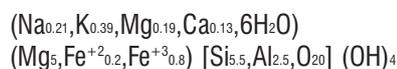


# Vermiculite

## What is Vermiculite?

Vermiculite is a member of the phyllosilicate or sheet silicate group of minerals. It has the remarkable ability to expand to many times its original volume when heated - a property known as exfoliation. The term exfoliation is used to describe the heat expansion of the vermiculite, which occurs at right angles to the strong basal cleavage. The name "vermiculite" is derived from the Latin *vermicularis* (worm-like) on account of the elongate, curved and twisted columns produced when the larger crystals are suddenly heated to high temperatures which releases the interlayer crystalline water.

Various chemical formulae are given for vermiculite. The general formula given below suggests a typical formula, which has been calculated from 65 vermiculite analyses.



The basic structure of the mineral is identical to the micas and to talc: a 2:1 silicate sheet composed of two flat layers of silica and alumina tetrahedra (the tetrahedral layers), which are joined together in a layer composed of apical oxygen atoms, and magnesium, iron, and hydroxyl molecules (the octahedral layer). Between the 2:1 sheets lies the ion exchangeable layer. This layer will change in thickness depending on the interlayer cation present and the arrangement of waters of hydration associated with it.

### Why does vermiculite exfoliate?

The interlayer water is an essential component in the vermiculite. When a particle of vermiculite is rapidly heated, the interlayer crystalline water transforms into steam. The pressure of this steam evolution, forces the silicate layers apart from one another and the vermiculite flake forms an elongate concertina like particle twenty to thirty times its original thickness.



### Multiple properties – many uses

The majority of applications call for vermiculite in its exfoliated form. Vermiculite is a very versatile mineral. It is clean to handle, odourless and mould resistant.

Vermiculite has a wide range of uses that take advantage of its remarkable properties: resilience to fire, refractory nature, thermal and acoustic insulation, absorption capacity, low density and ease of handling.

- **Animal Feedstuffs:** is free flowing, soft, sterile and absorbent. This means it has found a role as a support and carrying medium for a range of nutrients such as fat concentrates, vitamin preparations and molasses. The



use of vermiculite gives a high volume yield and accommodates a high liquid uptake whilst retaining good handling characteristics, so simplifying the process of mixing with other materials.

### ● Construction Industry:

**Bitumen Coated Screeds:** Vermiculite, coated with a bituminous binder, can be used as a dry, lightweight roof and floor screed. This type of screed has the advantages of low thermal conductivity, low moisture content and ease of placement.

**Lightweight Concretes:** Vermiculite concretes are lightweight, have good insulating properties and are intrinsically fire resistant. Vermiculite concretes may be used for in situ roof and floor screeds and in the fabrication of pre-cast products. Vermiculite concretes can also be used around back boilers and as a fire back support material.

**Vermiculite Plasters:** Vermiculite plasters can be made with either gypsum or Portland cement. The advantages of vermiculite plasters are: improved coverage; lighter weight; improved workability; excellent fire resistance; reduced thermal conductivity; improved adhesion to a wide range of backgrounds; increased resistance to cracking and shrinkage. Vermiculite also improves the spall resistance of plasters due to the ability of vermiculite particles to accommodate dimensional change. Vermiculite plasters, whether gypsum or cement based, can be applied by hand or by spraying machine. Being a non-abrasive aggregate, vermiculite is well suited to spray application and the sprayed plasters can have an attractive decorative appearance.

**Loosefill Insulation:** loosefill vermiculite can be used between joists in lofts for house insulation. The free flowing properties of exfoliated vermiculite make installation very simple. The insulating properties of vermiculite significantly reduce the loss of heat in cold weather and keep the interior cool in hot weather. It also functions as a sound absorbent material.

## Industrial Minerals

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● **High Temperature and Industrial Insulation:**

**Boards, panels and premixed coatings:** Vermiculite-based products range from factory made boards and panels to premixed coatings suitable for application by mechanical spray or by hand plastering techniques on a range of structures. These coatings have been used in the petrochemical industry and tunnel construction.

**Special coatings** are produced with vermiculite milled before or after exfoliation according to the range of particle sizes required. Such milled or ground material may be used for the production of anti-drumming coatings; condensation control paints; high performance gaskets and seals and for upgrading the fire resistance of organic foams and other polymer based systems. Exfoliated vermiculite can be coloured to suit its end use (e.g. retail display).

**Refractory and high temperature insulation:**

Vermiculite for refractory and high temperature insulation is normally bonded with alumina cements, fire clays and silicates to produce a wide range of vermiculite products which, depending on type and application can withstand hot face temperatures of up to 1,100°C. The type of refractory products made using vermiculite are:

- pre-fired clay bonded insulation firebricks;
- castable high alumina concretes for back up insulation;
- high alumina bonded bricks, slabs and special shapes;
- silicate bonded insulating shapes and moulded products.

**Steelworks and Foundries:** Thanks to its refractory properties, good thermal insulation and low density, Vermiculite is used in steelworks and foundries, for hot topping molten steel to reduce heat loss from ingots and ladles and generally as a loose-fill insulator.

**Silicate bonded shapes and blocks:** Pressed vermiculite block insulation can be used in high temperature kilns, furnaces, combustion plants, boilers, wood burning stoves and night storage heaters. It is becoming more widely accepted as an alternative for asbestos or man-made mineral fibre insulation. The units can vary from simple blocks to very intricate shapes designed to accommodate electrical elements, fixing screws etc.

● **Automotive Industry:** Vermiculite is now used extensively in the friction lining industry (e.g. brake and clutch linings) as a safe alternative to asbestos, and plays an important role in this field.

● **Horticulture:** Vermiculite is well established as a growing medium. It is most commonly used in compost formulations, usually in combination with peat or coir. Vermiculite/peat or coir compost formulations provide ideal conditions for plant growth. The presence of vermiculite particles in the compost aids aeration, improves moisture retention and promotes the steady release of added fertilisers, whilst the vermiculite itself contributes potassium, magnesium and a number of minor elements. The air/water ratios for vermiculite/peat or coir composts are ideal for the stimulation of root growth, and hence the production of healthy young plants. The vermiculite is sterile when processed. If stored correctly it will need no further treatment before incorporation into composts. Vermiculite can also be used as a carrier and extender for fertilisers, pesticides and herbicides. It is also used in a ground form for encapsulating seeds.

● **Packaging Materials:** Exfoliated vermiculite is a useful packaging medium. Not only is it lightweight, clean and easily poured around irregular shaped objects, it also provides a good baffle against shocks caused by impact and improper handling. Being highly absorbent, it safely retains leaks from packed materials such as hazardous chemicals. As it is inorganic it does not present any potential fire hazards. Exfoliated vermiculite can also be used as a packing material for storing fruit, bulbs and tubers. Vermiculite degrades naturally, so is easily disposed of. Being soft and non-abrasive it has also been used effectively for insulation and cushioning the base of plastic-lined swimming pools.

For more information, please contact:

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