ingredient in glass and in the Brin process to fix oxygen because when heated in air it goes reversibly to  $\text{BaO}_2$ . Mp  $1,923^\circ\text{C}$ ; density  $5,722\text{ kg m}^{-3}$ ; hardness (Mohs) 3.5. Also called **baryta** and **baria**.

**barium peroxide.** *Noun.*  $\text{BaO}_2$ . Has limited use in glass manufacture; strong oxidising agent; source of hydrogen peroxide when added to sulphuric acid. Mp  $450^\circ\text{C}$ ; decomposes at  $800^\circ\text{C}$ ; density  $4,580\text{ kg m}^{-3}$ .

**barium phosphate.** *Noun.*  $\text{Ba}_3(\text{PO}_4)_2$ . An orthophosphate that is sometimes used as a gunnable refractory to repair furnace linings. Mp  $1,727^\circ\text{C}$ ; density  $4,100\text{ kg m}^{-3}$ .

**barium phosphide.** *Noun.*  $\text{Ba}_3\text{P}$ . Source of phosphine when treated with acid. Density.  $3,180\text{ kg m}^{-3}$ ; hardness Vickers  $3\text{ GN m}^{-2}$ .

**barium propoxide.** *Noun.*  $\text{Ba}(\text{OC}_3\text{H}_7)_2$ . An alkoxide soluble in propanol that is used to prepare ceramic precursor sols and gels.

**barium silicate.** *Noun.* Several ionic and sheet structured silicates (1)  $\text{BaSiO}_3$ . A **pyroxene** chain silicate containing two dimensional chains of  $[\text{SiO}_4]^{2-}$  tetrahedra sharing two corners; mp  $1,640^\circ\text{C}$ ; density  $4,400\text{ kg m}^{-3}$ . (2)  $\text{Ba}_2\text{SiO}_4$ . A discrete ionic **orthosilicate** containing  $[\text{SiO}_4]^{4-}$  tetrahedral anions; mp approximately  $1,755^\circ\text{C}$ ; density  $5,200\text{ kg m}^{-3}$ . (3)  $\text{BaSi}_2\text{O}_5$ . A two dimensional sheet silicate structure; mp  $1,640^\circ\text{C}$ ; density  $4,405\text{ kg m}^{-3}$ . (4)  $\text{Ba}_2\text{Si}_3\text{O}_8$ . A fibrous silicate; mp  $1,449^\circ\text{C}$ ; density  $3,930\text{ kg m}^{-3}$ .

**barium sodium niobate.** *BNN. Noun.*  $\text{Ba}_2\text{NaNb}_3\text{O}_{15}$ . A piezoelectric material used to detect infrared radiation.

**barium stannate.** *Noun.*  $\text{BaSnO}_3 \cdot 3\text{H}_2\text{O}$ . Used as an additive to barium titanate bodies to decrease the **Curie temperature** when they are needed for use as capacitors of high **dielectric constant**. Also used in glass-enamels to improve alkali resistance. Loses  $\text{H}_2\text{O}$  at  $280^\circ\text{C}$ .

**barium sulphate.** *Noun.* See **blanc fixe**.

**barium sulphide.** *Noun.*  $\text{BaS}$ . Used to manufacture crucibles for melting cerium and uranium. Mp  $1,660^\circ\text{C}$  and may be fired in bodies that it will vaporise at  $1,600^\circ\text{C}$ ; density  $4,250\text{ kg m}^{-3}$ .

**barium tantalum oxynitride.** *Noun.*  $\text{BaTaO}_2\text{N}$ . A deep brown coloured **perovskite** dielectric capable of being sintered in a reducing atmosphere, which allows the use of metals other than Pt for electrodes to be sintered in place during processing.

**barium thorate.** *Noun.*  $\text{BaThO}_3$ . A perovskite phase; mp  $2,299^\circ\text{C}$ ; density  $7,660\text{ kg m}^{-3}$ .

**barium tin borate.** *Noun.*  $\text{BaSn}(\text{BO}_3)_2$ . A low-sintering-temperature metaborate used as a multilayer substrate.

**barium titanate.** *Noun.* A general name for several barium titanium oxides used in devices involving **piezoelectric** effects and magnetic properties such as guided missiles, ultrasonic generators, electronic filters, accelerometers etc. Compositions are: (1)  $\text{BaTiO}_3$ ; a **perovskite**; **ferroelectric** ceramic with **polymorphic** phase transition enhancement of piezoelectric performance;  $d_{33} = 190\text{ pC N}^{-1}$  but low Currie temperature,  $T_c = 120^\circ\text{C}$  limits use to sonar and record player needles; mp  $1,618^\circ\text{C}$ . (2)  $\text{BaTi}_2\text{O}_5$ ; mp  $1,320^\circ\text{C}$ . (3)  $\text{BaTi}_3\text{O}_7$ ; mp  $1,356^\circ\text{C}$ . (4)  $\text{BaTi}_4\text{O}_9$ ; mp  $1,420^\circ\text{C}$ ; density  $4,600\text{ kg m}^{-3}$ ; a dielectric resonator ceramic with frequency  $4\text{ GHz}$ . (5)  $\text{Ba}_2\text{Ti}_9\text{O}_{20}$ ; a dielectric resonator ceramic.

**barium titanium silicate.** *Noun.* (1)  $\text{BaTiSiO}_5$ ; mp  $1,398^\circ\text{C}$ . (2)  $\text{BaTiSi}_2\text{O}_7$ ; mp  $1,248^\circ\text{C}$ ; discrete ionic silicate containing the double tetrahedral  $(\text{Si}_2\text{O}_7)^{6-}$  anion.

**barium tungstate.** *Noun.*  $\text{BaWO}_4$ . Used as a white pigment and as a phosphor in ultraviolet radiation. Density  $5,040\text{ kg m}^{-3}$ .

**barium zirconate.** *Noun.*  $\text{BaZrO}_3$ . Another **perovskite** used as an addition to barium titanate bodies to improve their dielectric properties. Mp  $2,620^\circ\text{C}$ ; density  $2,630\text{ kg m}^{-3}$ .

**Barker-Truog clay treatment.** *Noun.* An alkali treatment for clay to obtain pH values ranging from 7 to 10, depending on the original acidity of the clay; such clays exhibit improved plasticity, which aids the shaping of brick.

**Barkhausen effect.** *Noun.* The succession of abrupt changes in magnetisation occurring when the magnetising force acting on a magnetic material is varied.

**Barlow's formula.** *Noun.* Used to calculate wall thickness in composite laminate pipes  $t = P \cdot r \cdot d / 2a$ , where  $t$  is the wall thickness,  $P$  the working pressure,  $d$  the pipe inside diameter, and  $a$  is the design stress.

**bar mat.** *Noun.* A mat of preassembled steel bars for installation as reinforcement in a concrete slab, usually a paving slab.

**bar mould.** *Noun.* A mould in which the inlets are arranged in rows on separate bars, each of which may be removed individually.

**barn. b.** *Noun.* A unit of area equal  $10^{-28} \text{ m}^2$ . Used as a convenient scale to measure the cross-sectional area of atomic nuclei. Colloquially derived from "as wide as a barn door" as far as nuclear bombardment is concerned.

**barometer.** *Noun.* An instrument designed to measure the pressure of the atmosphere.

**barophoresis.** *Noun.* The diffusion of suspended particles at a rate dependent on external forces.

**baroque.** *Noun.* (1) A style of decoration and architecture characterised by excessive ornamentation. Flourished from sixteenth to eighteenth centuries in Europe. (2) *Adjective.* Of pearls: irregularly shaped.

**barrel.** *Noun.* (1) A unit of measure of cement equal to 170.9 kg or four sacks. (2) The cylindrical portion of an extruder or injection-moulding machine containing the screw plunger.

**barrel finishing.** *Verb.* Improving the surface or removing burrs from the edges of work by tumbling the work in a rotating cylinder containing suitable particles or grains of abrasives.

**barrel vault.** *Noun.* An arch roof having the form of a half cylinder unbroken by joints.

**barrier.** *Noun.* A panel, wall, or other structure designed to bar or deflect the passage of something, such as a baffle placed to deflect combustion gases in a furnace from impinging on ware being fired.

**barrier voltage.**  $V_{gb}$ . *Noun.* The voltage drop across the grain boundary caused by the application of an extended voltage to a **varistor**; typically 2–4 V/grain boundary.

**barrier, moisture.** *Noun.* See **moisture barrier**.

**bar, runner.** *Noun.* See **runner bar**.

**bars, Holdcroft.** *Noun.* See **Holdcroft bars**.

**barye.** *Noun.* A unit of pressure in the cgs system equal to  $1 \text{ dyn cm}^{-2}$ . It is equivalent to 1 microbar.

**baryon.** *Noun.* Elementary particle with a spin of  $1/2$  involved in strong interactions. Baryons include protons and neutrons.

**baryta.** *Noun.* (1)  $\text{Ba(OH)}_2$ . A white solid mp  $408^\circ \text{C}$ . See **barium octahydrate**. (2) Common name for **barium oxide**,  $\text{BaO}$ . See **barium hydroxide**.

**barytes.** *Noun.*  $\text{BaSO}_4$ . A colourless or white mineral of barium sulphate in its rhombic crystal form occurring in **sedimentary rocks**. Used as a flux in glasses to reduce **seeds**, increase toughness, improve brilliance, and reduce annealing time; also used in ceramic bodies, glazes, and porcelain-enamels to minimise or prevent scumming. Mp  $1,580^\circ \text{C}$ ; density  $4,300\text{--}4,600 \text{ kg m}^{-3}$ ; hardness (Mohs) 2.5–3.5. Also known as **barite**, **blanc fixe**, and **heavy spar**.

**basal plane.** *Noun.* The plane perpendicular to the  $c$ -axis in a hexagonal or tetragonal structure. In the hexagonal system denoted as (0001), packing such planes in the sequence ... ABABAB ... generates an ideal close-packed hexagonal structure such that the  $c/a$  ratio is 1.633.

**basalt.** *Noun.* (1) A crystalline basic high-silica-content volcanic rock composed essentially of soda-lime **feldspar**, **pyroxene**, **magnetite**, **olivine**, **magnesite**, and **ilmenite**, all with very small grain sizes. (2) A black unglazed form of pottery resembling **basalt**.

**basalt, fusion-cast.** *Noun.* See **fusion-cast basalt**.

**basalt lava.** *Noun.* Ground volcanic lava that melts into a dark brown glass at **stoneware** temperatures; used as a basis for coloured and **tenmoku** glazes. See **Pele's hair**.

**basaltware.** *Noun.* A hard, black, fine grained, unglazed vitreous **stoneware** having an appearance similar to that of **basalt** rock.

**basanite.** *Noun.* A black basaltic rock containing **plagioclase**, **augite**, **olivine** and **nepheline**. Formerly used as a **touchstone**.

**base.** *Noun.* (1) An alkaline substance, either ionic or molecular, that accepts protons from another substance or which will react with an acidic material. (2) The bottom of a container, bottle, or other item. (3) The compacted earth or granular material upon which a paving slab is placed. (4) The foundation that supports a printed circuit or the pins, leads, or other terminals of a bulb or tube to which an external electrical or electronic connection is to be made. (5) The middle region of a **transistor** between the **emitter** and the **collector**.

**base coat.** *Noun.* A fired coating over which another coating is applied.

**base course.** *Noun.* The concrete foundation over which a wall, pavement, or other structure is to be erected or placed.

**base exchange.** *Noun.* A surface property exhibited by colloidal inorganic materials, such as clays, whereby certain anions are replaced by other ions from a surrounding medium.

**base metal.** *Noun.* The metal to which porcelain-enamel is applied.

**base unit.** *Noun.* Any of the fundamental units in measurement system. The SI base units are: **metre, kilogram, second, ampere, kelvin, candela, and mole.**

**basic.** *Adjective.* (1) Of, denoting, or containing a base; alkaline. (2) Of a salt containing hydroxide or oxide groups all of which have not been replaced by an acid radical. (3) Of, concerned with, or made by a process in which the furnace or converter equipment is made from a basic material, such as **magnesia**. (4) Of **igneous rocks**, such as **basalt** containing less than 50 % silica.

**basic brick, direct-bonded.** *Noun.* See **direct-bonded basic brick.**

**basic brick, pitch-bonded.** *Noun.* See **pitch-bonded basic brick.**

**basic brick, pitch-impregnated.** *Noun.* See **pitch-impregnated refractories.**

**basic fibre.** *Noun.* Untreated glass fibre as it is obtained from the forming equipment.

**basicity.** *Noun.* The extent to which a substance is basic.

**basic lava.** *Noun.* Magma with a high alkaline content, which results in rapid smooth flow. The surface solidifies but the centre still flows and wrinkled rocks arise. Such wrinkled rocks are called **ropy lavas**. See **acid lava**.

**basic lead carbonate.** *Noun.*  $\text{Pb}_3(\text{CO}_3)_2(\text{OH})_2$ . A white pigment. See **white lead** and **hydrocerussite**.

**basic-lined.** *Adjective.* A furnace, kiln, converter, or similar structure lined with basic refractory shapes made of materials such as lime, magnesite, chrome ore, etc.

**basic open-hearth furnace.** *Noun.* An open-hearth furnace constructed of basic refractories covered with **magnesite** or **burned dolomite**, and which is employed in the production of basic pig iron.

**basic oxide.** *Noun.* A metallic oxide that will react chemically with acidic materials.

**basic refractory.** *Noun.* A refractory composed of basic refractory materials, such as lime, magnesite, chrome magnesite, etc., and which will react with acidic slags or fluxes at elevated temperatures.

**basic slag.** *Noun.* A slag rich in basic ingredients produced as a by-product in the steel-making process; used in fertiliser formulations because it contains large amounts of calcium phosphate.

**basic structural unit.** *BSU. Noun.* A term now being used in the new polymorphs of carbon area where a BSU is an isolated polyaromatic entity less than 1 nm diameter.

**basket, pickle.** *Noun.* See **pickle basket**.

**basket weave.** *Noun.* One of the weaving formats where two more warp yarns are threaded through two or more yarns. Fabrics with these weaves are more pliable and easily formed to curved shapes.

**basket-weave chequer work.** *Noun.* An arrangement of corrosion-resistant refractory brick serving as flues in **regenerators** and other structures in which the ends of each brick are placed at right angles to the centre of each adjacent brick to form a pattern resembling the weave of the splints in a basket.

**bas-relief.** *Noun.* A type of **artware** in which the figures project slightly above the background surface.

**basse taille.** *Noun.* A process in which transparent or translucent porcelain-enamels are applied and fired over a metal background that has been carved in low relief.

**bastard ganister.** *Noun.* A mineral that has the appearance of **ganister** but having substantially different properties.

**bastnäsite.** *Noun.*  $\text{LnFCO}_3$ . A yellow-brown fluorocarbonate mineral containing amounts of **lanthanides** up to 70 % rare earth oxides by weight. A particular source of dysprosium oxide.

**bat.** *Noun.* (1) A plaster slab or disk upon which clay is worked, or upon which ware is formed and dried. (2) A fireclay slab upon which ware is placed and fired in a kiln. (3) A fragment of hardened clay or brick. (4) A slab of moist clay. (5) A brick cut transversely so as to leave one end whole. (6) A sheet of gelatine used in bat printing. A tangled mass of single filament fibres. Also called **batt** or **web**.

**batch.** *Noun.* A quantity of raw materials blended together for subsequent processing, such as a glass batch or furnace charge.

**batch blanket.** *Noun.* The solid layer of new ingredients added to a glass making furnace. The first part in the first stage in a modular melting industrial glassmelting process. It is where the batch materials enter and are heated to about 1,200 °C. This is achieved in part by a strong return flow of hot glassmelt and from the top by burning gas. See **modular glass making**.

**batch blending.** *Noun.* Stepwise changes in the composition of a batch to arrive at a desired composition of a final product.

**batch charger.** *Noun.* A mechanical device employed to introduce a batch into a smelter or melting tank.

**batch drier.** *Noun.* A periodic drier, in which the ware being dried remains stationary in a circulating stream of usually warm or hot air, until dry.

**batcher.** *Noun.* A type of equipment in which the ingredients of a batch are measured and collected before discharging into a process operation, such as a ball mill or concrete mixer.

**batch feeder.** *Noun.* A mechanical device, such as an **auger**, employed to charge a glass or porcelain enamel batch into a melting tank or smelter.

**batch-free time.** *Noun.* The time needed to complete the melting reactions in a glass melt. Consists of the time to heat the batch to reaction plus the time to complete the vigorous initial melt, plus the time to dissolve the residual sand grains.

**batch furnace.** *Noun.* A furnace into which ware is charged, fired, and removed before the introduction of another charge.

**batch house.** *Noun.* The area in a factory in which materials are received, stored, handled, weighed, and mixed preparatory for movement to a subsequent manufacturing operation.

**batching sequence.** *Noun.* The process of introducing raw materials into a batch mixer or process in an ordered, stepwise sequence.

**batch operation, contact.** *Noun.* See **contact batch operation**.

**batch process.** *Noun.* A manufacturing operation or process that is carried to completion before the same operation or process is repeated; that is, the process is not continuous.

**batch, raw.** *Noun.* See **raw batch**.

**batch smelter.** *Noun.* A periodic smelter or glass-melting tank into which a charge is introduced, melted, and discharged as a unit process in accordance with a prescribed time and temperature cycle.

**batch truck.** *Noun.* A dump truck in which the body is partitioned into compartments for the transport of weighed batches of cement and aggregate from the weighing areas to the mixer.

**batch-type mixer.** *Noun.* A machine into which all ingredients of a batch are weighed, mixed, and discharged as a unit operation before introduction of a subsequent charge.

**bath.** *Noun.* (1) A liquid preparation, such as water, cleaner, acid, neutraliser, or other solution, in which something is immersed for treatment. (2) Liquid penetrants into which parts are immersed for inspection.

**batholith.** *Noun.* Enormous igneous masses in the central core of major folded mountain ranges. During the cooling of these bodies major sulphide ore deposits are made.

**Bath stone.** *Noun.* A type of **limestone** found near Bath and used as a building stone.

**bat.** *Noun.* An alternative spelling of bat. See **bat**.

**batten.** *Noun.* A thin strip of material employed to seal, conceal, or reinforce a joint as, for example, a strip of flat or corrugated asbestos cement used to conceal butt joints of flat or corrugated asbestos-cement sheets.

**batter.** *Noun.* The upward slope or the angle at which the outer face of a wall slopes from the vertical.

**batteries.** *Plural noun.* Devices containing two or more primary **cells** usually connected in series. See **cell**.

**battery management.** *Noun.* The control of charging and discharging conditions by temperature, cut-off voltage and current.

**batt printing.** *Noun.* A process for printing on ceramic ware in which a design is transferred from an engraving plate to ware by means of a **bat** of solid glue or gelatine.

