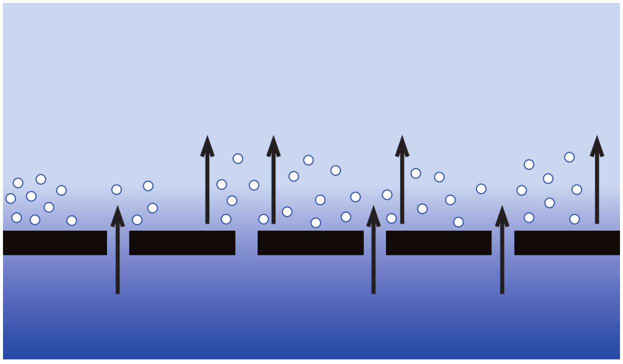
Fluidisation Explained

Porous Ceramic Tiles

Fluidisation or activation of finely divided materials by the use of diffused air has been extensively developed during the past 50 years, particularly for the handling of powders in bulk.

Fluidisation is the process of moving, transporting and treating powders and other granular materials by injection of air to make the powder act as a fluid. This means that air passes through a porous filter material where it is finely distributed and then creates a cushion or film to considerably reduce the friction between material and base.



Also, the air is mixed with the material in such a way that the friction between the particles is reduced, allowing the material to flow like water.

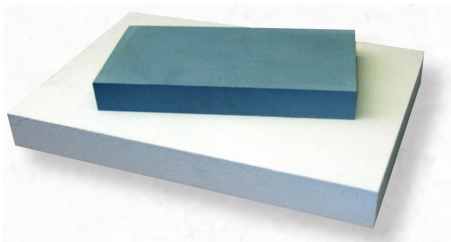
Experience has shown that porous ceramic tiles, used as the permeable membrane through which air is injected and which also supports the powder bed, provide the most efficient means of ensuring the even dispersion of gas, which is essential to the success of an operation.

Typical Tile Sizes

Ceramic Grade	Size (mm)	Size (inches)
P4, P5, P6, P8, C5, C6, C8, C9	305x305x25.4	12x12x1
	305x305x38	12x12x1.5
	305x305x51	12x12x2
	457x305x51	18x12x2
	610x152x25.4	24x6x1
	610x305x25.4	24x12x1

Porous Ceramic Tiles

The main product supplied by Mantec Filtration for fluidisation applications is the porous ceramic tile. These are arranged either in a bed for fluid fire treatment or in series as a fluidised conveyor for transporting powder from one location to another. Another application is to mount the tiles on the side of powder silos to aid flow and prevent solidification.



Porous ceramic tiles are subject to close control during manufacture. Individual tiles are matched one against the other to ensure even overall permeability and the grades used present sufficient resistance to spread the air evenly over the whole area.

Air or gas fed into a compartment or plennum chamber beneath the tiles can only escape by way of the ceramic tiles into the powder above. When velocities are high enough this induces fluidisation. In most cases no more than local fluidisation is necessary to bring about movement in the powder. Relatively small quantities of air at low pressures are needed with velocities of between 0.6 and 1.2 metres per minute (3.4-6.8 metres hour for a standard tile of 305x305mm) being adequate for most purposes and with pressures seldom exceeding 0.3 or 0.4 even in the largest of storage bins.

Typical Applications

The Fluidisation principle is used on many powders:

Coal Dust	Alumina	Sugar
Sand	Fly Ash	Molochite
Salt	Gypsum	Cement
Zircon	Flour	Soda Ash

In various processes:

Silo/Hopper Discharge	Fluidising Conveyors
Powder Mixing	Fluidisation Tanks
Fluidised Burners	Fluid Bed Dryers

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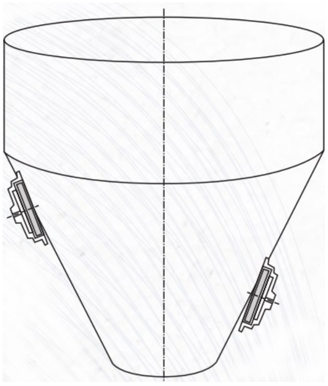
Note: Information contained herein is correct at the date of issue. Feb 2017

Fluidisation

Detailed below are a few process examples showing how ceramic tiles are utilised.

Silo/Hopper Discharge

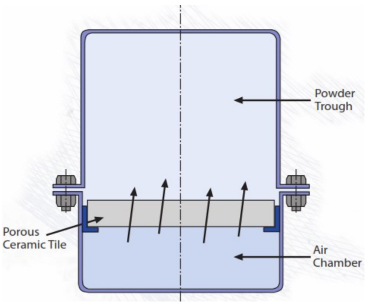


An interesting development of powder fluidisation is the employment of porous ceramic tiles positioned on the side of hoppers or silos. This prevents localised bridging and rat holding in the hopper outlet and thereby ensures continuity and acceleration of the rate of discharge.

Fluidisation Conveyors

The diagram below shows how porous ceramic tiles are installed into fluidised conveyors.

A fluidised conveyor consists essentially of a trough divided along its length by a layer of porous tiles into an upper and lower compartment. The latter comprises the plennum chamber through which air or gas is fed to the tiles. The upper portion is the conveying trough alone which the powder is transported.



In the un-fluidised state the ability of a powder to slide down a chute or slope is determined by the characteristic angle of repose in the material – the slope must be greater than the angle of repose. Transformation to the fluidised state virtually eliminates this angle of repose and fluidised conveying troughs can be operated at inclinations between 2 and 6 degrees.

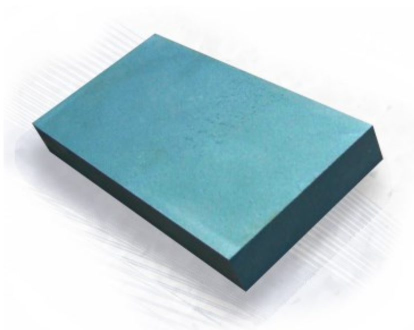
Fluidised Burners

In fluid fire applications a gas is passed through the fluidised bed and produces a high temperature area above the bed. The particles above the bed are in vigorous motion and burned at a rapid rate. This process is therefore very efficient in the breakdown of material by burning. The process is predominantly used for the firing of biomass, organics, refuse-derived fuels or plastics.

The temperature of combustion is affected by the feed rate of the fuel, the moisture content of the fuel, the feed rate of the fluidised air or gas, the calorific value of the fuel, the preheat temperature and the heat extraction. If these considerations are not calculated, sintering can occur. This results in the material becoming solidified and can form into a large block on the fluidised bed.

Simplicity of Equipment

Equipment which employs the technique of fluidisation has the advantage of having no moving parts needing to be in contact with the materials, which are highly abrasive in nature. There are exceptions when agitators are fitted in the fluid zone but in general the only moving parts are the blowers, shut-off and control valves.



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