The
Vermiculite
Association
Inc.



VERMICULITE

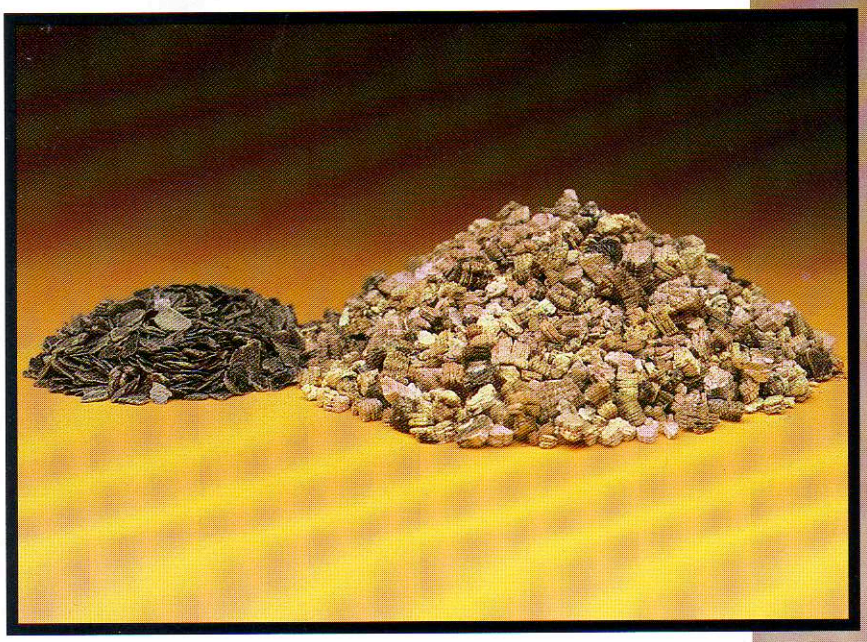
Its Properties And Uses

Vermiculite: Its Properties & Uses



Vermiculite is the mineralogical name given to hydrated laminar magnesium-aluminum-iron-silicate which resembles mica in appearance. When subjected to heat, it has the unusual property of exfoliating or expanding, due to the generation of interlaminar steam. Vermiculite is found in various parts of the world. Locations of the predominant commercial mines are in North America, South America, and Africa. Other deposits in countries such as India, Japan, Kenya, Zimbabwe, China, the Soviet Union and Australia are being developed.

Vermiculite mines are surface operations where ore is separated from other minerals, and then screened or classified into several basic particle sizes. The bulk density of crude vermiculite or vermiculite concentrate is in the range of 640-1120 kg/cu m or 40-70 lb/cu ft.



Exfoliation or Expansion

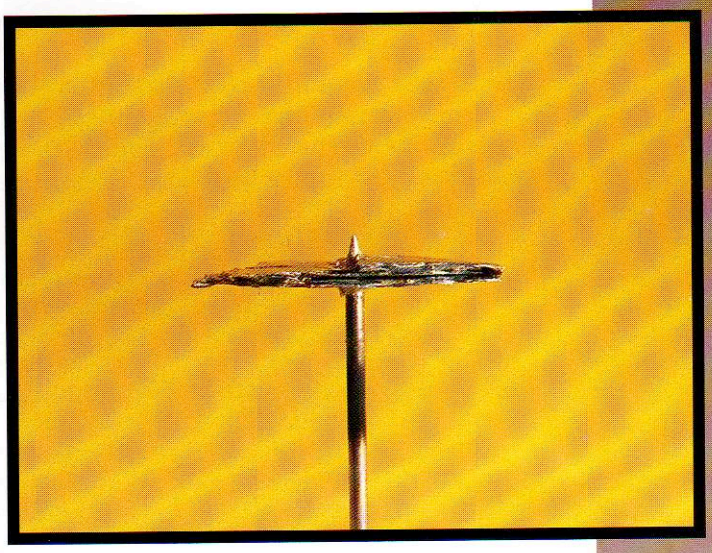


When heated quickly to an elevated temperature, particles of vermiculite exfoliate by expanding at right angles to the cleavage, into worm-like pieces (the name vermiculite is derived from the Latin 'vermiculare', to breed worms). This characteristic of exfoliation, the basis for commercial use of the mineral, is the result of the mechanical separation of the layers by the rapid conversion of contained water to steam. The increase in bulk volume of commercial grades is 8 to 12 times, but individual flakes may exfoliate as many as 30 times. There is a color change during expansion that is dependent upon the composition of the vermiculite and furnace temperature.