**bat wash.** *Noun.* A slurry of refractory materials applied to **kiln setters** to prevent the sticking of ware during firing.

**Baumé.** *Noun.* Either of two calibrated hydrometer scales to estimate the specific gravity of liquids. For liquids less dense than water, the specific gravity equals  $140/(130 + ^\circ\text{Be})$  at  $15.6^\circ\text{C}$ ; for liquids more dense than water, the specific gravity equals  $145/(145 - ^\circ\text{Be})$  at  $15.6^\circ\text{C}$ .

**Bauschinger effect.** *Noun.* The observation that if a specimen is lightly deformed in one direction and then immediately reloaded in the opposite direction it begins to flow in this direction at a reduced yield stress.

**bauxite.** *Noun.*  $\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ . Aluminium ore, found as clay-like rocks consisting largely of hydrates of **alumina**, together with varying amounts of iron and titanium oxides, silica, and other impurities. Bauxites fuse at  $1,800^\circ\text{C}$  and above, and have densities varying from  $2,450$  to  $3,250 \text{ kg m}^{-3}$ . As a major source of alumina, bauxites are employed extensively in the manufacture of grinding wheels, abrasive stones, abrasive cloth and paper, polishing and grinding powders, refractories for **kilns** and **glass tanks**, **electroceramics**, and quick-setting alumina cements.

**bauxite clay.** *Noun.* A natural mixture of bauxite and clay containing not less than 47 % or more than 65 % of alumina on a **calcined** basis.

**bayerite.** *Noun.*  $\alpha\text{-Al}(\text{OH})_3$ .  $\alpha$ -Aluminium trihydroxide which in old notation was called beta **alumina trihydrate**. The structure contains  $\text{Al}(\text{OH})_6$  octahedra in layers, stacked in the hexagonal sequence with the layers linked together by hydrogen bonds; rarely found in nature but made by several commercial methods.

**Bayer process.** *Noun.* A process in which aluminium ores are digested in hot solutions of caustic soda and the aluminium is removed as soluble **aluminates**. Further treatments can either lead to pure **alumina** or aluminium metal.

**Bayer red mud.** *Noun.* A complex mixture of waste products arising in large amounts from the **Bayer process**. It typically contains silica, alumina, iron oxide, titania, sodium compounds and has an alkaline pH. For every tonne of alumina powder produced in the **Bayer process** there is 1 tonne of red mud.



**B-basis.** *Noun.* Any stated mechanical property value above which 90 % of all test values should fall within a confidence limit of 95 %.

**BBO.** *Abbreviation.* Stands for barium borate. See **barium borate**.

**BCS theory.** *Noun.* See **Bardeen-Cooper-Schrieffer theory**.

**\*Be.** *Symbol.* Stands for Baumé. See **Baumé**.

**bead.** *Noun.* (1) An enlarged, rounded edge of a glass tumbler or other glass article. (2) An excess of porcelain-enamel slip or powder along the edge of a coated ware. (3) An application of porcelain enamel, usually of a contrasting colour to the edge or rim of a porcelain-enamelled article. (4) A small piece of glass tubing used to enclose a lead wire. (5) A ceramic insulator through which passes the inner conductor of a coaxial transmission line and by means of which the inner conductor is supported in a position coaxial with the outer conductor. (6) A spherical glass or pottery sample through the centre of which a hole has been drilled to allow it to be strung for decorative use.

**beader.** *Noun.* An operator who applies a beading enamel to a porcelain-enamelled article.

**beader-off.** *Noun.* An operator who removes a bead of excess porcelain-enamel or smooths the edges of the coating on porcelain-enamelled ware.

**beading.** *Verb.* (1) To apply porcelain-enamel, usually of a contrasting colour, to the edges of rims of porcelain-enamelled articles. (2) To remove excess slip from the edge of dipped ware.

**beading enamel.** *Noun.* Any of the special porcelain-enamels applied as a beading on ware for purposes of decoration and protection of exposed edges of the ware.

**bead test.** *Noun.* A test of the softening and flow characteristics of glaze, glass, and porcelain-enamel compositions in which a bead or button-like specimen of specified size and shape is compared with standard compositions at elevated temperatures.

**bead thermistor.** *Noun.* A **thermistor** consisting of two wire leads cemented together by a molten droplet of a semiconducting material, such as **nickel oxide**, NiO.

**beam, reinforced.** *Noun.* See **reinforced beam**.

**bearer arch.** *Noun.* One of a series of arches that supports the **checkerwork** in a **regenerator** or heat exchanger that heats air or gas before combustion.

**bearing zone.** *Noun.* The middle region of a fibre or wire drawing die where the final diameter and surface finish of the wire or fibre are determined. See **die zones**.

**Becke lines.** *Plural noun.* Lines that appear at the edges of a microscope image of a fibre caused by refraction at the fibre edge.

**beckelite.** *Noun.*  $\text{Ca}_3(\text{Ce}, \text{La}, \text{Y})_4(\text{Si}, \text{Zr})_3\text{O}_{15}$ . A yellow coloured mineral used as a source of cerium.

**Becquerel.**  $\text{B}_q$ . *Noun.* The **SI unit** of radioactive decay; one  $\text{B}_q$  is equal to one radioactive decay per second. Usually quoted as  $\text{B}_q \text{ g}^{-1}$  or  $\text{B}_q \text{ cm}^2$  to define the mass or area of contamination.

**becquerelite.** *Noun.*  $\text{UO}_2 \cdot 2\text{H}_2\text{O}$ . Small yellow crystals of hydrated **uranium dioxide** occurring on the surface of **pitchblende**.

**bed.** *Noun.* (1) The layer of mortar upon which brick and stone are laid. (2) The prepared base or foundation upon which ware is placed for processing, such as the floor of a kiln.

**bedded tuff.** *Noun.* A layered rock formed from volcanic ash. See **tuff**.

**bed depth, critical.** *Noun.* See **critical bed depth**.

**bedder.** *Noun.* A plaster-of-Paris shape for forming a bed of powdered **alumina** on which **bone china** is fired.

**bedding.** *Verb.* To place ceramic ware in a suitable refractory grain or powder as a support to prevent warpage during firing.

**bedding course sand.** *Noun.* Well-graded, free-draining, mechanically resistant sand placed below **clay pavers** in flexible pavements to provide a uniform support for the pavers and prevent stress concentrations that could cause damage.

**bed, expanded.** *Noun.* See **expanded bed**.

**bed, fluidised.** *Noun.* See **fluidised bed**.

**bed, intermittent-moving.** *Noun.* See **intermittent-moving bed**.

**bedrock.** *Noun.* The solid, unweathered rock that lies beneath the soil etc.

**beehive kiln.** *Noun.* A circular beehive-shaped kiln characterised by a domed roof and fired through chambers stationed around the circumference.

**Beer-Lambert law.** *Noun.* Layers of equal thickness of a homogeneous material absorb equal proportions of light. This is expressed as  $I = I_0 \exp(-ad)$ , where  $I$  is the intensity of the transmitted light,  $d$  is the layer thickness, and  $a$  is a constant known as the absorption coefficient;  $a$  is dependent on the wavelength of light used and the structure and composition of the material.

**Beevers-Ross site.** *Noun.* Positions formed by hexagonally close-packed  $\text{O}^{2-}$  ions on the mirror planes of  $\beta\text{-Al}_2\text{O}_3$ ; two types of site exist and are occupied by the  $\text{M}^{n+}$  ions, one is directly above an  $\text{O}^{2-}$  in the **spinel** layer and one above an **interstitial site** in the spinel layer. Movement of  $\text{M}^{n+}$  within these sites is responsible for fast ion conduction in  $\beta\text{-Al}_2\text{O}_3$ .

**beidellite.** *Noun.*  $(\text{Al}_{1.53}\text{Fe}_{0.2}\text{Mg}_{0.25})(\text{Si}_{3.88}\text{Al}_{0.12})\text{O}_{10}(\text{OH})_2$ . A **montmorillonite** three-sheet 2:1 layer-lattice clay mineral in which magnesium substitutes for aluminium in octahedral sites and some silicon is substituted by aluminium in tetrahedral sites.

**bel, b or B.** *Noun.* A unit for comparing two power levels. If two power levels to be compared are  $P_1$  and  $P_2$  the power ratio is  $\log_{10}(P_1/P_2)$  bel. Since the bel is particularly large it is more common to use a subunit, the **decibel**, which is one tenth of a bel.

**belemnite.** *Noun.* A fossil found in the Pee Dee formation in South Carolina that is used as the main standard for carbon isotope determination. See **mille**.

**Belgian kiln.** *Noun.* A longitudinal-arch, side-fired kiln in which the fire is directed to grates stationed at regular intervals along the bottom of the structure.

**belite.** *Noun.* One of the main constituents of **Portland cement** and is the colloquial name used to describe one of the four known **polymorphs** of the **orthosilicate**  $\text{Ca}_2\text{SiO}_4$ . It reacts with water to form a paste able to develop compressive strength. In **cement notation** it is  $\text{C}_2\text{S}$ .

**bell.** *Noun.* (1) The enlarged end of a concrete or other pipe that overlaps the end of an adjoining pipe. (2) A refractory funnel placed to receive molten steel from the nozzle of a ladle.

**bellarmine.** *Noun.* A fat, narrow-necked, **salt-glazed** bottle or jug usually having a bearded face stamped or engraved on the neck as a decoration.

**bell damper.** *Noun.* A bell-shaped, sand-seal type of damper frequently used in **annular kilns**.

**bell dresser.** *Noun.* A tool consisting of rotating metal cutters employed in the truing, shaping, and dressing of grinding wheels.

**Belleek china.** *Noun.* Thin, highly translucent chinaware having zero water absorption, which is composed of a body containing substantial amounts of frit, and which normally, is coated with a soft lustre glaze. Named after the town in Ireland where it was first made.

**bell glass.** *Noun.* See **bell jar**.

**bell jar.** *Noun.* A bell-shaped glass cover used to prevent gases escaping in experiments and to cover apparatus. Also called **bell glass**.

**belly.** *Noun.* (1) The side of a clay pot. (2) The section of a converter in which steel is collected before it is poured. (3) The widest section of a blast furnace.

**Belshazzar.** *Noun.* A wine bottle of approximately 16-quart capacity or 15.1 litres.

**belt.** *Noun.* An endless flexible band passing around two or more pulleys; used to convey materials or objects, or to transmit motion from one pulley to one or more other pulleys.

**belt conveyer.** *Noun.* An endless belt running between head and tail pulleys used to transport loose materials or products from one point to another.

**belt drive.** *Noun.* A mechanism actuating a **ball mill** or other item of equipment by means of a friction belt rotating around a pulley mounted on a rotating shaft.

**belt feeder.** *Noun.* A mechanical device that delivers raw materials from one point to a processing station by means of a moving belt.

**belt grinding.** *Verb.* To grind the surface of a material or product by means of a continuous abrasive-coated belt.

**belting.** *Verb.* A finishing operation for concrete pavement in which a wide belt is dragged back and forth across a fresh slab of concrete and advanced along the slab.

**belt kiln.** *Noun.* A kiln through which ware being fired is transported by means of an endless, high-temperature-resistant alloy belt.

**belt marks.** *Noun.* Marks made on the bottom of glass articles as they ride through the **lehr** on a slightly overheated chain belt.

**belt, segmented.** *Noun.* See **segmented belt**.

**bench.** *Noun.* The floor of a **pot furnace**, often called **siege**.

**bench grinder.** *Noun.* An offhand grinding machine supported on a bench, the grinding mechanism consisting of one or two grinding wheels mounted on a horizontal spindle.

**bench marks.** *Noun.* Striations on a fatigue fracture surface showing where the crack front was held between moves forward.

**bench moulding.** *Verb.* The hand tool production of small moulds at a bench.

**bench scale.** *Adjective.* A process, test, or other procedure carried out on a small scale as on a laboratory bench or worktable.

**bend.** *Noun.* A pane of glass that has been bent to fit an opening. See **bending**.

**bending.** *Verb.* To manipulate glass in a kiln, particularly flat glass, to form curved shapes or bends.

**bend test.** *Noun.* (1) A measure of the transverse or cross-bending strength. (2) A test in which **bisque** or fired porcelain-enamelled panels are distorted by bending to determine the resistance of the coating to cracking or fracture.

**benefication, beneficiation.** *Noun.* Any process of upgrading or improving the physical or chemical properties of a mineral to enhance its use, such as washing, **flotation**, etc.

**benitoite.** *Noun.*  $\text{BaTiSi}_3\text{O}_9$ . A **ring silicate** containing  $[\text{Si}_3\text{O}_9]^{6-}$  discrete ions formed from three corner-sharing  $[\text{SiO}_4]^{4-}$  tetrahedra.

**ben glass.** *Noun.* Flat glass that has been shaped into cylindrical, curved, or other shapes while hot.

**beptonite.** *Noun.* Clay derived from volcanic ash and characterised by an extremely fine grain size. Its main constituent is **montmorillonite**, plus 5–10 % of alkalis or alkaline earth oxides. One type, which absorbs large quantities of water, swells enormously. It is used to increase dry and fired strengths and reduce absorption in whiteware bodies; also used as a **suspension agent** in porcelain-enamel slips. See **montmorillonite**.

**berlinite.** *Noun.*  $\text{AlPO}_4$ . A phosphate with the quartz structure.

**bernalite.** *Noun.*  $\text{Fe}(\text{OH})_3$ . A rare greenish coloured iron oxide with a **perovskite** structure.

**Bernal-stacking.** *Noun.* Carbon atoms in the second layer of **graphene** sheets are positioned above the centres of hexagons in the first layer. This is the structure of **bilayer graphene**. Also known as AB-stacking.

**bertrandite.** *Noun.*  $\text{BeSi}_2\text{O}_5 \cdot \text{H}_2\text{O}$ . A major ore of beryllium in the form of hydrated beryllium disilicate.

**beryl.** *Noun.*  $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$ . A **ring silicate** inert to most reagents except hydrofluoric acid; employed as a **dielectric**, to reduce firing shrinkage, and to improve transverse strength, resistance to thermal shock, and improve electrical resistance in spark plug bodies; used in mat glazes for **talc** bodies, as a green colorant in other glazes, and in the production of glass windows for x-ray tubes. Gem varieties are **aquamarine** and **emerald**. Mp 1,410 °C; density 2,640–2,800  $\text{kg m}^{-3}$ ; hardness (Mohs) 7.5–8.

**beryl-ceramics.** *Plural noun.* Refractory compositions containing **beryllium oxide**.

**beryllia.** *Noun.* Ceramic nomenclature for beryllium oxide. See **beryllium oxide**.

**beryllides.** *Plural noun.* Refractory hard compounds in which one element is beryllium, the general formula being  $\text{Me}_x\text{Be}_y$ ; characterised by high melting temperatures ranging from approximately 1,427 to 2,080 °C; excellent resistances to oxidation up to 1,260 °C and some to as high as 1,540 °C; high strength with strength retention at elevated temperatures, and excellent thermal-shock resistance; reported **specific heats** range from 796 to 1,600  $\text{J kg}^{-1} \text{K}^{-1}$ ; **thermal conductivities** range from 0.44 to 1.41  $\text{J s}^{-1} \text{K}^{-1}$  between 371 and 1,483 °C; linear thermal expansions of about 2 % at 1,371 °C; bend strengths of about 173  $\text{MN m}^{-2}$  between 21 and 1,231 °C; **Vickers hardness** values between 5 and 13  $\text{GN m}^{-2}$  and Young's modulus around 258  $\text{GN m}^{-2}$  at 21 °C; potential materials for use in structural applications and spark-resistant tools.

**berylliosis.** *Noun.* An incapacitating lung disease caused by the inhalation of beryllium containing dusts.

**beryllium.** *Noun.* Be. A metalloid ceramic with toxic properties. A component in a number of special ceramics. Density 1,848  $\text{kg m}^{-3}$ ; mp 1,289 °C.

**beryllium aluminate.** *Noun.*  $\text{BeAl}_2\text{O}_4$ . An **olivine** even though formula suggests a **spinel**; mp 1,870 °C; density 3,500–3,840  $\text{kg m}^{-3}$ ; hardness (Mohs) 8.5. Also known as **chrysoberyl**.

**beryllium boride.** *Noun.*  $\text{Be}_2\text{B}$ ;  $\text{BeB}_2$ ;  $\text{BeB}_6$ . See **borides**.

**beryllium carbide.** *Noun.*  $\text{Be}_2\text{C}$ . Employed as a neutron **moderator** in nuclear applications and in applications where hardness, toughness, elasticity, and corrosion resistance at moderately high temperatures are important. Decomposes above 2,950 °C; unstable in oxygen above 982 °C; density 1,900  $\text{kg m}^{-3}$ ; hardness (Mohs) approximately 9; modulus of rupture 0.11  $\text{GN m}^{-2}$ ; compressive strength 72.4  $\text{GN m}^{-2}$ .

**beryllium nitride.** *Noun.*  $\text{Be}_3\text{N}_2$ . Used in incandescent mantles and in applications where hardness, elasticity, corrosion resistance and toughness at temperatures in the range 600–1,400 °C are required. Mp 2,200 °C; density 2,710  $\text{kg m}^{-3}$ ; oxidises in air above 600 °C.

**beryllium oxide.** *Noun.*  $\text{BeO}$ . A lightweight and rigid ceramic that exhibits excellent dielectric properties, good physical strength, resistance to wetting by metals and non-metals, and high thermal conductivity (ten times greater than **alumina**). Employed in rocket nozzles, crucibles, insulators, **radomes**, thermocouple protection tubes, microwave parts, solid-state devices, gyroscopes, as a **moderator**, reflector material, in some porcelain glazes and as a matrix for fuel elements in nuclear applications. Poisonous vapour. Mp 2,570 °C; density 3,016  $\text{kg m}^{-3}$ ; hardness (Mohs) 9. Also known as **beryllia**.

**beryllium silicate.** *Noun.*  $\text{Be}_2\text{SiO}_4$ . Mp 1,560 °C; density 2,990  $\text{kg m}^{-3}$ . Also known as **phenacite**.

**beryllosilicates.** *Plural noun.* Ceramics with three-dimensional structures made from corner sharing oxygen atoms in  $\text{SiO}_4$  and  $\text{BeO}_4$  tetrahedra. See **chkalovite**.

**Bessemer converter.** *Noun.* A refractory-lined vessel, in which, steel is produced by the **Bessemer process**.

**Bessemer process.** *Noun.* A process for making steel by blowing air through molten pig iron, whereby most of the carbon and impurities are removed by oxidation.

**BET.** *Acronym.* Stands for Brunauer-Emmett-Teller equation. See **Brunauer-Emmett-Teller equation**.

**beta activity.** *Noun.* A form of radioactivity in which the atomic nucleus emits an electron or positron accompanied by an uncharged anti-neutrino, or neutrino respectively.

