



Glossary of Terms in Powder & Bulk Technology

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### 3. Powder Properties

Written by [Lyn Bates](#) – edited by [mhd](#) on 18. Sep. 2022

absolute powder density	The mass of powder per unit of absolute powder volume.
absolute powder volume	The volume occupied by the solid content of a powder, excluding all pores and voids.
absorption (1)	Penetration of a substance, usually a fluid, into the body of another.
absorption (2)	The attachment of water molecules to the surface of particles
aerated bulk density	(See density, aerated bulk)
agglomerate	An accumulated cluster of many particles that are rigidly bonded together by inter-particle forces, partial fusion, sintering or by growing together, such that they act as a single, larger particle.
apparent powder density	The mass of powder per unit of apparent powder volume.
apparent powder volume	The total volume occupied by solid matter, including open and closed pores.
bed porosity	(See powder bed porosity)
blinding	The building up of small particles on a screening surface reducing the aperture size or closing them completely.
bulk	A mass of particles.

The secant slope, for a given pressure increment, of the pressure-void ratio curve.

coefficient of compressibility

$$a_v = (L^2 F^{-1})$$

Where a stress-strain curve is used, the slope of this curve is equal to  $a_v/(1+e)$ .

A coefficient, defined as

$$a_v (L^2 T^{-1})$$

utilised in the theory of consolidation containing the physical constant of the loose solid affecting its volume change:

coefficient of consolidation

$$c_v = k(1+e)/ a_v \gamma_w$$

where:

-  $k$  = coefficient of permeability,  $LT$

-  $e$  = Voids ratio

-  $a_v$  = coefficient of compressibility,  $(L^2 F^{-1})$

-  $\gamma_w$  = unit weight of water,  $FL^{-3}$

coefficient of friction

$\mu$ , The relationship between normal stress and the corresponding shear stress at which sliding takes place between two surfaces. (Between a loose solid and a contact surface, this behaviour is referred to as wall friction). See static friction and dynamic friction.

coefficient of permeability

The rate of passage of a fluid under laminar flow conditions through a unit cross section of a media under a unit pressure drop at standard temperature conditions.

coefficient of uniformity

$C_u (D)$ , The ratio  $D_{60}/D_{10}$ , where  $D_{60}$  is the particle diameter corresponding to 60 % finer on the cumulative particle-size distribution curve, and  $D_{10}$  is the particle diameter corresponding to 10 % finer on the cumulative particle-size distribution curve.

compression ratio

The ratio of the loose poured density to the pressed density.

dynamic friction

The frictional resistance to sustained sliding. See friction.

friability	The tendency of particles and granules to break down in size during handling and storage under the influence of light physical forces.
gravel	Mineral particles greater in size than 2000 microns
Hausner ratio	The ratio of tapped density to loose poured bulk density.
hydrodynamic cluster	The phenomenon of multiple, closely-grouped, individual particles falling through a fluid with a higher terminal velocity than that of the individual particles. Note that a focused flow stream achieves a higher fall velocity than the terminal velocity of an individual particle.
major principal stress	The largest principal stress acting on a bulk solid.
minor principal stress	The principal stress acting on a bulk solid at 90 degrees to the major principal stress.
oscillating hopper sample divider	A method of securing a representative sample by oscillating feed from a hopper over two contiguous chutes leading into separate collectors.
parent population	The overall bulk system from which a powder sample is taken.
permeability	The ease with which a porous mass e.g. a powder bed or compact, permits the passage of a fluid such as air. This feature has a major influence on the flow behaviour of fine powders. Changes in volume of the bulk essentially are reflected in changes in the voidage. This must initially respond to the volume variation by pressure change of the ambient fluid. A positive void pressure acts to partially support the particle mass. This support reduces particle-to-particle contact pressures and surface interferences that resist shear. In extreme circumstances, the shear strength of the bulk is negated and a highly dilated mass behaves as a fluid. A void pressure less than ambient, as generated by the shear of a settled bed, opposes the expansion of the bulk and hence increases its resistance to expansion and flow.
powder density, absolute	(See absolute powder density).

powder density, apparent	(See apparent powder density).
powder density, bulk	(See bulk density).
powder density, tapped	(See tapped density).
powder volume, apparent	(See apparent powder volume).
pressed density	(See density, pressed).
principal stress	A stress acting in a plane that is not subjected to a shear stress.
principal stress, major	(See major principal stress)
principal stress, minor	(See minor principal stress)
pyrophoric	The property of a powder to self combust when exposed to oxygen.
ratio, compression	(See compression ratio).
recovery factor	The change in dimension of a non-metallic compact on ejection from its die or mould.
representative sample	A quantity taken from a larger amount, that fairly reflects the qualities relative to the conditions of interest of the whole.
sampling table	A device for taking a small powder sample from a large quantity by pouring the material through a series of divided chutes that successively reject 50% of the material flowing.
sand	Mineral particles in the size range 200 to 2000 microns.
sand, fine	Mineral particles in the size range 20 to 200 microns.
silt	Mineral particles in the size range 2 to 20 microns. (Mineral particles less than 20 microns are usually referred to as 'clay').
sliding friction	(See dynamic friction).

static friction	The friction value developed when resistance to slip is fully mobilised prior to relative movement taking place between the material and the contact surface. Note that friction is dependent upon both the nature of the bulk solid and its interaction with a specific contact surface. The magnitude of frictional resistance is then a function of the normal stress acting between the bulk material and the contact surface. See surface friction, co-efficient of friction, dynamic friction.
surface adhesion	The result of attractive mechanisms between a particulate solid and a contact surface. These will give rise to surface cohesion effects according to the frictional nature of the interface. See adhesion, cohesion.
surface cohesion	The resistance to slip offered by internal forces between a particulate solid and a contact surface, separate from any frictional effect due to a normal force acting on the surface. These forces may be generated by such effects as surface tension, in the case of a damp powder, electrostatic forces or molecular forces. The effect may be exacerbated by a negative void pressure differential with ambient pressure. See adhesion. Cohesion.
surface friction	(See static friction, dynamic friction).
tortuosity	A measure of the convoluted path followed by an element of fluid passing through the interstices of a packed powder bed.
volume, absolute	The volume of the solid matter after exclusion of all the spaces (pores and voids).
volume, apparent powder	(See apparent powder volume).
volume, powder	The apparent volume of a powder as measured under specific conditions.

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