Perlite Volcanic Glass as a Hollow Microsphere Filler

Formerly Perlite-Lightweight Hollow Spheres

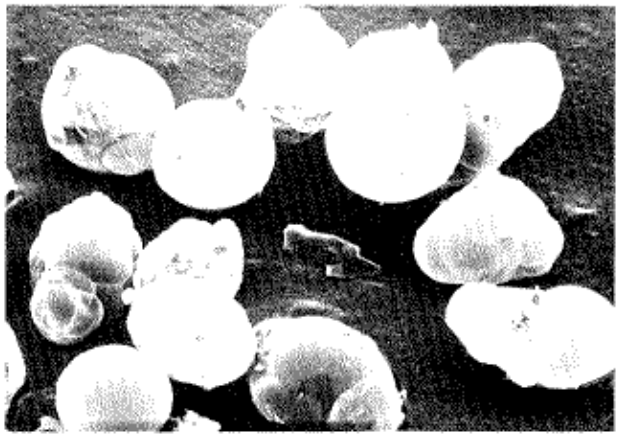
What is Perlite?

Perlite is not a trade name but a generic term for naturally occurring siliceous volcanic rock. The distinguishing feature which sets perlite apart from other volcanic glasses is that when heated to a suitable point in its softening range, it expands from four to twenty times its original volume.

This expansion process is due to the presence of two to six percent combined water in the crude perlite rock. When quickly heated to above 1600°F (870°C) the crude rock pops in a manner similar to popcom as the combined water vaporizes and creates countless tiny bubbles in the heat softened glassy particles. It is these tiny glass-sealed bubbles which account for the amazing light weight and other exceptional physical properties of expanded perlite.

The expansion process also creates one of perlite's most distinguishing characteristics: its white color. While the crude perlite rock may range from transparent to light gray to glossy black, the color of expanded perlite ranges from snowy white to grayish white.

Expanded perlite can be manufactured to weigh from 2 lb/ft^3 (32 kg/m^3) to 15 lb/ft^3 (240 kg/rn3) making it adaptable for numerous uses, including filtration, horticultural applications, insulation, inert carriers and a multitude of filler applications.

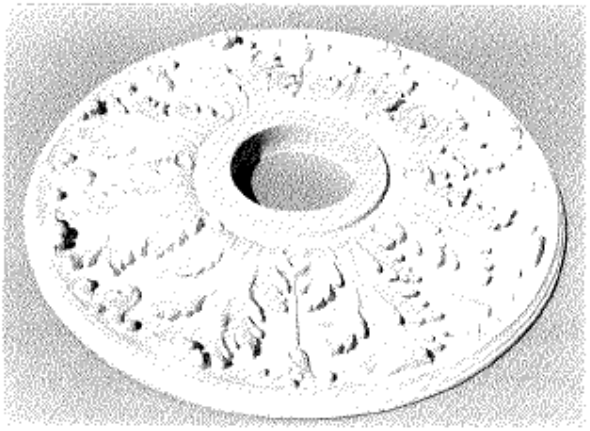


Photomicrograph of perlite lightweight hollow spheres.

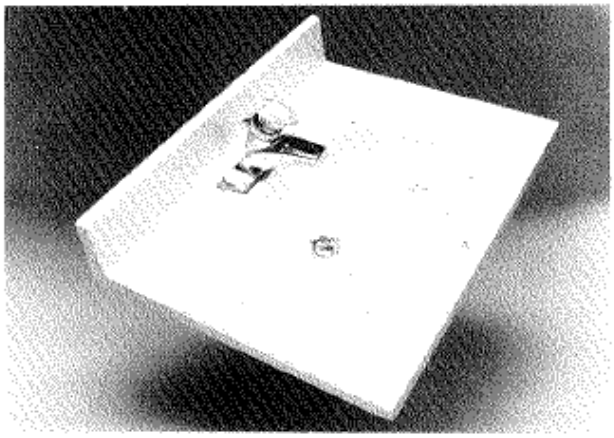
Perlite as a Filler

As a filler, perlite ore is not that much different than any other non-white kind of a rock, other than its small amount of chemically bound water. The expansion described above creates the characteristic white color and the rounded shape of each perlite particle.

This expansion creates the characteristic white color, and the rounded shape of each particle. Perlite hollow glass microspheres are one such filler made in a manner. Care is taken to control the expansion process to ensure as complete a closed cell bubble as possible. When properly made, perlite microspheres have only a few inner cells, as opposed to the large number found in the larger, standardly expanded perlite aggregate particles.



Decorative ceiling rosette manufactured with perlite filler.



Perlite filled cultured marble sink.

TYPICAL CHEMICAL ANALYSIS*

Silicon	33.8
Aluminum	7.2
Potassium	3.5
Sodium	3.4
Iron	0.6
Calcium	0.6
Magnesium	0.2
Traces	0.2
Oxygen (by difference)	47.5
Net Total	97.0
Bound Water	3.0
Total, %	100.0

* All analysis are shown in elemental form.

TYPICAL PRODUCT DATA

Bulk Density, lb/ft^3	4-10
kg/m^3	64-144
Alkalinity	.030-.035
Oil Absorption	175-350*
Thermal Conductivity, $Btu \cdot in/h \cdot ft^2 \cdot °F$	.30-.40
$W/m \cdot K$	.050-.057
Surface pH	neutral
Color	White
Average Particle Size, Microns	40-310
Effective Density, lb/ft^3	as low as 12**
kg/m^3	as low as 192**

*Lbs (kg) of oil per 100 lbs (kgs) of filler
**Varies with product and application

Applications in which perlite microspheres are desired include their use as fillers in water-based construction compounds, paints and coatings, asphalt, and resin-based castings. They are commonly used as sensitizers in blasting explosives as well.

Perlite microspheres are used to provide the following in a formulation:

- Weight reduction
- Shrink and/or crack resistance
- Low volume-based cost compared to binders and some other fillers
- Cost effectiveness vs. other hollow microspheres
- Whiteness
- Impact resistance
- Machinability & ease of sanding
- Nail and screw holding ability
- Flexural strength modification
- Very fine texture in coatings
- Gloss and sheen removal
- Pigment extension (aluminum in asphalt roofing compounds, for example)
- Inertness and non-toxicity

These microspheres are generally smaller than 140 microns in diameter and, depending on the grade, average between 30 and 70 microns in diameter. Despite their small size, an average grade will replace, by volume, 10 – 12 times its weight of calcium carbonate, or 8 – 10 times its weight of sand. Weight reductions of 20 – 40 percent are common in many types of formulations. Starting formulations are available from suppliers upon request.

For further information about this type of filler or any other grade of perlite, please contact your local perlite supplier or the Perlite Institute. Please note, however, that hollow perlite microspheres are only produced by certain manufacturers under demanding quality control conditions, and through the use of special technologies. Perlite microspheres are unlike any other grade of perlite. Products made with normal perlite aggregate grades will not be similar.

Perlite Institute, Inc.
4305 North Sixth Street, Suite A, Harrisburg, PA 17110
717.238.9723 / fax 717.238.9985 / www.perlite.org