**beta-alumina.** *Noun.* See **alumina-beta**.

**beta-eucryptite.** *Noun.*  $\beta$ -LiAlSiO<sub>4</sub>. The stable hexagonal solid solution of  **$\beta$ -quartz** present in some glass-ceramic compositions.

**beta particle.** *Noun.* An electron, of either positive or negative charge, which has been emitted by an atomic nucleus or neutron in the process of transformation.

**beta phase.** *Noun.* A **polymorph** of a material. See **quartz inversion**, **cristobalite**, **tridymite**.

**beta-plane.** *Noun.* Terminology used in the **electrical double layer model**. It is the outer surface of the first layer of water molecules adsorbed on an oxide surface. It is often disrupted by the presence of large-sized anions. The estimated **dielectric constant** of this water layer is 32. Also called the **outer Helmholtz plane**. See **d-plane** and **o-plane**.

**betatron.** *Noun.* Machine consisting of an evacuated circular tube used to accelerate electrons to energies around 100 MeV.

**betavoltaic.** *Noun.* A three-dimensional **p-n diode** formed in **porous silicon**. It is used to capture energetic electrons ( **$\beta$ -particles**) released in the radioactive decay of **tritium** absorbed within the pores and turn the **beta particle** energy directly to electric current.

**BeV.** *Acronym.* American term for GeV, which is an energy of 10<sup>9</sup> eV or 1.602 × 10<sup>-10</sup> J.

**bevel brick.** *Noun.* A brick with one edge or surface sloping to another surface at an angle that is not a right angle.

**bevelled pipe.** *Noun.* A pipe with an end angled to mate with a complementary pipe end.

**beveling.** *Verb.* To edge-finish flat glass to a desired bevel angle.

**beaverite.** *Noun.* Pb(Cu,Fe,Al)<sub>3</sub>SO<sub>4</sub>(OH)<sub>6</sub>. An hydrous mineral consisting of lead, copper, iron and aluminium sulphates existing as canary-yellow plates.

**BFRA.** *Abbreviation.* Standing for boron fibre-reinforced aluminium.

**BFRP.** *Abbreviation.* Standing for boron fibre-reinforced plastic.

**bias.** *Noun.* A constant or systematic error as opposed to random error, manifested as a persistent positive or negative deviation of the method average from the accepted reference value.

**B-H curve.** *Noun.* See **magnetisation curve**.

**BHD.** *Abbreviation.* Stands for baghouse dust. See **baghouse dust**.

**bias, statistical.** *Noun.* See **statistical bias**.

**biaxial crystal.** *Noun.* A crystal with two axes or directions in which light vibrating in any plane will travel

with the same velocity. Most naturally occurring crystals are of this type. See **optic axis**.

**biaxial winding.** *Noun.* A type of winding used to make reinforced composites in which the helical band of fibre is laid in sequence, side by side, with no fibre crossover.

**biberon.** *Noun.* A ceramic cup with a spout for feeding invalids.

**bicarbonate.** *Noun.* An acid carbonate, [HCO<sub>3</sub>]<sup>-</sup>; systematic name is acid carbonate.

**bicchulite.** *Noun.* Ca<sub>8</sub>[Al<sub>2</sub>SiO<sub>6</sub>]<sub>4</sub>(OH)<sub>8</sub>. A framework **aluminosilicate** mineral used as a **zeolitic** catalyst. It has an unusual structure consisting of Ca<sub>4</sub>(OH)<sub>4</sub> cubes in a **fcc** packing arrangement linked by Al<sub>2</sub>SiO<sub>6</sub> double tetrahedra.

**Bicheroux process.** *Noun.* An intermittent process employed in the fabrication of **plate glass** of high quality in which molten glass is cast between driven conveyor rolls or a flat moving table which delivers the strip to a **lehr** where the glass is slowly cooled while passing between a series of asbestos-covered rollers.

**bichromate of potash.** *Noun.* K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. Employed with **whiting** and **zinc oxide** to make **carnation pink** or red ceramic colours. Mp 396 °C; decomposes at 500 °C; density 2,692 kg m<sup>-3</sup>.

**biconical cheese.** *Noun.* See **cheese**.

**bidet.** *Noun.* A low, basin-like item of ceramic sanitary ware designed for personal hygiene.

**Bierbaum scratch hardness.** *H<sub>s</sub>. Noun.* A measure of the hardness of a solid material based on the width of a scratch made by drawing a diamond point across the surface under preset pressure conditions, the measurement being made by use of a microscope. The calculation of the hardness value depends on the shape of the diamond, e.g., for a square-based pyramid with edge leading  $H_B = 4P/W$ , where P is the load and W is the track width, and for a conical diamond  $H_B = 2.55P/W$ .

**bifilar.** *Adjective.* Relating to a resistor where the wire is wound in a loop around a coil, this gives two parallel leads, which reduces inductance.

**bifurcate.** *Verb.* To divide into two branches, as cracks do in brittle ceramics and glass when they reach a **terminal propagation velocity**.

**bilayer graphene.** *Noun.* A polymorph of carbon consisting of two hexagonal layers with **Bernal-stacking**. See **low dimensional materials**.

**bilayer manganates.** *Plural noun.* A crystal structure resulting from blocks of MnO<sub>6</sub> octahedra corner sharing oxygens in 3-D but separated in to two-dimensional double layers by inserting a thin **rock-salt** layer to form the bilayer structure. This structure type often leads to **colossal magnetoresistance**.

**billet.** *Noun.* A cylinder-shaped specimen.

**bi-metal.** *Noun.* A bonded laminate of two dissimilar metals having different expansion properties; employed in thermocouples to measure differences in temperature.

**bi-morph element.** *Noun.* A device consisting of two **piezoceramic** strips **poled** in opposite directions and bonded together. Any strain caused by bending produces a voltage; used in record player pickup heads.

**BIMOS.** *Acronym.* Stands for bipolar metal-oxide semiconductor. See **bipolar metal oxide semiconductor**.

**bin.** *Noun.* A relatively large enclosed area in which raw materials are stored prior to use.

**binary diagram.** *Noun.* A **phase diagram** of a two-component system.

**binary phase.** *Noun.* A material with two **components**.

**binder.** *Noun.* A cementing medium, or a substance, often organic, added to a powder or granular material, to give formed items workability and green or dry strength sufficient for handling and machining in all stages prior to firing, and which usually is expelled during sintering or firing; normally a material of relatively low melting point added to a powder mixture for the specific purpose of cementing together powder particles which alone could not be handled without danger of breakage or which would not sinter or fire into a strong body.

**binder course.** *Noun.* A **bituminous** layer serving as a **bonding agent** between the **foundation layer** and the **wearing course** of a concrete installation.

**binder tape.** *Noun.* A paper or other material employed to wrap groups of insulated wire into cable configuration prior to sheathing.

**binding energy.** *Noun.* Used to denote the energy required to just remove an electron from an atom or molecule.

**binding energy of nuclei.** *Noun.* Atomic nuclei have a mass less than their constituent neutrons and protons; the mass difference is the **mass defect**. In order to break up a nucleus, energy equal to  $mc^2$  must be supplied, where  $c$  is the velocity of light and  $m$  is the mass defect.

**bing.** *Noun.* A heap or pile of minerals or mine spoil.

**Bingham plasticity.** *Noun.* Flow associated with a minimum **shear stress** value. The minimum shear stress needed to cause flow is known as the **yield value**. Once flow is established shear stress is almost proportional to **shear rate**.

**Bingham plastometer.** *Noun.* An instrument designed to assess the deformation and flow of materials in which slurry is forced through a capillary under various pressures.

**biocers.** *Abbreviation.* Stands for bioceramics, which are biological-inorganic materials created from proteins,

peptides, and DNA or biological cells. For example, protein molecules **intercalated** between the aluminosilicate layers in clay or the unstable **vaterite** form of **calcium carbonate** that is stabilised when protein secreted from *verticillium* acts as a catalyst when  $Ca^{2+}$  ions are added to a solution of the fungus spores. See **biomimetics**.

**biodegradation.** *Noun.* See **biodeterioration**.

**biodeterioration.** *Noun.* Any undesirable change in the properties of ceramics and glasses caused by the vital activities of living organisms. Not to be confused with **biodegradation** which is often a useful process in pollution control.

**Bioglass. Trademark.** *Noun.* A **soda-lime silica glass** containing 6 wt.% phosphoric oxide,  $P_2O_5$ , which can bond to living tissue. The composition has about double the soda and lime and reduced amounts of silica compared to normal **soda-lime glass**. When implanted a **silica-gel** surface is formed by ion exchange between body fluids and the  $Na^+$ ,  $K^+$  and  $Ca^{2+}$  in the glass. The glass ions are replaced by  $H_3O^+$  ions which then react with  $-Si-O-Si-$  bonds to form silol groups,  $Si-OH$ . This leads to a surface layer with a high concentration of  $Ca^{2+}$  and  $P_2O_5$  from which **hydroxycarbonate apatite (HCA)** crystallises and this resembles bone and so becomes the layer on which new bone grows.

**biognosis.** *Noun.* See **biomimetics**.

**biomimetics.** *Plural noun.* The abstraction of materials design from nature. Sometimes called **bionics**, **biognosis**.

**bionics.** *Noun.* See **biomimetics**.

**biopersistence.** *Noun.* The dwell time of **man-made vitreous fibres** in lungs as estimated by one of three tests: **vitro dissolution test**,  $K_{diss}$ , **long term animal test**,  $T_{1/2}$  or for fibres longer than 20  $\mu m$ , the **short term animal test**.

**bipolaron.** *Noun.* A mobile pair of electrons arising from strong electron-lattice interactions in a mixed-valent system, such as  $Ti_4O_7$ . Unlike **Cooper pairs** the bipolaron moves by a diffusion process.

**biotite.** *Noun.*  $K(Mg,Fe)_3(Al,Fe)Si_3O_{10}(OH)_2$ . A common mineral of the **mica** family with a monoclinic crystal structure derived from **talc**. A frequent impurity in **feldspar** and **nepheline syenite**; usually black or dark green in colour and therefore often called **black mica**. It is a **true mica**. Density 2,800–3,200  $kg\ m^{-3}$ ; hardness (Mohs) 2.5–3.

**biotite granite.** *Noun.* A coarse grained **intrusive rock** in which the grains are **quartz** and **feldspar** is commonly called **granite** and this can contain finer grains of **mica**, such as **biotite**.

**Biot modulus.** *Noun.* See **Biot number**.

**Biot number.  $\beta$ .** *Noun.* A numerical evaluation to estimate the **thermal-shock resistance** of a material from its heat-transfer properties by the formula:  $\beta = rh/k$ , in which  $h$  is the **heat-transfer coefficient**,  $r$  is the distance between a specific plane and the surface of a specimen, and  $k$  is the **thermal conductivity** of the material. It is used to apply a correction to the **thermal shock fracture parameter, R**. It has values in the range 0.5–20 for real cooling situations and high values of  $\beta$  are equivalent to more severe conditions. Its use explains why the maximum stress occurs sometime after the initial **thermal shock** and hence to delayed fracture.

**biphasic.** *Adjective.* Having two phases.

**bipolar.** *Adjective.* (1) Having or involving the use of two poles, such as positive and negative electrical poles. (2) A transistor using both majority and minority charge carriers.

**bipolar field.** *Noun.* The longitudinal magnetic field within a part or object having two magnetic poles.

**bipolar metal oxide semiconductor. BIMOS.** *Noun.* A semiconductor **transistor** with two poles and one **gate**.

**bipolaron.** *Noun.* A state where two **holes** or two electrons are bound together by their lattice distortion and move as an entity together with their distortion through the lattice.

**biprism.** *Noun.* A prism with a very obtuse angle to facilitate beam splitting.

**birdsmouth.** *Noun.* A notch cut on the face of one material in order to join another piece.

**birefringence.** *Noun.* (1) The double bending of light rays as observed in an **anisotropic** crystal viewed under cross Nicols when characteristic and measurable colours are produced to indicate the difference in the minimum and maximum **indices of refraction** of the crystal. It is the property of certain crystals, like **calcite** and **mica**, of forming two **refracted rays** from a single incident ray. The **ordinary ray** obeys the normal laws of refraction, the other, called the **extraordinary ray**, follows different laws. The two refracted rays are **polarised** at  $90^\circ$  to each other. Along an **optic axis** both rays travel at the same velocity. (2) The difference between the refractive index of a fibre measured parallel to its axis,  $n_{||}$ , and that measured perpendicular to the axis,  $n_{\perp}$ ;  $\Delta n = n_{||} - n_{\perp}$ .

**birefringent.** *Adjective.* Light transmitting.

**birnessite.** *Noun.* A polymorph of manganese dioxide,  $MnO_2$ . See **manganese dioxide**.

**biscrolling.** *Verb.* A technique for making ceramic yarns that contain 95 % of the ceramic powder so that the yarn has effectively the properties of the powdered material. The powder is placed on top of a host nanotube sheet, which is then twisted to form a **yarn**. Carbon, silica and  $Si_3N_4$  nanotubes can be used. Using carbon nanotubes and  $LiFePO_4$  powders a flexible Li-ion battery cathode can be spun or knitted.

**biscuit.** *Noun.* (1) Unglazed **clayware** hardened by the effect of heat producing dehydration and **vitrification**. (2) A term employed in some industries having the same meaning as **bisque**. (3) A small setter composed of refractory clays on which pots are placed for firing.

**biscuit fire.** *Noun.* The firing that converts ceramic **green ware** to **biscuit**. Also called **bisque fire**.

**biscuiting.** *Verb.* A first firing of ceramic **greenware** that converts it to **biscuit**.

**bishofite.** *Noun.*  $MgCl_2 \cdot 6H_2O$ . Hydrus magnesium chloride. A mineral occasionally used in formulations to adjust magnesium content in ware, frits and cements.

**bishop's purple.** *Noun.* A violet coloured glaze in some oriental porcelains. Also called **aubergine purple**.

**bisilicate.** *Noun.* Another name for the ionic metasilicates. A silicate containing  $[SiO_3]^{2-}$  ions or chains of  $[SiO_3]_n^{2n-}$  ions.

**bismuth.** *Noun.* Bi. Used as organic complexes to make **lustre glazes** as the organic components burn away to leave shiny bismuth metal. often used as a carrier of other lustre colours and can give a **mother-of-pearl** effect.

**bismuth chromate.** *Noun.*  $Bi_2(CrO_3)_2$ . Used as an orange-to yellow pigment in porcelain-enamels and glazes.

**bismuth cuprate. BISCCO.** *Noun.* A high-temperature superconductor oxide involving bismuth, strontium, calcium, copper, and oxygen. The material can be fabricated into tapes and wires capable of carrying currents of  $5,000 \text{ A cm}^{-2}$ . Zero resistance of  $Bi_2Sr_2Ca_2Cu_3O_x$  occurs at 70 K. See **2212-bismuth oxides**.

**bismuth ferrite.** *Noun.*  $BiFe_2O_4$ . A **spinel** phase that can be doped to make a useful lead-free **actuator**. See **samarium doped bismuth ferrite**.

**bismuthinite.** *Noun.*  $Bi_2S_3$ . Bismuth trisulphide; an ore of bismuth found in fibrous masses; hardness (Mohs) 2; density  $6,810 \text{ kg m}^{-3}$ .

**bismuth oxide.** *Noun.*  $Bi_2O_3$ . Employed as a fluxing component in optical glasses, as a flux and bonding agent for metallic components in ceramic glazes, as a flux in cast-iron porcelain-enamels, and in ceramic colours; its ceramic properties are similar to those of **lead oxide**, but it is more fusible. Mp  $820\text{--}860^\circ\text{C}$ ; density  $8,200\text{--}8,900 \text{ kg m}^{-3}$ .

**2212-bismuth oxides.** *Noun.*  $Bi_2Sr_2CaCu_2O_{8+x}$ . High temperature superconducting compounds whose structure consists of intergrowths of **perovskite** and **rock salt** layers:  $(AO)_m(A'CuO_{3-y})_n$ ;  $T_c = 100 \text{ K}$ . See **bismuth cuprate**.

**bismuth potassium titanate.** *Noun.* **BKT**;  $Bi_{0.5}K_{0.5}O_3$ ; a lead-free **ferroelectric ceramic** with the tetragonal **perovskite** structure that allows **compositional engineering** around the tetragonal to cubic phase transition to improve the **ferroelectric** properties. Hot pressing needed to achieve 97 % density in devices;  $d_{33}$  value of  $70 \text{ pC N}^{-1}$ .

**bismuth pyrochlore.** *Noun.*  $\text{Bi}_2(\text{Zn}_{1.33}\text{Sb}_{0.67})\text{O}_6$ . A resistive grain boundary phase which limits grain growth in ZnO varistor manufacture.

**bismuth selenide.** *Noun.*  $\text{Bi}_2\text{Se}_3$ . Used in some thermoelectric applications. Mp 706 °C; density 6,820 kg m<sup>-3</sup>.

**bismuth sodium titanate. BNT.** *Noun.*  $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$ . A lead-free ferroelectric. See **BKT**.

**bismuth stannate.** *Noun.*  $\text{Bi}_2(\text{SnO}_3)_3 \cdot 5\text{H}_2\text{O}$ . Used as an additive in **barium titanate** capacitors to produce bodies of intermediate **dielectric constant**. Dehydrates at 200 °C and above to form  $\text{Bi}_2(\text{SnO}_3)_3$ .

**bismuth subcarbonate.** *Noun.*  $(\text{BiO})_2\text{CO}_3$ . Used as a flux and **opacifier** in glass and porcelain-enamels. Density 6,860 kg m<sup>-3</sup>.

**bismuth subnitrate.** *Noun.*  $\text{Bi}_5\text{O}(\text{NO}_3)_4(\text{OH})_9$ . Used to give **pearly** lustre to glasses and glazes, as a constituent in high-refractive index glass, and in low-temperature porcelain-enamels and colorants. Decomposes at 260 °C; density 4,928 kg m<sup>-3</sup>.

**bismuth telluride.** *Noun.*  $\text{Bi}_2\text{Te}_3$ . Thermoelectric material employed in cooling devices. Mp 585 °C; density 7,300 kg m<sup>-3</sup>; hardness (Mohs) 1.5–2.

**bismuth titanate. BIT.** *Noun.*  $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ . A **ferroelectric Aurivillius** phase consisting of **perovskite** blocks sandwiched between **fluorite**-like  $[\text{Bi}_2\text{O}_2]^{2+}$  sheets. A dielectric used in the fabrication of multilayer **ceramic capacitors** and as information storage material in **random access memories**.