Typical Physical Properties Of Exfoliated Vermiculite

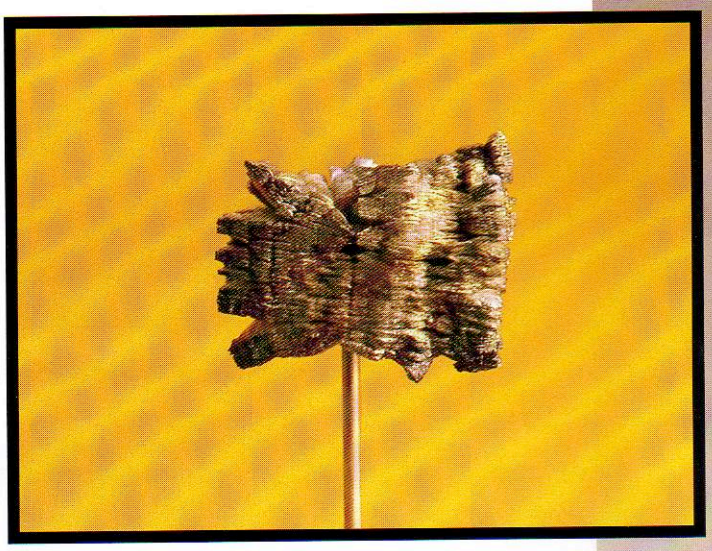


Color:	Light to dark brown
Shape:	Accordion-shaped granule
Bulk density(a):	64-160 kg/cu m 4-10 lb/cu ft
Moisture loss @110°C (230°F):	4-10%
pH (in water):	6-9
Combustibility:	Non-combustible
Sintering temperature:	1150-1250°C 2100-2280°F
Fusion point:	1200-1320°C 2200-2400°F
Cation exchange capacity (b):	50-150 me/100g
Specific heat:	0.84-1.08 kJ/kgK 0.20-0.26 kcal/kgK 0.20-0.26 Btu/lb°F
Waterholding capacity (a):	200-325% by wt 20-50% by vol





Ore Concentrate Before Exfoliation





Concentrate After Exfoliation

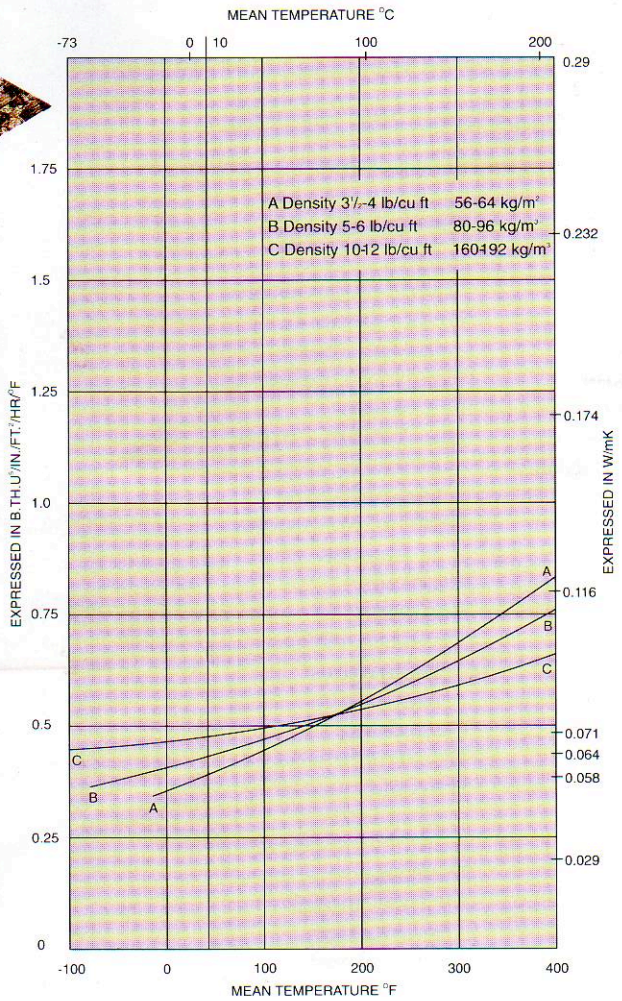
Thermal conductivity at different bulk densities