**bismuth trioxide.** *Noun.*  $\text{BiO}_3$ . See **bismuth oxide**.

**bisque, bisque ware.** *Noun.* (1) Unglazed ceramic ware that has been subjected to a single fire. (2) A coating of wet-process porcelain-enamel that has been dried but not fired.

**bisque fire.** *Noun.* (1) A low temperature, about 1,000 °C, firing of **porcelain** where glaze has been added to the body for a one stage process. After the bisque fire the temperature is raised to 1,200–1,400 °C. (2) The kiln firing of ceramic ware before application of a glaze. See **biscuit fire** and **high biscuit-low glost**.

**BISCCO.** *Acronym.* Standing for bismuth strontium calcium copper oxide. See **bismuth cuprate**.

**bistability.** *Noun.* The ability of a molecular system to occur in two different electronic states.

**BIT.** *Acronym.* Standing for bismuth titanate. See **bismuth titanate**.

**bit gatherer.** *Noun.* An operator who gathers small quantities of glass on an appropriate tool for use in the decoration of hand-blown glassware.

**bit stone.** *Noun.* Refractory particles, such as **flint** fragments or sand, placed in **saggers** to prevent ware from sticking to the sagger bottoms during firing.

**bitumen.** *Noun.* (1) A transparent brown pigment or glaze made from **asphalt**. (2) Various impure mixtures of hydrocarbons that occur naturally in asphalt, tar, and mineral waxes. Used in road surfacing and roofing. (3) The part of **coal** that can be extracted using an organic solvent.

**bituminise.** *Verb trans.* To treat with **bitumen**.

**bituminous.** *Adjective.* See **bitumen**.

**bituminous coal.** *Noun.* A soft, black coal rich in volatile hydrocarbons. Carbon content 46–86 %. Calorific value  $1.93\text{--}3.96 \times 10^7$  J kg<sup>-1</sup>. Also called **soft coal**. See **coal rank**.

**bituminous concrete.** *Noun.* Concrete in which a bituminous material has been incorporated as a binder.

**bixbyite.** *Noun.* A family of cubic oxides with the  $\alpha\text{-Mn}_2\text{O}_3$  structure. The structure contains two types of linked polyhedra, one a distorted octahedron containing two longer M-O distances as a result of the **Jahn-Teller effect**.

**Bizen ware.** *Toponym, noun.* Made in Japan in the Bizen area from about 1180 AD. A robust development of **Sue ware**. Made in large, 50 m, **tunnel kilns** fired by pine wood and reaching temperatures of 1,250 °C for up to 20 days, which develops a partial natural glaze from the pine ash, over dark-bronze coloured **stoneware**.

**BKT.** *Abbreviation.* Stands for bismuth potassium titanate. See **bismuth potassium titanate**.

**blackband ironstone.** *Noun.*  $\text{FeCO}_3$ . Carbonate iron ore containing coal-type deposits sufficient for the iron to be smelted without additional fuel.

**blackboard enamel.** *Noun.* A special, slightly roughened porcelain-enamel that will provide a suitable writing surface for blackboard chalk.

**black body.** *Noun.* A hypothetical body that will absorb all radiation and which will emit radiant energy at a maximum rate for a given temperature; used to determine the temperature of a closed furnace when viewed through a relatively small hole with an **optical pyrometer**. Also called a **full radiator**.

**black body radiation.** *Noun.* Radiation characterised by a spectral energy distribution according to **Planck's law**, such as would be radiated by a **black body** measured as a function of wavelength. The shape of such a curve is only dependent on the absolute temperature of the body and as the temperature increases the peak in the curve moves towards higher energies. The energy spectrum emerging from a small hole in the wall of a high temperature furnace resembles a **black body** spectrum quite closely.

**black box.** *Noun.* An individual, self-contained unit in an electronic system whose circuitry need not be known in order to use it.

**black cobalt.** *Noun.* See **asbolite**.

**black cobalt oxide.** *Noun.* A coverall term used to describe mixed **cobalt oxides**, such as  $\text{Co}_3\text{O}_4$ ,  $\text{Co}_2\text{O}_3$  and  $\text{CoO}$ . Used as a **flux** and powerful blue colorant in glazes where small changes in content give pale blue to blue-black glazes. Small amounts are used to whiten the appearance of **porcelain** bodies.

**black copper oxide.** *Noun.*  $\text{CuO}$ . A **basic oxide** used to produce blue and green colours in glass, **faience**, **porcelain**, **stoneware**, and other ceramics when fired in an oxidising atmosphere, and red colours when fired in a reducing atmosphere. Enhances lead release from lead glazes. Strongly absorbs microwaves and so powders can be used to heat other ceramics in microwave ovens. Mp 1,064 °C; density 6,320 kg m<sup>-3</sup>.

**black core, black heart.** *Noun.* A defect occurring in fireclay and other refractory brick when **vitrification** of the surface takes place before oxidation of carbonaceous matter in the interior is complete.

**black coring.** *Noun.* See **coring**.

**black cotton soils.** *Noun.* The name for swelling clays, dark in colour, low in organic matter, with alkaline or near-neutral suspension; found in northeast Nigeria.

**black diamond.** *Noun.* See **carbonado**.

**black earth.** *Noun.* Black soil rich in humous and carbonates.

**black edge, black edging.** *Noun.* A black porcelain-enamel applied and fired over the ground coat at the exposed edges of ware for both protective and decorative purposes; subsequent coatings of cover-coat enamels are brushed from the areas prior to firing.

**black glass.** *Noun.* Carbon-modified silica.

**black hot-pressed ceramic.** *Noun.* A metal carboxide that is a dispersion of **titanium carbide** particles in **alumina** containing more than 40 % titanium carbide. Used as a hard cutting tool.

**blackening.** *Noun.* Graphite applied to the working surface of moulds as a parting material to prevent a casting from sticking, and to improve the surface of ware cast in the moulds.

**black iron oxide.** *Noun.*  $\text{FeO}$ . A widely **nonstoichiometric** ceramic oxide. Mp 1,420 °C; density 5,700 kg m<sup>-3</sup>. Also known as **wüstite**.

**blackjack.** *Noun.* The colloquial name for sphalerite the most important zinc ore. See **sphalerite**.

**black lead.** *Noun.* A synonym for **graphite**.

**black light.** *Noun.* Light in the near-ultraviolet and infrared range of wavelengths just below and above the visible range, from 320 to 400 nm.

**black-light filter.** *Noun.* A filter that will suppress transmission of visible light but will permit passage of ultraviolet radiation having wavelengths in the range of 320–400 nm.

**black mica.** *Noun.* Sometimes called **brown mica**, which is the **ferromagnesian** variety of mica, known as biotite. See **biotite**.

**black raku.** *Noun.* A rough, thick-walled, very soft, and porous **earthenware** coated with a **lead borate** glaze; used in the tea ceremony in Japan.

**black sands.** *Plural noun.* Found in volcanic areas they are beach sands rich in dark minerals with very little **quartz** content. Dark **olivine** sands are found in Scotland and **magnetite** sands in the Canary islands.

**black shape.** *Noun.* Fabricated ware or shapes prior to porcelain-enamelling.

**black silicon carbide.** *Noun.* A black, impure silicon carbide manufactured from coke and **silica** in an electric furnace, and employed as an abrasive; contains free carbon.

**black speck.** *Noun.* A defect in fired porcelain-enamels or glassware appearing as visible black specks, usually caused by dirt or scale, but which also may be **glass-eye blisters** or **boiling** from the ground coat.

**black titania.** *Noun.* Titanium dioxide,  $\text{TiO}_2$ , nanocrystals that have been hydrogenated to introduce vacancies and disorder in the crystal structure. The process turns the white oxide black in the surface layers so that it will absorb infrared and visible radiation while the inner white material absorbs ultraviolet radiation making the material more efficient at photocatalysis and improving the breakdown of water to produce hydrogen for fuel.

**black top.** *Noun.* A bituminous mixture.

**blaes.** *Plural noun.* A hardened **clay** or **shale** reddish or blue-grey in colour usually used in small broken pieces to make paths and drives.

**blanc de chine.** *Noun.* A white, glazed Chinese porcelain.

**blanc fixe.** *Noun.* See **barite**.

**blank.** *Noun.* (1) A **parison** or preliminary shape from which a finished article is further formed, or a mould for producing such a shape. (2) Any article of glass on which subsequent forming or finishing is required. (3) A piece cut from a metal sheet from which a finished article for porcelain-enamelling is to be fabricated.

**blanket.** *Noun.* A layer of radioactive material placed around the core of a nuclear reactor as a reflector and to breed new fissionable fuel.

**blanket feed.** *Noun.* A technique for charging a glass batch into a furnace to produce a broad, thin layer of even distribution across the width of the furnace.

**blanking.** *Verb.* To cut and form metal shapes for porcelain-enamelling by means of a mechanically operated die and plunger press.

**blank mould.** *Noun.* A metal mould employed in the manufacture of glass holloware to give the item its initial shape or form.



**blank, optical.** *Noun.* See **optical blank**.

**blank, pressing.** *Noun.* See **pressing blank**.

**blast.** *Noun.* (1) Air blown into a furnace or kiln under pressure. (2) An explosion, as of dynamite, in a quarry or mine to break up the mineral.

**blast-furnace cement.** *Noun.* A mixture of ordinary Portland cement and crushed slag from a steel furnace. It has lower setting properties than **OPC** alone.

**blast-furnace slag.** *Noun.* The non-metallic product, consisting essentially of **silicates** and **aluminosilicates** of calcium and other base materials that is developed in a molten condition simultaneously with iron in a blast furnace.

**blast-furnace slag, expanded.** *Noun.* See **expanded blast-furnace slag**.

**blast-furnace slag, granulated.** *Noun.* See **granulated blast-furnace slag**.

**blasting.** *Noun.* The process of cleaning metal, especially cast iron, for porcelain-enamelling in which the surface of the metal is subjected to the abrasive action of sharp abrasive particles carried in a fast-moving stream of air.

**blaze.** *Noun.* A ridge that occurs on the sloping sides of crystals.

**bleaching powder.** *Noun.*  $\text{CaCl}(\text{OCl})\cdot 4\text{H}_2\text{O}$ . Chlorinated calcium hydroxide; used in solution as a bleaching agent and disinfectant. Also called **chloride of lime**, **chlorinated lime**.

**bleb.** *Noun.* (1) A small blister. (2) An air bubble. (3) A small blister or bubble defect on the surface of pottery.

**bleed.** *Verb intrans.* To exude a liquid, usually water, during compaction of cement, mortar etc.

**bleed back.** *Noun.* The ability of a penetrant to bleed out of a discontinuity after it has been cleaned from the surface of a specimen.

**bleeder resistor.** *Noun.* A resistor connected across the output terminals of a power supply in order to improve voltage regulation and to discharge filter capacitors.

**bleeding.** *Noun.* The autogenous flow of mixing water within, or its emergence from, newly placed concrete or mortar, caused by the settlement of the solid materials or drainage of the mixing water.

**bleed out.** *Noun.* The action of an entrapped penetrant in emerging from surface discontinuities.

**bleed valve.** *Noun.* A valve for allowing gas accumulation in a liquid to blow off.

**blemish.** *Noun.* (1) A defect or flaw in a product consisting of a stain, disfigurement, or strained area attributable to the normal composition, forming, or extraneous factors encountered in the production of the item. (2) An insignificant imperfection in a dry-process porcelain-enamel.

**blend.** *Noun.* A combination of materials that are thoroughly mixed.

**blende.** *Noun.*  $\text{ZnS}$ . (1) Synonym for **sphalerite** or abbreviation for **zinc blende**. (2) Any naturally occurring metal sulphide.

**blender brush.** *Noun.* A china decorating paintbrush of which the soft squirrel hair is formed into a dome shape about 40 mm long and 20 mm across the end.

**blending.** *Verb.* (1) To mix materials. (2) To even the rougher part of a surface with the smoother part so that the entire surface is of the same plane or surface texture, or both.

**blending, batch.** *Verb.* See **batch blending**.

**blending sand.** *Noun.* Sand that is added to the normal available sand in concrete to improve **gradation**.

**blibe.** *Noun.* A defect in glass in the form of a gas-filled cavity, between a **seed** and **blister** in size.

**blind hole.** *Noun.* A hole not completely drilled through.

**blinding.** *Noun.* (1) A surface defect in glazes due to devitrification, resulting in a dull or crystalline appearance. (2) The clogging of a sieve. Corrected by paying attention to the amount of powder used in the sieve analysis.

**blind spit.** *Noun.* A colloquial term for broken bubbles on the surface of porcelain as opposed to bone china.

**blister.** *Noun.* (1) A bubble or gaseous inclusion of relatively large size in a body or at the surface of a glaze or porcelain-enamel after firing. (2) Large bubbles remaining in finished glass. Also known as **bubbles**.

**blister copper.** *Noun.* The product when **matte** is reduced. It is 99 % pure copper.

**blistering.** *Noun.* (1) The development of enclosed or broken macroscopic bubbles or a **vesicular** structure in a body, glaze, porcelain-enamel, or other coating during firing. (2) Non-adherence of colour in firing.

**blister, metal.** *Noun.* See **metal blister**.

**blister, pipe.** *Noun.* See **pipe blister**.

**blister, weld.** *Noun.* See **weld blister**.

**bloach.** *Noun.* An imperfection resulting from the incomplete grinding of plate glass caused by a low point in the glass, which retains a part of the original rough surface.

**loat.** *Verb trans.* To cause solid particles, such as clays and slags, to puff or swell due to sudden expansion of air or moisture contained in the material or a chemical release of a gas, such as carbon dioxide, when subjected to a blast of a superheated air, hot flame, or other high-temperature source.

**bloated clay.** *Noun.* See **expanded clay**.

**bloating.** *Noun.* The permanent expansion or swelling of a ceramic material or body during heating which produces a **vesicular structure** in the substance being heated.

**Bloch wall.** *Noun.* The transition layer, with finite thickness of a few hundred lattice constants, between adjacent **ferromagnetic domains** magnetised in different directions. It allows the spin directions to change gradually from one orientation to another, rather than abruptly.

**block.** *Noun.* (1) A master mould made from an original pattern from which case moulds are produced. (2) Hollow, translucent glass units having various patterns moulded on their interior or exterior surfaces, or both, and usually made in two halves that are sealed together.

**block brick.** *Noun.* A brick, larger than standard or jumbo in size, used to bond adjoining or intersecting walls.

**block density.** *Noun.* The mass of a unit volume of a substance, including its pore volume but excluding inter-particle voids; determined under specified conditions.

**block diagram.** *Noun.* (1) A three-dimensional drawing showing geological structure. (2) A diagram showing the interconnections between parts of an industrial process, such as ceramic manufacture.

**block filter.** *Noun.* A hollow, rectangular, vitrified clay masonry unit, sometimes **salt glazed**, used in trickle-type floors in sewage disposal plants. The block is designed with apertures connecting with drainage channels through the upper surface, which are arranged to form aeration and drainage grilles to pass air into, and liquids from, overlying filter media; the drainage channels convey liquid away from the filter bed.

**block handle.** *Noun.* A particular type or style of handle attached to a cup, vase, or other item by means of a clay bar.

**blocking.** *Verb.* (1) To shape a **gather** of glass in a metal or wood cavity called a **block mould**. (2) To stir a glass batch by immersing a wooden block or other source of gaseous bubbles in the molten mass. (3) To reprocess glass in order to remove surface imperfections. (4) To mount **optical glass** blanks in a holder for grinding and polishing operations. (5) To idle a furnace at a reduced temperature. (6) To set refractory blocks in a furnace.

**block model.** *Noun.* A way to analyse electrical properties of ceramic solid-state devices which assumes that the device contains cubes of conducting oxide of side length  $d$ , separated by insulating barriers of thickness  $t$ , within an electrode separation distance,  $D$ .

**block mould.** *Noun.* A one-piece mould used in glass-making; often consists of wood or iron.

**block out.** *Noun.* An opening or cavity formed in concrete to facilitate subsequent construction operations, such as an opening in a wall for the installation of a pipe or other item; the opening frequently is sealed with mortar or concrete when the installation has been completed.

**block press.** *Noun.* A press used to bind **laminate** squares while heating them. Each square is superimposed in a perpendicular way to minimise **anisotropy** caused by first forming a laminate.

**block, quarl.** *Noun.* See **quarl block**.

**block rake.** *Noun.* A scratch or **cullet cut** imperfection in glass caused by a particle of cullet lodged in the polishing felt during the polishing operation on flat glass. Also called **block reek**.

**block reek.** *Noun.* See **block rake**.

**block, rotary kiln.** *Noun.* See **rotary kiln block**.

**block, scotch.** *Noun.* See **scotch block**.

**block, scouring.** *Noun.* See **scouring block**.

**block, skimmer.** *Noun.* See **skimmer block**.

**block, sleeper.** *Noun.* See **sleeper block**.

**block, soldier.** *Noun.* See **soldier block**.

**block, spreader.** *Noun.* See **spreader block**.

**block structure.** *Noun.* A slab-like assembly of corner sharing  $[\text{MO}_6]$  octahedra. M is usually a metal like Mo, W, Ti, Re and some other transition block element.

**block, tank.** *Noun.* See **tank block**.

**block, trimmed.** *Noun.* See **trimmed block**.

**block, tweel or tuille.** *Noun.* See **tweel block**.

**blomstrandine.** *Noun.* A mineral with useful **rare earth** content.

**bloom.** *Noun.* (1) A non-reflecting coating on glass. (2) A surface film on glass resulting from attack by constituents in the atmosphere, or by the deposition of smoke or other vapours. (3) Formation of powdery or crystalline salt on the surface of concrete or masonry due to diffusion and precipitation of salt solutions from the interior. See **efflorescence**.

**blotter.** *Noun.* A disk of compressive material, usually of blotting paper stock, used between an abrasive grinding or polishing wheel and its mounting flange.

**blotting.** *Noun.* In liquid penetrant inspections, particularly of electromagnetic and magnetic particles and products, it is the action of a developer in soaking up a penetrant from the surface of a fault in order to obtain increased contrast.

**blow-and-blow process.** *Noun.* The process of forming hollow glassware in which the preliminary and final shapes are formed by air pressure.

**blow-blow.** *Noun.* A process or machine using compressed gas blown into the mouth of an artefact to form both **parison** and final object.

**blower.** *Noun.* (1) An operator who forms glass by blowing. (2) A machine employed to move or supply air to a particular area for a particular use.

**blow head.** *Noun.* Part of a glass-forming machine serving to introduce air under pressure to blow a hollow glass article.

**blowhole.** *Noun.* (1) A large blister such as is formed when contaminants are vaporised along a weld seam during the firing of porcelain-enamels. (2) A device placed in the top of a kiln to facilitate the escape of steam and other gases, particularly during the early stages of the firing operation.

**blowing.** *Verb.* (1) To shape hot glass by air pressure, either by machine or by mouth. (2) *Noun.* The bursting of pots and crucibles when heated too rapidly.

**blowing iron.** *Noun.* The pipe used by a glassmaker for gathering and blowing glassware by mouth.

**blow mould.** *Noun.* The metal mould in which a blown glass article is finally shaped.

**blow moulding.** *Verb.* To shape glass in the viscous or molten state by placing a **parison** in a mould and completing the shaping operation by blowing air into the parison.

**blown away.** *Noun.* A fault in the neck of a glass bottle that occurs when an insufficient quantity of molten glass is employed during fabrication.

**blown enamel.** *Noun.* Ridges produced on the surface of ware during the spraying of wet porcelain-enamels, usually the result of the coating being too thick or too fluid or of excessive atomising air pressure at the spray gun.

**blown glass.** *Noun.* Glassware formed by air pressure, as by mouth blowing or by the use of compressed air.

**blow off.** *Verb.* To remove dust and dirt from the surface of dry, or **bisque**, porcelain-enamels just prior to firing.

**blowout.** *Verb.* To displace and lengthen an electrical arc to cause its extinction, as by an air blast, magnetic field, or raising one electrode.

**blow-over.** *Noun.* The thin-walled bubble of glass formed above a **blow mould** in a handshop operation to facilitate **bursting off**.

**blow pipe.** *Noun.* (1) An apparatus employed to produce a hot localised flame by using a mixture of compressed air and coal gas also called **blow torch**. (2) A long metal pipe used for the working and forming of glass at the bench.

**blow torch.** *Noun.* See **blow pipe**.

**blue asbestos.** *Noun.* See **crocidolite**.

**blue aventurine.** *Noun.* A mineral rock suitable for **tumbling** to reveal a pale-blue and white mottling that is a pleasant decoration to wear.

**blue azurite.** *Noun.* See **copper carbonate**.

**blue copper.** *Noun.* See **azurite**.

**blue enamel.** *Noun.* Wet or dry process enamel applied so thinly that it appears bluish in colour as the base metal ground coat shows through.

**blue ground coat.** *Noun.* A porcelain-enamel composition usually containing additions of cobalt, manganese, and nickel oxides as adherence-promoting agents; the coating, which fires to a dark blue colour, is used as a ground coat on sheet iron and steel.

**blueing-off.** *Verb.* A term used in mould making when a coating of **Prussian blue** is applied to one of a pair of mating faces in order to check the efficiency of mating by observing how the blue colour is transferred.

**blue john.** *Noun.* A corruption of the term “bleu-jeune” which was used to describe the blue form of the normally yellowish form of the naturally occurring **fluorite** crystals. The blue colour is caused by electron excess **F-centres** formed by radiation from uranium compounds in nearby deposits. See **Derbyshire spar**.

**blue lead.** *Noun.* Alternative name for **lead sulphide** or **galena**.

**blue lias.** *Noun.* A type of rock consisting of alternate layers of bluish clay and grey **argillaceous limestone**.

**blue malachite.** *Noun.* See **azurite**.

**blue, mazarine.** *Noun.* See **mazarine blue**.

**blue spinel.** *Noun.* A naturally occurring **spinel** that has large crystals that can be cut and used as jewellery.

**bluestone.** *Noun.* (1) A blue-grey sandstone containing high proportions of clay. Used as a building stone and for **pavers**. (2) A blue variety of **basalt** found in Australia. (3) Blue crystals of copper sulphate.

**blue topaz.** *Noun.* A natural silicate found in granites and pegmatites as very large crystals that are valued for their use as gems. See **topaz**.

**blue tourmaline.** *Noun.* A gem quality form of the mineral **tourmaline** that occurs as large crystals in some **pegmatites**.

**blue zircon.** *Noun.* A naturally occurring form of **zirconium silicate** coloured blue from partial cation substitution. It can be cut and polished when it displays a **lustre** and fire close to that of **diamond**.

**blunge or blunging.** *Verb trans.* To agitate or blend ceramic materials in a mechanical or hand-operated mixer, usually to suspend the materials in water or other liquid.

**blunger.** *Noun.* A large vat used as a mixer with revolving paddles or other mixing device employed to produce slurries or slips.

**blurring highlight test.** *Noun.* A test, usually visual, to evaluate the resistance or the degree to which porcelain-enamels are attacked by acids.

**blushing.** *Adjective.* The discoloration or clouding of a glaze on porcelain-enamel during firing.

**BMC.** *Abbreviation.* Stands for **bulk moulding compound**.

**BNN.** *Abbreviation.* Stands for barium sodium niobate. See **barium sodium niobate**.

**BNT.** *Abbreviation.* Stands for bismuth niobium titanate. See **bismuth niobium titanate**.

**boart.** *Noun.* See **bort**.

**boat.** *Noun.* A ceramic artefact used to hold a substance for combustion analysis.

**BoB.** *Abbreviation.* Stands for bobbin. See **bobbin**.

**bobbin coil.** *Noun.* A coil, or coil assembly, used for electromagnetic testing by insertion into a test specimen as, for example, an inside probe for tubing.

**Boccaro ware.** *Toponym.* Red, unglazed **stoneware** with relief decorations.

**body.** *Noun.* (1) A mixture of clays and non-plastic material that is workable and has suitable firing properties from which ceramic products are made. (2) The structural portion of a ceramic article, as distinct from the glaze, or the material or mixture from which the item is made. (3) The attribute of molten glass associated with homogeneity and viscosity that contributes to its workability. (4) An object or substance that has three dimensions, a mass, and is distinguishable from surrounding objects.

**body centred.** *Noun.* Having a lattice point at the centre of each crystallographic unit cell as well as at the corners. A common cubic crystal structure.

**body colour.** *Noun.* Colour arising from selective absorption of some parts of the visible spectrum because light penetrates a certain distance into the material before reflection and selective absorption occurs in this volume of material.

**body mould.** *Noun.* The portion of a glass mould that shapes the outer surface of ware during pressing.

**boehmite.** *Noun.*  $\gamma$ :  $\text{AlO}(\text{OH})$ . Grey, red, or brown mineral; a natural hydrated aluminium oxide occurring as a major constituent in **bauxite** and **bauxitic clays**. Contains  $\text{AlO}(\text{OH})$  double layers that are cubic close packed. Decomposes at  $360^\circ\text{C}$ ; density  $3,014\text{ kg m}^{-3}$ .

**BOF.** *Acronym.* for basic oxygen furnace used in steel-making for which refractories are specially designed.

**bogie.** *Noun.* A small wagon of short wheelbase running on a railway track.

**bog manganese.** *Noun.* See **manganite**.

**bogie kiln.** *Noun.* An intermittent box-type kiln in which ware, placed on a **bogie** or **kiln car**, is charged, fired, and discharged before a subsequent charge is placed in the kiln.

**Bohemian glass.** *Noun.* A hard, brilliant glass employed in table and chemical ware, usually a lime-potash glass with high silica content.

**Bohr atomic model.** *Noun.* An early model of the atom in which electrons are assumed to move in orbits around the nucleus that are discrete and have **stationary state** properties.

**bohr magneton.**  $\mu_B$ . *Noun.* Fundamental unit of measurement of magnetic dipole moment of an atom equal to  $9.274 \times 10^{-24}\text{ T}^{-1}$ .

**Bohr theory.** *Noun.* A theory of atomic structure developed to explain the spectrum of the hydrogen atom. It assumes that electrons orbiting the nucleus can only exist in certain energy states, **stationary states**, and change from one state to another is accompanied by the absorption or emission of a **quantum** of radiation.

**boil.** *Noun.* (1) A defect occurring in fired porcelain-enamels that consists of bubbles, pinholes, black specks, dimples, or spongy surfaces. (2) An imperfection in glass that consists of gaseous inclusions or small bubbles; bubbles larger than seeds. (3) The turbulence caused by the evolution of gases from melting glass, porcelain-enamels, or other batches. Also called **boiling**.

**boiling.** *Noun.* See **boil**.

**boiling through.** *Adjective.* A term sometimes used to describe the boiling of porcelain-enamels, particularly in instances of severity when defects occur in cover coats.

**boiling water reactor. BWR.** *Noun.* A nuclear reactor that surrounds the **uranium dioxide** fuel elements with water which acts as **moderator** and coolant. Hence the steam is produced within the reactor.

**boil, primary.** *Noun.* See **primary boiling**.

**bole.** *Noun.* Any of a variety of soft unctuous clays used to produce colour in whiter-firing clays, or a reddish-brown body made from such clays. Used as a pigment. Also known as **bolus**.

**bolelection.** *Noun.* A stepped moulding projecting beyond the joint of two members with surfaces at different levels.

**boligong.** *Noun, colloquial.* Expression for glass fibre-reinforced plastic; of Chinese origin meaning "glass-steel."

**bolometer.** *Noun.* A device for measuring the energy of an **electromagnetic wave** by absorbing the wave and registering an increase in temperature as measured by a change in its electrical resistance.

**bolt-hole.** *Noun.* A hole made in a component during the manufacture of an item to facilitate final assembly of the item by means of inserted bolts, screws, or other fasteners.

**bolt-hole brush.** *Noun.* A special round brush, usually equipped with a centred metallic guide pin, employed to remove bisque porcelain-enamel from the inside and edges of small openings in the ware, particularly to prevent chipping during subsequent assembly of the porcelain-enamelled product. See **bisque** (2).

**Boltzmann constant. k.** *Noun.* The ratio of the **gas constant** to the **Avogadro constant**. A thermal energy constant; also known as the **gas constant** when considering 1 molecule only; has a value equal to  $1.3806 \times 10^{-23} \text{ J atom}^{-1} \text{ K}^{-1}$ .

**Boltzmann distribution.** *Noun.* An expression concerning the statistical distribution of large numbers of particles subject to thermal agitation and acted upon by a field, such as magnetic, electric or gravitational. The number of particles per unit volume in any region of the field when in equilibrium is given by  $N = N_0 \exp\{-E/kT\}$ , where  $N_0$  is the number of particles per unit volume in a region in which the energy  $E$  of a particle is zero.

**Boltzmann factor.** *Noun.* The term  $\exp(-E/kT)$  in the **Boltzmann distribution**.

**bolus.** *Noun.* See **bole**.

**bolus alba.** *Noun.* See **kaolin**.

**bonne.** *Noun.* A large playing marble.

**bond.** *Noun.* (1) The degree of adhesion of a porcelain-enamel or other coating to the metal to which it is applied and fired. (2) The forces holding one material to another at the interface. (3) The material in a grinding wheel that holds the grains together and supports them while in use. (4) The intergranular material that provides strength in ceramic bodies. (5) The adhesion of cement paste to aggregate particles, or of concrete or mortar to reinforcing steel, or of concrete to previously hardened concrete on a construction joint or in a patch.

**Bond and Wang crushing theory.** *Noun.* The energy required to pulverise or crush a solid may be calculated by the equation:  $h = 0.001748 C^2 (n + 2)(n - 1)/SEn$ , where  $h$  is the energy required,  $C$  is the **compressive strength**,  $S$  is the **specific gravity**,  $E$  is **Young's modulus** of elasticity, and  $n$  is the approximate **reduction ratio**.

**bond, chemical.** *Noun.* See **chemical bond**.

**bond clay.** *Noun.* A plastic clay of high dry strength employed as a binder in ceramic bodies containing substantial amounts of non-plastic components.

**bonded abrasive disk.** *Noun.* A disk-shaped bonded abrasive product fitted onto a faceplate for use on grinding and milling machines; work for polishing and grinding is presented to the side of the abrasive disk opposite to the faceplate.

**bonded brickwork.** *Noun.* Any regular arrangement of bricks in a structure designed to increase the strength and to enhance the appearance of the structure.

**bonded fabric.** *Noun.* A fibre web held by a matrix that is not continuous itself.

**bonded products.** *Plural noun.* Products in which an abrasive and a bonding agent have been intermixed and processed to produce a relatively inflexible abrasive product, such as a grinding wheel or rubbing stone.

**bonded restoration.** *Noun.* A combination of **porcelain** and a metal alloy, usually nickel-chromium, used in restorative dentistry. The alloy is cast to fit a prepared space and then coated in porcelain making it a form of enamelling.

**bonded roof.** *Noun.* The roof of a furnace or kiln in which the transverse joints are staggered.

**bonder.** *Noun.* (1) A brick of special size and shape employed to begin or finish a course of bonded brickwork. (2) See **bondstone**.

**bond fireclay.** *Noun.* A fireclay exhibiting sufficient natural plasticity to bond nonplastic materials in the manufacture of refractory products.

**bond, in-and-out.** *Noun.* See **in-and-out bond**.

**bonding agent.** *Noun.* (1) An admixture for improving the bond of mortar and concrete in a patch. (2) A paint or coating applied to hardened concrete to facilitate the bonding of a new application of concrete or mortar. (3) Any material in a sand or ceramic powder mixture that by means of adhesion and cohesion holds the grains to a degree suitable for further processing.

**bonding energy.** *Noun.* The energy required to separate two atoms that are chemically bonded to each other. It is most commonly expressed on a per mole of atoms basis. See **bond strength**.

**bonding force.** *Noun.* The force that holds two atoms together; it results from a decrease in total electron wave energy as two atoms are brought closer to each other.

**bonding materials.** *Plural noun.* Organic materials employed in conjunction with glass and ceramic fibres, sheets, moulded shapes, and other products to impart strength, adherence, chemical resistance, weather resistance, electrical properties, and similar properties for use in the production of cloth, laminates, electrical and electronic components, insulating materials, and the like.

**bonding pattern.** *Noun.* When bricks are laid they form patterns between courses and these are called bonding patterns. The most common is called stretcher bond. See **stretcher**.

**Bondley process.** *Noun.* A metalising process in which titanium or zirconium is bonded to the surface of a ceramic body to facilitate soldering or joining of components in the production of electrical and electronic products.

**bond line.** *Noun.* A line along which two surfaces are joined together.

**bond, organic.** *Noun.* See **organic bond**.

**bond, shellac.** *Noun.* See **shellac bond**.

**Bond's hypothesis.** *Noun.* The grinding rate of a solid material is proportional to the rate at which a crack will progress through the material.

**bondstone.** *Noun.* A long stone or brick laid in a wall as a **header**. Also called **bonder**.

**bond strength.** *Noun.* (1) The degree of adherence of a porcelain-enamel to the metal to which it is applied and fired. (2) The strength of a mortar joint or wall in construction applications. (3) The energy measured in  $\text{kJ mol}^{-1}$  needed to overcome the forces holding atoms in solids and molecules. (4) The ability of a heterogeneous product to resist stress loading. (5) The binding forces produced by electron interactions between atoms.

**bond, vitrified.** *Noun.* See **vitrified bond**.

**bone ash.** *Noun.* A white porous residue of high temperature calcined bones consisting of 67–85 % **calcium phosphates** but mainly **hydroxyapatite**,  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ . Employed in the manufacture of porcelain, where at high temperature it reacts with silica and alumina to produce a liquid binding phase. The final product is known as **bone china**.

**bone china.** *Noun.* A soft, highly translucent chinaware of relatively low firing temperature made from a whiteware body containing a minimum of 25 % **bone ash** as a mineraliser and having a water absorption ranging from 0.3 to 2 %; a typical composition is 50 % bone ash, 25 % **china clay**, and 25 % **Cornish stone**. Fired under oxidizing conditions, melting range 1,350–1,500 °C; contains **apatite** crystals and  $\text{Ca}_3(\text{PO}_4)_2$  crystals.

**bone-dry.** *Adjective.* Thoroughly dried and free of uncombined water.

**bone turquoise.** *Noun.* Fossilised bone stained blue with ferrous phosphate and used as a gemstone. Also called **odontolite**.

**bonnet hip.** *Noun.* A roofing tile of special angular shape employed as a junction between two faces of a roof.

**bookform splittings.** *Noun.* Consecutive splittings of **mica** from the same block, each usually dusted with

mica powder to reduce cohesion, arranged in individual books or bunches for use as an electrical insulating material.

**boojom.** *Noun.* Chiral supramolecular nanoparticle based on  $\text{C}_{60}$  **fullerene**-type carbon. It has been functionalised with six optically active liquid crystalline components called **mesogens**. On slow cooling the fullerene adduct exhibits a helical liquid crystalline phase.

**book mica.** *Noun.* Large irregular crystals of mica having cleavage plates resembling the pages of a book.

**boost melting.** *Noun.* An auxiliary method of adding heat to molten glass in a fuel-fired tank by passing an electric current through the glass.

**boot.** *Noun.* A suspended or floating refractory shape in the nose of a glass-melting tank to protect the glass from fuel gases and floating scum and to serve as an opening for the **gathering** of the glass.

**BOP.** *Acronym.* Standing for basic oxygen process for steelmaking. See **basic oxygen process**.

**boracic acid.** *Noun.*  $\text{H}_3\text{BO}_3$ . Alternative name for boric acid. See **boric acid**.

**boracite.** *Noun.*  $\text{Mg}_3\text{B}_7\text{O}_{13}\text{Cl}$ . Magnesium borate; a natural **borate** mineral occurring as fibrous masses in salt domes. The structure contains  $\text{BO}_4$  tetrahedra and  $\text{BO}_3$  planar units linked to form tunnels in which  $\text{Mg}^{2+}$  and  $\text{Cl}^-$  ions reside. Overall the structure is pseudocubic. Hardness (Mohs) 7–7.5; density  $2,970 \text{ kg m}^{-3}$ .

**borate glass.** *Noun.* A glass in which **boric oxide** in combination with **silica** is employed as the major glass-forming ingredient.

**borates.** *Plural noun.* Salts of the family of boric acids. The borate anions  $(\text{B}_x\text{O}_y)^{n-}$  are not as easy to classify as silicates because boron has both 3 and 4 coordination by oxygen. The simple ions are orthoborate,  $(\text{BO}_3)^{3-}$ , discrete ions; pyroborate,  $(\text{B}_2\text{O}_5)^{4-}$ , also discrete ions; metaborate chains,  $(\text{BO}_2)^{n-}$ ; amphibole-type double chains,  $(\text{B}_4\text{O}_7)^{2n-}$  and sheets of  $(\text{BO}_4)^{5-}$ . All are used in glass-forming reactions, in detergent formulations and as fluxing agents.

**borax.** *Noun.*  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ . A refined borate employed as a powerful flux in analysis and as a glass-forming agent in glass, glazes, porcelain-enamels, etc. Mp (anhydrous) 741 °C; density  $1,700 \text{ kg m}^{-3}$ ; hardness (Mohs) 2–2.5.

**borax decahydrate.** *Noun.* See **borax**.

**borax glass.** *Noun.* Vitreous, anhydrous borax used as a glass former and flux in glass, glazes, and porcelain-enamels.