Bulk densities		Thermal conductivity values	
Kg/cu m	lb/cu ft	Lambda (λ)W/mK	**Btu in/sq ft h°F**
56-64	3.5-4.0	0.058	**0.40**
80-96	5.0-6.0	0.064	**0.44**
160-192	10-12	0.071	**0.49**

Notes:

(a) Bulk density and water holding capacity vary with particle size.
(b) Exchangeable ions are Mg^{+2} and Ca^{+2}, sodium acetate saturation/ammonium acetate substitution method.

Thermal Conductivity Of Exfoliated Vermiculite



Typical Chemical Analysis

Element	Percent by Weight
SiO_2	38-46%
AL_2O_3	10-16
MgO	16-35
CaO	1-5
K_2O	1-6
Fe_2O_3	6-13
TiO_2	1-3
H_2O	8-16
Other	0.2-1.2%

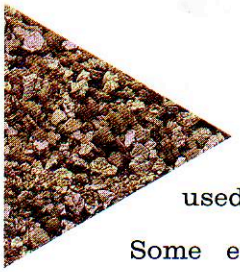
Chemical Formula

$(Mg,Ca,K,Fe^{11})_3\ (Si,AL,Fe^{111})_4O_{10}(OH)_2O4H_2O$

Exfoliated Vermiculite Particle Sizes

Size		Densities Kg/Cu M	Densities Lb./Cu. Ft.	Equivalent Names/Designations System A	System B	
16mm (5/8″)	down	56-72	3.5-4.5	NA	Premium	(6)
8mm (5/16″)	down	64-85	4.0-5.0	1	Large	(4)
4mm (5/32″)	down	72-90	4.5-5.5	2	Medium	(3)
2mm (0.08″)	down	75-112	4.7-7.0	3	Fine	(2)
1mm (0.04″)	down	80-144	5.0-9.0	4	Superfine	(1)
0.5mm (0.02″)	down	90-160	5.6-10.0	5	Micron	(0)

How Vermiculite Can Be Used



Vermiculite has been used in various industries for over 70 years. It is used in the construction, horticultural, agricultural, and industrial markets.

Some examples of vermiculite uses include:

CONSTRUCTION
- Gypsum plaster
- Air setting binder
- Board
- Loft insulation
- Fire protection (internal & external)
- Acoustic finishes
- Floor and roof screeds (lightweight insulating concrete)
- Sound deadening compounds

AGRICULTURAL
- Animal feed
- Pesticide
- Fertilizer
- Bulking agent
- Seed encapsulant
- Anti-caking material
- Soil conditioner

HORTICULTURAL
- Seed germination
- Sowing composts
- Seedling wedgemix
- Blocking mixes
- Rooting cuttings
- Micro-propagation
- Twin scaling bulbs
- Potting mixes
- Hydroponics

INDUSTRIAL
- Paints
- Moulded products
- Brake pads & brake shoes
- Fireproof safes
- Filtration
- Insulation - high & low temperature
- Insulation blocks & shapes
- Furnaces
- Sealants
- Fixation of hazardous materials
- Castables
- Drilling muds
- Nuclear waste disposal
- Absorbent packing
- Perfume absorbent
- Molten metal insulation
- Dispersions



Below are some examples of typical binders and other materials which are often used in combination with vermiculite:

- Portland cement
- High alumina cement
- Clay
- Plaster (gypsum)
- Fertilizers
- Resins
- Sodium silicate
- Potassium silicate
- Peat
- Bark



Consider vermiculite if you are looking for:

- Loosefills
- Carriers
- Asbestos substitutes
- Absorbents
- Soil conditioners
- Lightweight aggregates
- Density modifiers
- Fire protection
- Industrial heat insulation

Safety, Storage & Handling



Information on safe handling, storage, personal protection, health, and environmental considerations has been gathered on this product and is available from the material suppliers upon request. It is recommended that all users and specifiers acquaint themselves with this information.

For more information, please contact:

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(312) 922-6222
(312) 922-2734 — FAX

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