**Borazon.** *Trademark, noun.* The cubic polymorph of **boron nitride**, BN. See **boron nitride**.

**borescope.** *Noun.* A stand-alone video probe used to inspect inaccessible areas within turbines.

**boric.** *Adjective.* Containing **boron**.

**boric acid.** *Noun.*  $H_3BO_3$ . Correctly known as trioxoboric III acid and polydioxoboric II acid but technically as orthoboric,  $HBO_3$ , and metaboric acid,  $(HBO_2)_n$ . Orthoboric acid is a white solid soluble in water, mp 169 °C. Both are used in glass making, borosilicate glass, low temperature glazes and enamels. Has the colloquial name **sassoline**.

**boric oxide.** *Noun.*  $B_2O_3$ . Used principally in the manufacture of glass and porcelain-enamels as a flux, and in nuclear applications as a thermal-neutron absorber. Unexpectedly low mp at 450 °C; density 1,830–1,880 kg m<sup>-3</sup>.

**borides.** *Plural noun.* Special ceramics in which one element is boron and the other a metal or **metalloid**, and having composition ranging from  $M_3B$  to  $MB_{12}$  and occasionally  $MB_{60}$ . They are characterised by the degree of self-bond formation by the boron atoms, for example,  $MB_{12}$  phases contain covalently bonded  $B_{12}$  icosahedra packed closely in a cubic stacking sequence with metal atoms occupying octahedral interstitial sites.  $MB_6$  phases contain discrete  $B_6$  octahedra joined at each apex to another such unit, metal atoms occupying octahedral sites between six such units. Other units are isolated B atoms,  $B_2$  pairs, and sheets of 2-dimensional hexagonal rings. In the high-metal content borides the structures are viewed as being formed from the filling of  $M_6$  trigonal prisms with boron atoms. No single metal will form all 12 known types of boride phases and molybdenum forms the most with six known borides. Because of the extensive, covalent+metallic+ionic bonding they are harder, higher melting, chemically less reactive, and electrically more resistive than the constituent metallic elements. They are characterised by high oxidation resistance and strength retention at elevated temperatures; melting points can be as high as 3,260 °C; densities range from 2,500 to 16,000 kg m<sup>-3</sup>; specific heats of less than 5.8 J kg<sup>-1</sup> K<sup>-1</sup> up to 2,205 °C; linear thermal expansions of 2 % or less between 21 and 1,649 °C; elastic moduli ranging between 200 and 400 GN m<sup>-2</sup> at room temperature; microhardness values range between 13 and 33 GN m<sup>-2</sup>. All these properties make them potential materials for use as structural materials, particularly in aerospace applications. Used in composites.

**bornite.** *Noun.* A mineral sulphide that is a major copper ore; named after the mineralogist Born. See **peacock ore**.

**borocalcite.** *Noun.*  $CaB_4O_7 \cdot 4H_2O$ . A natural **borate** mineral.

**boron. B.** *Noun.* A reactive non-metallic element; when formed as fibre, on a very hot tungsten core by vapour deposition, it is used in metal-matrix composites. A **moderator** material in nuclear reactors. Mp 2,300 °C; density 2,450 kg m<sup>-3</sup>.

**boronatrocalcite.** *Noun.*  $Na_2B_4O_7 \cdot Ca_2B_6O_{11} \cdot 16H_2O$ . A natural **borate** mineral.

**boron carbide.** *Noun.*  $B_4C$ . Third only to diamond in hardness; produced by reduction of boric oxide by carbon in an electric furnace; employed as an abrasive in grinding wheels, belts, papers, and powders; in articles of high resistance to abrasion, in nozzles for high-temperature applications, in control rods for nuclear reactors, and electrical-resistance heating elements for high-temperature furnaces. 6-mm thick hot-pressed tiles are used in aircraft and body armour.  $B_4C$  is the idealised composition since the structure of  $B_{12}$  icosahedra bonded to each other and to  $C_3$  carbon chains does have some composition variation as some of the  $C_3$  chains can contain boron. Mp 2,350 °C; density 2,505 kg m<sup>-3</sup>.

**boron content, equivalent.** *Noun.* See **equivalent boron content**.

**boron-content, equivalent factor.** *Noun.* See **equivalent boron-content factor**.

**boron content, total equivalent.** *Noun.* See **total equivalent boron content**.

**boron-epoxy.** *Noun.* A ceramic composite in which the matrix is a thermosetting plastic and boron fibres provide strength.

**boron equivalent.** *Noun.* The absorptive capacity for thermal neutrons of weights of various elements expressed in terms of the weight of natural boron. Also called **boron value**.

**boron nitride.** *Noun.* BN. Two ceramics of this composition exist: (1) hexagonal BN, also known as **white graphite**, in which both B and N are sp<sup>2</sup>-hybridised and so form infinite 2-D sheets of B-N-B-hexagonal rings only held by weak van der Waals forces to other sheets; a structure which imparts solid lubricating properties. Unlike **graphite** it is an electrical insulator. Refractory crucible material mp about 3,000 °C; used to form seals, gaskets, furnace insulation and in pump parts where aggressive chemicals are to be moved; a neutron absorbing material. (2) **Borazon**, the cubic modification derived by subjecting the hexagonal form to 2,000 °C and pressures in excess of 100 GN m<sup>-2</sup>. Atom hybridization is now sp<sup>3</sup> to give a material nearly as hard as diamond; used as an abrasive and in some cutting tools. Density 2,250 kg m<sup>-3</sup>.

**boron oxide.** *Noun.* See **boric oxide**.

**boron phosphate.** *Noun.*  $BPO_4$ . Used in ceramic bodies and special glasses; isomorphous with **high cristobalite**. Vaporises at 1,400 °C; density 1,873 kg m<sup>-3</sup>.

**boron phosphate glass-ceramics.** *Plural noun.* Glasses in the molar composition range 1:1:1 to 1:1:3 of  $B_2O_3$ - $P_2O_5$ - $SiO_2$  can be heat-treated to yield ultrafine-grained transparent glass-ceramics containing **boron phosphate** as the crystalline phase. They have dc resistivities around 1,016 Ω-cm at 250 °C, which is higher than  $Al_2O_3$ .

**boron phosphide.** *Noun.* BP. A material with the **zinc blende** structure; **electroluminescent** material; bulk modulus 166 GN m<sup>-2</sup>; mp above 2,000 °C; density 2,970 kg m<sup>-3</sup>.

**boron silicide.** *Noun.* (1) B<sub>6</sub>Si; mp 1,946 °C; density 2,430 kg m<sup>-3</sup>. (2) B<sub>4</sub>Si; decomposes at 1,093 °C; density 2,460 kg m<sup>-3</sup>. (3) B<sub>3</sub>Si; mp 1,927 °C; sp. gr. 2,640 kg m<sup>-3</sup>. Also known as **silicon boride**.

**boron, soluble.** *Noun.* See **soluble boron in boron carbide**.

**boron value.** *Noun.* See **boron equivalent**.

**borosilicate.** *Noun.* Any of a large number of substances in which BO<sub>3</sub>-planar triangles and SiO<sub>4</sub>-tetrahedra are linked to form networks. When fused they produce glasses with lower fusion temperatures and a longer working viscous range that makes them useful; **Pyrex glass** is an example.

**borosilicate crown glass.** *Noun.* An **optical crown glass** containing substantial quantities of **silica** and **boric oxide**. See **optical crown glass**.

**borosilicate glass.** *Noun.* A **silicate glass** containing not less than 5 % of **boric oxide**.

**boroxol group.** *Noun.* A structural unit present in the range 12–75 % in **boric oxide** glass. It consists of 3 BO<sub>3</sub> planar triangles bonded into a planar hexagonal B<sub>3</sub>O<sub>3</sub> ring with B-O-B angles of 120°.

**borsic.** *Acronym, noun.* A composite of **silicon carbide** reinforced by **boron fibres**.

**bort.** *Noun.* An imperfect **diamond** or diamond fragments employed principally as an abrasive or as a bonded tip on a cutting tool. Also called **boart** or **bortz**.

**bortz.** *Noun.* See **bort**.

**Bose-Einstein statistics.** *Noun.* The part of quantum statistics developed to deal with systems of particles of zero or integral spin, such as bosons like pions that do not obey the exclusion principle. See **Pauli exclusion principle**.

**bosh.** *Noun.* (1) The lower tapering part of a blast furnace between the hearth and stack in which iron ore is reduced to metallic iron. (2) Siliceous deposits occurring on metal refining vessels, particularly copper. (3) A water tank used for cooling glass-making tools.

**boson.** *Noun.* A particle (e.g., **photon**) that does not obey the **Pauli exclusion principle** but obeys **Bose-Einstein statistics**.

**bossing.** *Verb.* To remove brush marks from painted pottery by patting or striking the design with a silk bag stuffed with soft cotton or wool, particularly used for designs that are first painted in oil and then dusted with powdered pigments.

**botryoidal.** *Adjective.* Resembling a bunch of grapes.

**botryoidal aggregate.** *Noun.* Prismatic crystals radiating from a common centre to form spherical surfaces with groups larger than 13 mm in size; **haematite kidney ore** is an example.

**Bottger ware.** *Noun.* Dark red **stoneware**.

**botting clay.** *Noun.* A refractory clay of high plasticity used to plug the tapping spouts of cupolas and furnaces containing molten materials.

**bottle.** *Noun.* A glass or ceramic vessel of cylindrical shape that can be closed-off with a cork or cap that is used to store liquids.

**bottle glass.** *Noun.* Glass with an **aluminosilicate** composition used to make bottles.

**bottle green.** *Adjective.* A dark-green colour so named because many wine bottles are made to be this colour.

**bottle kiln, bottle oven.** *Noun.* An **updraft kiln** in the shape of a tapered bottle, the tapered neck serving as the flue.

**bottle, vacuum.** *Noun.* See **vacuum bottle**.

**bottom clay.** *Noun.* The layer next to the sand at the base of a **ball clay lens**.

**bottoming.** *Noun.* The lowest level of rocks, stones or concrete used as part of a foundation for a road or building.

**bottom pouring.** *Verb.* To discharge the contents of a smelter, melting tank, ladle, or other container from the bottom.

**bottom, slugged.** *Noun.* See **slugged bottom**.

**bottom tap.** *Noun.* A hole for the drainage of molten compositions and slags from the bottom of a furnace, smelter, or melting tank.

**bottom teeming.** *Verb.* To fill ingots or moulds in which the molten batch enters the moulds from the bottom.

**bottom up nanotechnology.** *Noun.* See **top down nanotechnology**.

**boulder.** *Noun.* Sedimentary rock rounded in shape and bigger than 256 mm in diameter.

**boulder clay.** *Noun.* A glacial deposit of fine clay mixed with **boulders** and **pebbles**.

**boule.** *Noun.* A pure crystal, such as silicon or **sapphire**, frequently a pear-shaped mass consisting of a single crystal, formed in a special furnace by rotating a small seed crystal while slowly pulling it out of the molten bath; used as bearings, thread guides, record player needles, etc.

**boundary.** *Noun.* (1) A thermodynamic boundary that separates a thermodynamic system from its surroundings. (2) Something that denotes the farthest limit of an area.

**boundary, large-angle.** *Noun.* See **large-angle grain boundary**.



- boundary layer.** *Noun.* The layer of a fluid closest to the surface of a solid over which the fluid is flowing. Because of adhesion it flows more slowly than the bulk of the liquid.
- boundary lubrication region.** *Noun.* See **Stribeck curve**.
- boundary, small-angle.** *Noun.* See **small-angle grain boundary**.
- bound state.** *Noun.* The function describing an electron in an atom, in which the energy is discrete and the **wave function** localised.
- bournonite.** *Noun.*  $\text{PbCuSbS}_3$ . One of the most abundant sulphosalts. A major ore of lead and copper; grey to black, orthorhombic crystals; hardness (Mohs) 2.5–3; density  $5.933 \text{ kg m}^{-3}$ .
- Bowen's reaction series.** *Noun.* The sequence in which minerals are formed during the cooling of a **batholith**.
- bowing.** *Noun.* The tendency of a length of coated abrasive or other material to curve or bend; caused by excess moisture (expansion) or lack of moisture (shrinkage) on one side of the abrasive strip
- bowl.** *Noun.* The portion of a feeder that delivers molten glass to the **forming unit**, and which consists of the orifice, revolving tube, needle, etc.
- bow-off.** *Verb.* To remove excess clay from a moulded artefact prior to removing it from the mould.
- boxcar roof.** *Noun.* The roof of an **open-hearth furnace** in which the transverse and horizontal ribs form box-like shapes along the top.
- box furnace, box kiln.** *Noun.* An intermittent box-shaped furnace in which ware is placed, fired, and removed on a scheduled basis before the introduction of a subsequent charge.
- boxing.** *Noun.* To arrange cups rim-to-rim in a kiln to prevent distortion during firing.
- box section.** *Noun.* A concrete pipe of rectangular cross section.
- boy.** *Noun.* Apprentice glassblower who takes hand-blown **lead crystal glass** to the **annealing lehr**.
- boy, mechanical.** *Noun.* See **mechanical boy**.
- bp.** *Abbreviation.* Stands for boiling point. Also **b.pt.**
- b.pt.** *Abbreviation.* Stands for boiling point. Also **bp**.
- Bradford.** *Toponym.* Used attributively for a type of **clay** found near the town of Bradford-on-Avon. It is a grey **marl** clay with thin layers of tough **limestone** and **calcareous sandstone**.
- Bragg equation.** *Noun.* See **x-ray diffraction**.
- Bragg's law.** *Noun.* A relationship that sets out the conditions for a set of crystallographic planes to diffract a beam of x-rays. See **Bragg equation**.
- Bragg stack.** *Noun.* An acoustic mirror composed of multiple layers each with a different acoustic impedance.
- braid.** *Noun.* (1) A shield from strong electrostatic fields for insulated cables and conductors consisting of woven metallic wire. (2) A woven, fibrous, protective covering over an insulated conductor or cable.
- brain coral.** *Noun.* A stony coral with a structure resembling the convoluted surface of a brain.
- brake lining.** *Noun.* A covering of **asbestos**, **cermet**, **carbon fibre** or other ceramic material moulded to the brake shoe or brake band which presses against the rotating drum to apply resistance to the motion of a body.
- brale.** *Noun.* A diamond indenter of sphero-conical shape used in **Rockwell hardness** testing.
- branch.** *Noun.* (1) An arm of a dendritic crystal. (2) A section of a curve separated from the rest of the curve by discontinuities or special points. (3) In computer technology it is a departure from the normal sequence of programmed instructions into a sub-routine.
- brannerite.** *Noun.*  $\text{ThTi}_2\text{O}_6$ . The **archetype** of the  $\text{AB}_2\text{O}_6$  family of ceramics, some of which are used as **electroceramics**.
- brash.** *Noun.* Loose, broken rock.
- brass wire.** *Noun.* Wire of selected diameters employed to cut clay and unfired ceramic products.
- braunite.** *Noun.*  $\text{Mn}_7\text{SiO}_{12}$  or  $3\text{Mn}_2\text{O}_3 \cdot \text{MnSiO}_3$ . A brownish-black mineral consisting of both **manganese oxide** and **manganese silicate**. A source of manganese.
- Bravais lattice.** *Noun.* The 14 regular arrangements of points in 3-D space. Every crystal structure belongs to one of these lattices.
- Brazilian test.** *Noun.* A diametral splitting test performed on ceramic disks in which a disk is compressed until it fails in tension along the vertical diameter. See **splitting tensile test**.
- brazilite.** *Noun.* The name given to naturally occurring **baddeleyite**,  $\text{ZrO}_2$ , when it is found with a fibrous or columnar habit.
- brazing.** *Noun.* To join two or more metal parts by fusing a solder between the adjoining surfaces to form a vacuum-tight bond; in ceramic technology, the braze is made between a metallised ceramic and a mating metal.
- breadboard.** *Noun.* An experimental model of an item being considered for production, particularly a proposed electronic product, to establish the feasibility of the item and to detect areas for its improvement.
- breakdown field.** *Noun.* The local field at grain boundaries in a ceramic **varistor** at which the grains change from insulators to large current conductors.

**breakdown field strength.** *Noun.* The electric field strength at which excessive ionisation in the ceramic occurs. Any conductive paths may carbonise or cause arcs and consequential damage.

**breakdown voltage.** *Noun.* The potential difference at which electrical failure occurs in an electrical insulating material located between two electrodes under specified conditions. Also termed **dielectric** and **electric breakdown voltage**.

**breaking extension.** *Noun.* See **extension at break**.

**breaking length.**  $L_B$ . *Noun.* The length of a specimen whose weight is equal to the breaking load  $L_B = P_B \rho$ , where  $\rho$  is density  $\text{kg m}^{-3}$  and  $P_B$  is the breaking load in  $\text{kg m}^{-2}$ .

**breaking stress.** *Noun.* The stress required to fracture a material, by tension, compression, or shear.

**breakout.** *Noun.* A defect in dry-process porcelain-enamels characterised by an area of blisters with well-defined boundaries.

**break point.** *Noun.* (1) The first appearance in the effluent of an adsorbate on activated carbon under prescribed conditions. (2) A change in the shape of a plot of density against log of the compacting pressure in a uniaxial compaction of dry powder. It becomes obvious when the powder contains granules of homogeneous size and strength. The break point represents the stress needed to break the **agglomerate** bonds in the granules.

**breasts.** *Noun.* The sloping refractory components below the ports and adjoining brickwork of an **open-hearth furnace** that serves to join the hearth with the furnace ends.

**breast wall.** *Noun.* (1) The entire side wall of a furnace between the **flux block** and **crown**, excluding the ends. (2) The refractory wall between pillars of a **pot furnace** and in front of or surrounding the front of a pot.

**breccia.** *Noun.* A rock consisting of angular fragments embedded in a finer matrix.

**breccia violetto.** *Noun.* An Italian marble with a very distinctive polished microstructure that is typical of a **breccia** and as a result is used to decorate buildings etc.

**breche sanguine.** *Noun.* An attractive red **marble breccia**. Also called **red African**.

**breeze.** *Noun.* Ashes of coal used to make **breeze block**.

**breeze block.** *Noun.* A low density building brick used for non-load bearing walls made from **breeze** bonded by cement. Also called **cinder block**, **clinker block**.

**breeze coal.** *Noun.* The residue from coke and charcoal making; used in concrete and bricks.

**breezing.** *Noun.* A thin layer of buckwheat, anthracite coal, or coarse sand spread on the refractory floor of a glass furnace before the setting of pots.

**bremssstrahlung.** *Noun.* Electromagnetic radiation emitted when the velocity of a charged particle changes.

**Brenner gauge.** *Noun.* A device calibrated to estimate the thickness of porcelain-enamels as a function of the force required to lift a metal pin from contact with the coating surface against a known magnetic force acting beneath the under-surface of the base metal.

**breunnerite.** *Noun.* A **solid solution** of iron magnesium carbonate that occurs naturally with an iron content in the 4–8 wt.%  $\text{Fe}_2\text{O}_3$ , which when **dead burned** makes a good refractory for steel production.

**Brewster.** *Noun.* A unit of photoelasticity equivalent to a retardation of  $10^{-12} \text{ m}^2 \text{ N}^{-1}$ .

**Brewster angle.**  $\theta_i$ . *Noun.* The angle of incidence of a light beam at an air-reflecting medium interface at which it is polarised to its maximum extent, which is the maximum divergence in reflectivity between the **p-wave** and **s-wave** of the light. The reflectivity of the p-wave becomes zero at the angle:  $\tan \theta_i = n_2/n_1$ , where  $n_1$  and  $n_2$  are the medium and air refractive indices.

**Brewster's law.** *Noun.* The tangent of the polarising angle,  $\alpha$ , for a material is equal to the index of refraction  $n$ :  $n = \tan \alpha$ ; the polarising angle is defined as the angle of incidence for which the reflected polarised ray is perpendicular to the refracted ray.

**Brewster's window.** *Noun.* A glass window of special composition used in each end of some gas **lasers** to transmit one polarisation of the laser output beam without loss.

**brianchone lustre.** *Noun.* A lustre in which a reducing agent is incorporated as a component of a ceramic glaze.

**brick.** *Noun.* A block of clay or shale formed into a rectangular prism while in a plastic condition, and hardened by firing in a kiln or by sun baking (**adobe**) for use as a masonry unit in building and other construction. Manufactured brick now contains up to 10 % of recycled material and they can be recycled after use. Burnt brick has the resilience of stone but can also be shaped and fired with glazes to produce a range of bright colours. The mineral content of the original clay, the firing temperature and the kiln atmosphere affects the colour of the brick.

**brick acid.** *Noun.* A solution used to clean cement mortar stains from concrete blocks, pavers and bricks. Commonly contains hydrochloric acid.

**brick, acid resisting.** *Noun.* See **acid resisting brick**.

**brick, air.** *Noun.* See **air brick**.

**brick, alumina.** *Noun.* See **alumina brick**.

**brick, angle.** *Noun.* See **angle brick**.

**brick, arch.** *Noun.* See **arch brick**.

**brick, ashlar.** *Noun.* See **ashlar brick**.

- brick, basic.** *Noun.* See **basic brick**.
- brickbat.** *Noun.* A piece of brick.
- brick, bauxite.** *Noun.* See **alumina brick**.
- brick, block.** *Noun.* See **block brick**.
- brick brindled.** *Noun.* See **brindled brick**.
- brick, building.** *Noun.* See **building brick**.
- brick, calcium silicate.** *Noun.* See **calcium silicate brick**.
- brick, centre.** *Noun.* See **centre brick**.
- brick, chequer.** *Noun.* See **chequer brick** or **checkers**.
- brick, chemically bonded.** *Noun.* See **chemically bonded brick**.
- brick, chrome.** *Noun.* See **chrome brick**.
- brick, chrome-magnesia.** *Noun.* See **chrome-magnesia brick**.
- brick, chrome-magnesite.** *Noun.* See **chrome-magnesite brick**.
- brick, chuff.** *Noun.* See **chuff brick**.
- brick, circle.** *Noun.* See **circle brick**.
- brick classification.** *Noun.* A naming system indicating the potential use of the brick. There are three classes: **common**, **face** or **facing**, and **engineered** or **engineering brick**.
- brick clays.** *Plural noun.* Clays possessing properties suitable for the production of brick. Such clays, which usually fire to a red colour, are somewhat impure, containing considerable amounts of fluxing ingredients, will mould readily, fire to an appropriate degree of hardness at a relatively low temperature, and will be resistant to warping and cracking during firing. Grades that contain lesser amounts of impurities and soluble salts, and which fire to greater hardness, lower porosity, greater strength, and more uniform colours are used in the manufacture of face brick.
- brick, clinker.** *Noun.* See **clinker brick**.
- brick, concrete.** *Noun.* See **concrete brick**.
- brick, cored.** *Noun.* See **cored brick**.
- brick, critical diameter.** *Noun.* See **critical diameter**.
- brick, crown.** *Noun.* See **crown brick**.
- brick, dc/dc.** *Noun.* See **dc/dc brick**.
- brick, deaired.** *Noun.* See **deaired brick**.
- brick, dolomite.** *Noun.* See **dolomite brick**.
- brick, dolomite-magnesite.** *Noun.* See **dolomite-magnesite brick**.
- brick, dome.** *Noun.* See **dome brick**.
- brick, double.** *Noun.* See **double brick**.
- brick, drop-machine silica.** *Noun.* See **drop-machine silica brick**.
- brick, dry-pressed.** *Noun.* See **dry-pressed brick**.
- brick earth.** *Noun.* A loamy, relatively impure clay used in making some types of common brick.
- brick, economy.** *Noun.* See **economy brick**.
- brick, electrocast.** *Noun.* See **electrocast brick**.
- brick, end-cut.** *Noun.* See **end-cut brick**.
- brick, end skew.** *Noun.* See **end skew brick**.
- brick, engineered.** *Noun.* See **engineered brick**.
- brick, engineering A brick.** *Noun.* See **engineering A brick**.
- brick, engineering B brick.** *Noun.* See **engineering B brick**.
- brick, facing.** *Noun.* See **face brick**.
- brick, feather.** *Noun.* See **feather brick**.
- brick, fire.** *Noun.* See **firebrick**.
- brick, flashed.** *Noun.* See **flashed brick**.
- brick, floor.** *Noun.* See **floor brick**.
- brick, furring.** *Noun.* See **furring brick**.
- brick, glass.** *Noun.* See **glass brick**.
- brick, graphite.** *Noun.* See **graphite brick**.
- brick, green.** *Noun.* See **green brick**.
- brick, hard-burned.** *Noun.* See **hard-burned brick**.
- brick, hand-made.** *Noun.* See **hand-made brick**.
- brick, high-alumina.** *Noun.* See **alumina brick**.
- brick, high-duty fireclay.** *Noun.* See **high-duty fireclay brick**.
- brick, industrial floor.** *Noun.* See **industrial floor brick**.
- brick, inwall.** *Noun.* See **inwall brick**.
- brick, ipre.** *Noun.* See **ipre brick**.
- brick, jack.** *Noun.* See **jack brick**.
- brick, jamb.** *Noun.* See **jamb brick**.
- brick, jumbo.** *Noun.* See **jumbo brick**.
- brick, key.** *Noun.* See **key brick**.
- brick, ladle.** *Noun.* See **ladle brick**.
- brick, lattice.** *Noun.* See **lattice brick**.
- bricklayer.** *Noun.* A skilled person trained to lay bricks.
- bricklaying.** *Noun.* The art and skill of laying bricks.

- brick, low-duty fireclay.** *Noun.* See **low-duty fireclay brick**.
- brick, lug.** *Noun.* See **lug brick**.
- brick, magnesia.** *Noun.* See **magnesia brick**.
- brick, magnesite.** *Noun.* See **magnesia brick**.
- brick, medium-duty fireclay.** *Noun.* See **medium-duty fireclay brick**.
- brick, merch.** *Noun.* See **merch brick**.
- brick, metalkase.** *Noun.* See **metalkase brick**.
- brick, modular.** *Noun.* See **modular brick**.
- brick, mould.** *Noun.* See **mould brick**.
- brick, neck.** *Noun.* See **neck brick**.
- brick, nine-inch.** *Noun.* See **nine-inch brick**.
- brick, Norman.** *Noun.* See **Norman brick**.
- brick, nozzle.** *Noun.* See **nozzle brick**.
- brick, packaged.** *Noun.* See **packaged brick**.
- brick, panel.** *Noun.* See **panel brick**.
- brick, paving.** *Noun.* See **paving brick**.
- brick, perforated.** *Noun.* See **perforated brick**.
- brick, pitch-bonded basic.** *Noun.* See **pitch-bonded basic brick**.
- brick, pitch-impregnated.** *Noun.* See **pitch-impregnated refractories**.
- brick, place.** *Noun.* See **place brick**.
- brick, pressed.** *Noun.* See **pressed brick**.
- brick, radial.** *Noun.* See **radial brick**.
- brick red.** *Adjective.* A reddish-brown colour.
- brick, refractory.** *Noun.* See **refractory brick**.
- brick, repressed.** *Noun.* See **repressed brick**.
- brick, Roman.** *Noun.* See **Roman brick**.
- brick, rubbing.** *Noun.* See **rubbing brick**.
- brick, runner.** *Noun.* See **runner brick**.
- brick, salmon.** *Noun.* See **salmon brick**.
- brick, sand-creased.** *Noun.* See **sand-creased brick**.
- brick, sand-lime.** *Noun.* See **sand-lime brick**.
- brick, sand-struck.** *Noun.* See **sand-struck brick**.
- brick saw.** *Noun.* A mechanically operated abrasive disk used to cut brick.
- brick, scove.** *Noun.* See **scove brick**.
- brick, SCR.** *Noun.* See **SCR brick**.
- brick scratchers.** *Noun.* A wire comb employed to texture the surface of brick following the extrusion operation.
- brick, semi-silica fireclay.** *Noun.* See **semi-silica fireclay brick**.
- brick, sewer.** *Noun.* See **sewer brick**.
- brick, sidearch.** *Noun.* See **sidearch brick**.
- brick, side-cut.** *Noun.* See **side-cut brick**.
- brick, silica.** *Noun.* See **silica brick**.
- brick, siliceous fireclay.** *Noun.* See **siliceous fireclay brick**.
- brick, skewback.** *Noun.* See **skewback brick**.
- brick, sleeve.** *Noun.* See **sleeve brick**.
- brick, soap.** *Noun.* See **soap brick**.
- brick, soft-mud.** *Noun.* See **soft-mud brick**.
- brick, standard.** *Noun.* See **standard brick**.
- brick, stiff-mud.** *Noun.* See **stiff-mud brick**.
- brick, straight.** *Noun.* See **straight brick**.
- brick, sun-dried.** *Noun.* See **sun-dried brick**.
- brick, superduty fireclay.** *Noun.* See **superduty fireclay brick**.
- brick, superduty silica.** *Noun.* See **superduty silica brick**.
- brick, tapestry.** *Noun.* See **tapestry brick**.
- brick, textured.** *Noun.* See **textured brick**.
- brick, triple.** *Noun.* See **triple brick**.
- brick, tuyere.** *Noun.* See **tuyere brick**.
- brick, unburned.** *Noun.* See **unburned brick**.
- brick, water-struck.** *Noun.* See **water-struck brick**.
- brick, wedge.** *Noun.* See **wedge brick**.
- brick, wire-cut.** *Noun.* See **wire-cut brick**.
- brickwork.** *Noun.* Any masonry structure or pavement made of brick.
- brickwork, reinforced.** *Noun.* See **reinforced brickwork**.
- brickyards.** *Noun.* A commercial unit where bricks are made, stored and sold.
- brick, zirconia.** *Noun.* See **zirconia brick**.
- bridge.** *Noun.* The structure formed by the end walls of the adjacent **melter** and **refiner** compartments of a **glass tank**.
- bridge cover.** *Noun.* A refractory block spanning the space between the end walls of a glass-melting tank and the adjacent **refiner tank**.

**bridge-material transfer.** *Noun.* Material transfer that occurs in an electric arc furnace without the presence of a gaseous electric discharge. The filament of molten contact material that connects the two separating electrodes does not rupture in the middle and there is a gain of material on one contact and a loss of material from the other from this molten bridge.

**bridge wall.** *Noun.* The part of a **glass-melting tank** that separates the **melting** and **refining sections**.

**bridging oxygen.** *Noun.* An atom of oxygen situated between and covalently bonded to two **network-forming atoms**, such as silicon, in a glass structure.

**bright.** *Adjective.* Emitting or reflecting considerable light.

**bright annealing.** *Verb.* To heat steel or iron to a red heat or above in an inert or reducing atmosphere which inhibits or prevents oxidation, the surface of the metal remaining bright for subsequent enamelling.

**bright glaze.** *Noun.* A white, coloured, or clear ceramic glaze having a high gloss.

**bright gold.** *Noun.* An inexpensive **lustre of gold** resinate combined with other metal resins and a flux; used as a decoration when fired on glass, porcelain-enamel, glaze, or other surfaces. See **lustre**.

**brightness.** *Noun.* (1) A term for the flux emitted per unit emissive area as projected on a plane normal to the line of sight. The unit is that of a perfectly diffusing surface emitting  $10^4 \text{ lm m}^{-2}$  of projected surface, called a **lambert**; millilambert is more convenient. The **SI unit** is the **candela** per steradian. (2) A measure of total light present in a colour.

**brights.** *Noun.* Any portion of decorated glass forming a part of a design, but which has not been acid-treated.

**brilliance.** *Noun.* The property of being very bright in appearance. In glasses or glassy compositions, the **index of refraction**, the transparency, and the surface polish of the item being observed influence the property.

**brilliant cutting.** *Verb.* To decorate flat glass by cutting designs in the glass by abrasives and polishing wheels.

**brimstone.** *Noun.* An old name for sulphur.

**brindled brick.** *Noun.* A brick of high crushing strength made of iron-bearing **sedimentary clays** in which the iron oxides are partially reduced during firing.

**Brinell hardness.** *Noun.* See **Brinell test**.

**Brinell hardness number.** *Noun.* See **Brinell test**.

**brinelling.** *Noun.* Surface corrosion at very localised places.

**Brinell test.** *Noun.* A measurement of the hardness of a material obtained by pressing a steel ball 1 cm in diameter into a polished surface of the material being tested under a prescribed load; the applied load is divided by the spherical-surface arc area of the resulting indentation; the results are reported as the **Brinell number** with

units of  $\text{kg mm}^{-2}$ . Sometimes called the **Brinell hardness number**.

**briquette or briquet.** *Noun.* (1) A mass of fine granular material compressed into some desired shape and held together with a bonding agent. (2) A small brick of any substance. (3) A small brick made by compressing coal dust and used for fuel. (4) *Verb trans.* To make into a brick form.

**briquetting.** *Verb trans.* To form powdered or granular materials into cubes, blocks, or other shapes in dies under pressure.

**bristle.** *Noun.* A generic term for short stiff fibres.

**Bristol glaze.** *Noun.* An unfritted zinc-bearing glaze for **stoneware**, **terra cotta**, and similar bodies. It has the following composition in wt. %:  $\text{SiO}_2$  (67.09),  $\text{Al}_2\text{O}_3$  (13.01),  $\text{Na}_2\text{O}$  (1.98),  $\text{K}_2\text{O}$  (3.01),  $\text{MgO}$  (2.57),  $\text{CaO}$  (7.16) and  $\text{ZnO}$  (5.19).

**britholite.** *Noun.*  $\text{Ca}_4\text{Ln}_6(\text{SiO}_4)_6\text{O}_2$ . A mineral with a structure and composition that make it a possible containment phase for plutonium by **isomorphous replacement** of the lanthanide ions in the structure.

**British thermal unit. Btu.** *Noun.* The unit of heat required to raise the temperature of 1 lb of water at maximum density (air-free)  $1^\circ\text{F}$  under a constant pressure of 1 atm; the equivalent of 252 cal.

**brittle.** *Noun, adjective.* The property of being broken or fractured without prior deformation. Unable to support slow crack growth. Having a low value for the **fracture toughness parameter**,  $K_{\text{Ic}}$ , which is usually  $<1.0 \text{ MN m}^{-3/2}$ .

**brittle-ductile transition. BDT.** *Noun.* Most brittle materials when tested at constant strain rate as a function of temperature show a change from characteristic brittle fracture to one showing some ductile characteristics. The BDT is associated with a reduction in the localised force on an existing critical crack due to plastic flow during loading. The change in behaviour has a characteristic temperature,  $T_c$ .

**brittle fracture.** *Noun.* A fracture occurring in a metallic or ceramic body exhibiting the characteristics of very rapid crack propagation. In this mode cracks propagate rapidly with little obvious plastic deformation.

**brittle mica.** *Noun.* A **divalent mica**, that is one containing divalent cations between the Si-O sheets for charge balancing, showing perfect basal cleavage but the greater **ionic bond strength** makes the resultant sheets brittle in character.

**brittleness index.** *Noun.* A measure of ceramic grindability defined as  $H_v/K_{\text{Ic}}$ , where  $H_v$  is the **Vickers hardness** measured in  $\text{GN m}^{-2}$  and  $K_{\text{Ic}}$  is the **fracture toughness parameter**, which has the units  $\text{MN m}^{-3/2}$ . Hence, brittleness index is measured in units of  $\text{m}^{-1/2}$  and the larger the value the less energy required grinding to a given particle size.

- brittle-ring test.** *Noun.* A **tensile strength** test in which maximum stress is applied to the inner periphery of a ring-shaped specimen by application of a compressive load to the outer periphery of the ring. Failure should occur through the vertical diameter of the annular specimen.
- brochantite.** *Noun.*  $\text{Cu}_4\text{SO}_4(\text{OH})_6$ . A basic copper sulphate formed by atmospheric corrosion of copper. A characteristic green colour.
- broken-joint tile.** *Noun.* A roofing tile laid over the centre of the head of a tile immediately below.
- broken seed.** *Noun.* A fractured bubble on the surface of plate glass after polishing.
- Brongnart's formula.** *Noun.* A formula used to calculate the solid content of a suspension:  $W = (P - 20)S / (S - 1)$ , in which  $W$  is the weight of solid in 1 pint of the slurry in ounces,  $P$  is the weight of 1 pint of the slurry, and  $S$  is the **specific gravity** of the dry solid material.
- bronzing.** *Noun.* A mixture of pigments of a metallic lustre or powdered metal, and a binding agent, such as gold size, that is applied to a ceramic surface.
- bronzite.** *Noun.* An **orthopyroxene** silicate having a metallic or pearly lustre.
- bromellite.** *Noun.*  $\text{BeO}$ . A somewhat rare ore; synthetic bromellite, **beryllium oxide**, has some specialised refractory uses.
- Brookfield viscometer.** *Noun.* An instrument to measure the viscosity of a porcelain-enamel or glaze slip in which the resistance of an electrically operated cylinder to rotation in the slip is determined.
- brookite.** *Noun.*  $\text{TiO}_2$ . A black, brown, or reddish, orthorhombic mineral of titania, which is **trimorphous** with **anatase** and **rutile**, having a density of 3,870–4,080  $\text{kg m}^{-3}$  and a **Knoop hardness** of 8.53  $\text{GN m}^{-2}$ .
- brown asbestos.** *Noun.* Colloquial expression for the fibrous **amphibole** mineral amosite. See **amosite**.
- brown coal.** *Noun.* See **lignite**.
- brown coat.** *Noun.* A mortar or plaster that has been strengthened by the addition of hair or other fibrous material and over which a finish coat is applied.
- Brownian motion.** *Noun.* The incessant motion of small particles suspended in a fluid. It is an important factor in causing nanoparticles in suspension to **aggregate**. This is seen in the controlling equation:  $\Delta x = [6kT\Delta t / 3\pi\mu d_p]^{1/2}$ , where  $\Delta x$  is the mean displacement,  $\Delta t$  is the diffusion time,  $k$  the **Boltzmann constant**,  $T$  the temperature,  $\mu$  the viscosity of the suspension fluid, and  $d_p$  is the particle diameter. This shows that particles approach each other more often as their size decreases, which enhances aggregation.
- brownies.** *Noun.* A synonym for copperheads in porcelain-enamel. See **copperheads**.
- brown mica.** *Noun.* See **black mica**.
- brownmillerite.** *Noun.*  $\text{Ca}_2\text{AlFeO}_5$ . A phase formed in **cement clinker**.
- brownstone.** *Noun.* An iron-rich **sandstone** with an attractive reddish-brown colour; used for building.
- brown tourmaline.** *Noun.* A gem quality form of the mineral **tourmaline** that occurs as large crystals in some **pegmatites**.
- brucite.** *Noun.*  $\text{Mg}(\text{OH})_2$ . Magnesium hydroxide. Used in refractories as a source of **dead-burned magnesite**, and as a component in welding-rod coatings. Density 2,380–2,400  $\text{kg m}^{-3}$ ; hardness (Mohs) 2.5.
- bruise.** *Noun.* An area of small cracks in glassware resulting from impact.
- Brunauer-Emmett-Teller equation. BET.** *Noun.* A function for the determination of the surface area of a powder or porous solid by computing the monolayer area from the volume of a gas adsorbed on the surface of a sample of known mass; an extension of **Langmuir's isotherm equation**. An expression of the equation is:  $1/[ (p/p_o) - 1 ] = c - 1/v_m c [p/p_o] + 1/v_m c$ , where  $p$  is the equilibrium pressure,  $p_o$  is the saturation pressure of adsorbate,  $v$  is the adsorbed gas volume,  $v_m$  is the monolayer adsorbed gas volume, and  $c$  is the BET constant;  $c$  is obtained from  $c = \exp(E - E_L/RT)$ , where  $E$  is the heat of adsorption and  $E_L$  is the heat of liquefaction of the adsorbent.
- brush.** *Noun.* A conductor arranged to make electrical contact between a stationary and one or more moving components.
- brush, blender.** *Noun.* See **blender brush**.
- brush, bolt-hole.** *Noun.* See **bolt-hole brush**.
- brush, edging.** *Noun.* See **edging brush**.
- brush force.** *Noun.* The force required to close, maintain, and open electrical contacts.
- brush, fan blender.** *Noun.* See **fan blender brush**.
- brushing.** *Verb.* (1) To remove bisque porcelain-enamel from ware before firing by brushing through a stencil or along an edge to produce a design or edging. (2) To remove bedding material from ceramic ware after the **bisque fire**.
- brush, Japanese.** *Noun.* See **Japanese brush**.
- brush, lawn.** *Noun.* See **lawn brush**.
- brush mark.** *Noun.* A defect or blemish in glassware consisting of fine lines having the appearance of brush marks.
- brush, sable detail.** *Noun.* See **sable detail brush**.
- brush, scroller.** *Noun.* See **scroller brush**.
- brush, stain.** *Noun.* See **stain brush**.

**brush, tinter.** *Noun.* See **tinter brush**.

**BSI.** *Abbreviation.* Stands for British Standards Institute: the UK's national standards body.

**BSU.** *Abbreviation.* Stands for basic structural unit. See **basic structural unit**.

**Btu.** *Abbreviation.* Stands for British thermal unit. See **British thermal unit**.

**bubble.** *Noun.* See **blister**.

**bubble cap.** *Noun.* A ceramic cap, serrated along the bottom to permit the passage of vapours; for use in distillation and de-acidifying towers in chemical processes.

**bubble glass.** *Noun.* A decorative product containing bubbles of prescribed size and arrangement.

**bubble-pressure pore-size determination.** *Noun.* A method of estimating the maximum pore size of a material by calculating the pressure required to force a bubble of air through the material wetted by a liquid of known surface tension.

**bubble raft.** *Noun.* A two-dimensional frame where bubbles are produced on the surface of a liquid. The bubble morphology can be studied as a model of grain size, grain boundaries, and grain structures.

**bubble structure.** *Noun.* The size and distribution of voids in a fired porcelain-enamel coating.

**bubbly clay.** *Noun.* Clay containing organic impurities that cause bubbles in porcelain-enamels and glazes during firing.

**Buchner funnel.** *Noun.* A laboratory filter funnel used under reduced pressure, made from **porcelain** consisting of a shallow cylinder with a perforated base

**buck.** *Noun.* A special support employed in the firing of heavy porcelain-enamelled ware.

**bucket conveyor.** *Noun.* A conveyor of bulk material consisting of a series of scoops or bucket-like containers mounted on an endless belt or chain.

**bucking coil.** *Noun.* A coil connected and positioned in such a way that its electric or magnetic field opposes the electric or magnetic field of one or more other coils so that an imbalance is produced in the system to yield an indication.

**buckling.** *Adjective.* A mode of failure found in **fibre-reinforced composites** where an unstable lateral deflection is produced by a compressive stress. In advanced composites not only general buckling is observed but also micro-instability at individual fibres can be a problem.

**buckling, local.** *Noun.* See **local buckling**.

**buckminster fullerene.** *Noun.* An allotrope of carbon consisting of  $C_{60}$  molecular units that are football-shaped cage molecules. The cage contains 6- and

5-membered rings as the carbon atoms are arranged at the vertices of a polyhedron with hexagonal and pentagonal faces to produce the spherical shape. Each  $C_{60}$  unit packs to form a face-centred cubic solid that is a new allotrope of carbon. It is produced in carbon arcs where it condenses on the cool hearth and can occasionally be found in some minerals. Also called **fullerene** or **buckyballs**. Interstitial sites in the solid structure can be occupied by K or Cs to give  $M_3C_{60}$  superconducting carbides;  $T_c = 18$  K. See **fullerene**.

**buckstave, buckstay.** *Noun.* A steel bracing employed to take the thrust of the refractory structure, such as the roof, in the construction of a furnace.

**buckyballs.** *Noun.* See **buckminsterfullerene, fullerene**.

**buckytubes.** *Noun. Colloquial.* Name for a form of carbon consisting of cylindrical carbon molecules. The cylinders are helically wrapped sheets of hexagonal carbon rings. Tubes have outer diameters of 4–30 nm and therefore may form electron guides. The tubes can be multi-walled i.e. several sheets are rolled-up or single-walled i.e. **graphene** rolled into a tube.

**buddie.** *Noun.* A sloping trough used to wash minerals as part of their **beneficiation**.

**buff.** *Adjective.* A dull yellow colour.

**buffer.** *Noun.* (1) A flexible disk or wheel impregnated with a fine abrasive for polishing. (2) A cloth or pad used for polishing. (3) The salt of a weak acid or base added to a solution to stabilise its pH.

**buffing wheel.** *Noun.* A flexible disk coated with a very fine abrasive that is used in buffing or polishing surfaces.

**bugholes.** *Noun.* Small pits, bubbles, or voids in the surface of formed concrete.

**buhr mill.** *Noun.* A pulverising machine in which materials are ground between a siliceous rock rotating against a stationary surface of the same material.

**buhrstone.** *Noun.* See **burstone**.

**builder.** *Noun.* A scrap refractory used as a filler in the construction of **kiln bottoms** and similar items.

**building block.** *Noun.* Hollow concrete or fired-clay blocks used in the construction of walls that usually are to be covered with a finishing material such as stone.

**building brick.** *Noun.* A brick formed and fired to a stable unit from clay, but not especially produced for colour or texture, for use in the general construction industry.

**building clay.** *Noun.* Clay suitable for the production of brick for use in the construction industry.

**bulb edge.** *Noun.* The heavy rounded edge or bead on sheetdrawn glass.

**bulb trailer.** *Noun.* An instrument for squeezing out the flow lines of slip on a clay surface.

**bulged finish.** *Noun.* A distended top section of a glass bottle.

**bulk density.** *Noun.* The ratio of the mass of an object or material to its total volume, including pore space; units are  $\text{kg m}^{-3}$ .

**bulkhead.** *Noun.* A panel of brick built into a wall for easy replacement.

**bulking.** *Noun.* The tendency of fine particles of a material to occupy a greater volume when moist.

**bulk modulus of elasticity, K.** *Noun.* The ratio of the compressive forces applied to a material per unit of surface area to the change in the volume of the material per unit of volume.  $K = -V \, dp/dv$ .

**bulk nanostructured materials.** *Plural noun.* Solid samples with **nanoscale** or partly nanoscale microstructures after sintering, within them.

**bulk sample.** *Noun.* A portion of a sample designed to represent the whole.

**bulk specific gravity.** *Noun.* The ratio of the mass of a material to that of a quantity of water which has a volume equal to the bulk volume of the material at the temperature of measurement.

**bulk volume,  $V_b$ .** *Noun.* The volume of a solid material, including the volume of open and sealed pores. Calculated by the equation:  $V_b = P_o + P_s + V_T = D_w/\rho$ , in which  $V_b$  is the bulk volume,  $P_o$  is the volume of open pores,  $P_s$  is the volume of sealed pores,  $V_T$  is the true volume of the solid,  $D_w$  is the dry weight of the specimen, and  $\rho$  is the bulk density of the specimen.

**Buller rings.** *Plural noun.* Unfired ceramic rings, 6.35 cm in diameter with a hole 2.22 cm in diameter in the centre, of prescribed compositions, which by their respective shrinkages are used as an indication of the thermal history to which accompanying ware has been exposed during firing.

**bulletproof glass.** *Noun.* See **bullet-resisting glass**.

**bullet-resisting glass.** *Noun.* A special laminated safety glass composed of three sections: (1) impact striking section, (2) transition section, (3) impact absorbing section; total thickness 1.9–7.6 cm. Also known as **bulletproof glass**.

**bull float.** *Noun.* A finishing tool with a handle several feet long which will permit a worker, standing at a distance, to finish a slab of concrete from the interior to the edge.

**bull header.** *Noun.* A bull-nosed or **jamb brick** laid on its face so that the normal bedding area is visible in the wall face.

**bullion.** *Noun.* The central portion of a disk of crown glass to which the blowing iron was attached.

**bullnose.** *Noun.* A brick having the corner of one end and side rounded to a radius approximately equal to the width of the brick.

**bull's eye.** *Noun.* A circular window.

**Bull's kiln.** *Noun.* A clamp kiln in which bricks are placed and fired in trenches.

**bunch.** *Noun.* A fibre yarn defect where a length <6 mm shows an abrupt increase in diameter where the fibres are matted.

**bundle strength.** *Noun.* Filament strength as determined from a tensile test of a bundle of parallel fibres rather than from monofilament tests, which are more difficult to perform.

**bundle, fibre.** *Noun.* See **fibre bundle**.

**bung.** *Noun.* (1) A group of **saggers** or pots stacked in a kiln. (2) A removable roof section built in a kiln.

**bunker fuel oil.** *Noun.* A heavy fuel oil formed by the stabilisation of the residual oil remaining after the cracking of crude petroleum, and used in large-scale heating and power-production applications. A graded product and grade 6 is commonly used in industry.

**bunsenite.** *Noun.* NiO. The mineralogical name for cubic **nickel oxide**. It has a glassy dark green colour. Density  $6,790 \text{ kg m}^{-3}$ ; hardness 5.5 (Mohs).

**burette.** *Noun.* A graduated glass tube used in analysis for transferring known volumes of liquids.

**Burgers vector, b.** *Noun.* A vector that specifies the direction and distance by which atoms in a slipped area of crystal have moved with respect to those on the plane below, over which they have moved. This vector is the most characteristic feature of a **dislocation**.

**burin.** *Noun.* A hardened steel chisel used to carve marble.

**burley clay, burley flint clay.** *Noun.* A rock containing nodules of **aluminous** or **ferruginous** materials, or both, bonded by **fireclay**.

**burley flint.** *Noun.* See **burley clay**.

**burn.** *Noun.* (1) The controlled heat treatment of ceramic ware and coatings in a furnace or kiln. (2) *Synonym* for firing.

**burned sand.** *Noun.* A sand mixture in which the bonding agent has been **calcined** by the heat of the cast.

**burned sienna.** *Noun.* See **sienna**.

**burner.** *Noun.* (1) The mechanism by which air and fuel are mixed and directed into a combustion chamber. (2) The operator whose duty it is to tend a ceramic kiln.

**burner block.** *Noun.* A refractory block with one or more orifices through which fuel is introduced into a furnace or kiln.



**burner, premix.** *Noun.* See **premix burner**.

**burning.** *Verb.* (1) To fire ceramic bodies, glazes, porcelain-enamels and other coatings and products in a furnace or kiln for the purpose of developing a bond or other necessary or desired physical and chemical properties. (2) The heat treatment, vitrification, or curing of a grinding wheel to produce desired bond properties. (3) Over pickling of metal for porcelain-enamelling, often producing pits in the metal surface. (4) *Noun.* The change in a material being ground or polished caused by heat generation during the grinding operation, frequently accompanied by discoloration of the material.

**burning bar, point, or tool.** *Noun.* A heat-resistant metal alloy used to support porcelain-enamelled ware during the firing operation.

**burning glass.** *Noun.* A convex glass lens used to concentrate sun rays and raise temperatures locally.

**burning off.** *Verb.* Over firing of porcelain-enamels resulting in a rough, dark surface saturated with undissolved iron oxide.

**burning shrinkage.** *Noun.* See **firing shrinkage**.

**burning-tool marks.** *Noun.* A defect in porcelain-enamels occurring on the sheet-metal surface opposite the point of contact with the supporting burning tool.

**burning zone.** *Noun.* The volume in a continuous furnace where the major amount of heat is supplied to ware during the firing operation.

**burnish.** *Noun.* A shine or lustre.

**burnished gold.** *Noun.* A durable type of gold applied to glazed ware as a suspension in oil, fired, and rubbed with **agate** or other polishing material to a bright finish.

**burnishing.** *Verb trans.* Polishing of overglaze gold, **leather-hard clay**, or other material with **agate**, stone, sand, or steel wool to produce a bright surface.

**burnishing, pattern.** *Noun.* See **pattern burnishing**.

**burn-off.** *Verb.* (1) The process of severing an unwanted portion of a glass article by fusing the glass. (2) *Noun.* Slag-like area resulting from an insufficient coating of porcelain-enamel that occurs during firing.

**burn-out.** *Verb.* The removal of organic binders from unfired shapes by the application of heat

**burnt lime.** *Noun.* Calcined **dolomitic limestone** or **calcite**, or a mixture of these.

**burnt shale.** *Noun.* Carbonaceous **shale** formed by distillation of oil shale. Can be used in road making.

**burnt sienna.** *Adjective.* Of a reddish-brown or deep reddish orange colour. (2) *Noun.* The natural raw material of a brownish-yellow colour heated to give the reddish-orange coloured material used a pigment.

**burnt umber.** *Noun.* A brown pigment made by heating **umber**.

**burn-up.** *Noun.* Nuclear transformations induced during nuclear operations. The term may be applied to fuel or to other materials or to the amount of depletion due to nuclear transformation.

**burr.** *Noun.* (1) A thin, ragged edge of metal resulting from punching, cutting, or grinding of a metal sheet. (2) A fragment of excess material, or of a foreign material, adhering to the surface of a body. (3) A mass of hard siliceous rock enclosed by soft rock.

**burring.** *Verb.* The removal of sharp edges or fins from punched, cut, or ground metal items.

**burr mill.** *Noun.* A mill consisting of two ribbed disks of stone or metal rotating against each other. Used in the grinding of solid materials and in homogenising mixtures of pigments in a suitable liquid medium to produce pastes for the decoration of ware.

**burrstone.** *Noun.* See **burstone**.

**bursting.** *Noun.* The disintegration of refractories containing **chrome ore** when exposed to **iron oxide** at high temperatures; characterised by having the exposed face swell and grow until it breaks away from the brick mass following a permanent increase in volume.

**bursting expansion.** *Noun.* A term sometimes used as a synonym for bursting.

**bursting off.** *Verb.* The breaking of the thin-walled bubble of glass formed above a blow mould.

**bursting strength.** *Noun.* The rupture strength of a material as determined by applying internal gas pressures.

**burstone.** *Noun.* (1) A high silica content, tough rock used as a grindstone. (2) A grindstone or **millstone** made of this rock. Also called **buhrstone** or **burrstone**.

**burst phenomenon.** *Noun.* A rapid rise in temperature shown by some ultrafine amorphous powders as they are heated to a temperature at which they crystallise. The transformation from amorphous to **tetragonal zirconia** is a good example.

**burst pressure.** *Noun.* The maximum inside pressure a material or object can withstand without rupture.

**bushing.** *Noun.* (1) The liner of an orifice that delivers molten glass to a forming machine, or the liner of the unit through which molten glass is drawn in the production of glass fibres. (2) A bearing that lines the supporting structure for a rotating shaft.

**bushing, reducing.** *Noun.* See **reducing bushing**.

**busting strength.** *Noun.* The ability of woven fabric to resist rupture by pressure.

**bustle pipe.** *Noun.* A large refractory-lined pipe that encircles and delivers a hot-air blast to a blast furnace.

**butter of zinc.** *Noun.* Archaic name for **zinc chloride**; sometimes used as a **flashing** agent.

**buttes.** *Plural noun.* Very large protruding rocks produced by wind erosion.

**butting contact.** *Noun.* Electrical contact in which the motion of the moving contact is perpendicular to the contact faces, and which opens and closes with no appreciable sliding or rolling action.

**button.** *Noun.* A section in pressed glassware so designed that it may be knocked out to form a hole of specified dimensions in the parent glass.

**button test.** *Noun.* A test in which button-like specimens of prescribed form and sometimes density, are employed to evaluate the fusion and flow characteristics of frits, glasses, and powders.

**buttress.** *Noun.* A projection designed to increase the resistance of a wall in a structure to lateral forces.

**butt joint.** *Noun.* Geometry for joining two pieces of composite or ceramic with adhesive. The two pieces meet end on with the adhesive between them. It gives a continuous section profile but is a poor design for joining thin sheets.

**butt seal.** *Noun.* Straight end-to-end joining of ceramic to metal or glass to metal seals which will withstand high temperatures and a high vacuum without leakage. Often achieved by having a thin sheet of metal between the components when heat is applied to form the seal.

**BWR.** *Abbreviation.* Stands for boiling water reactor. See **boiling water reactor**.

**bytownite.** *Noun.* Soda-lime **feldspar**.

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