

TRADE OF
Industrial Insulation

PHASE 2

Module 4

Insulation – Materials, Science and Application

UNIT: 9

Vermiculite

Produced by

S O L A S

An tSeirbhís Oideachais Leanúnaigh agus Scileanna
Further Education and Training Authority

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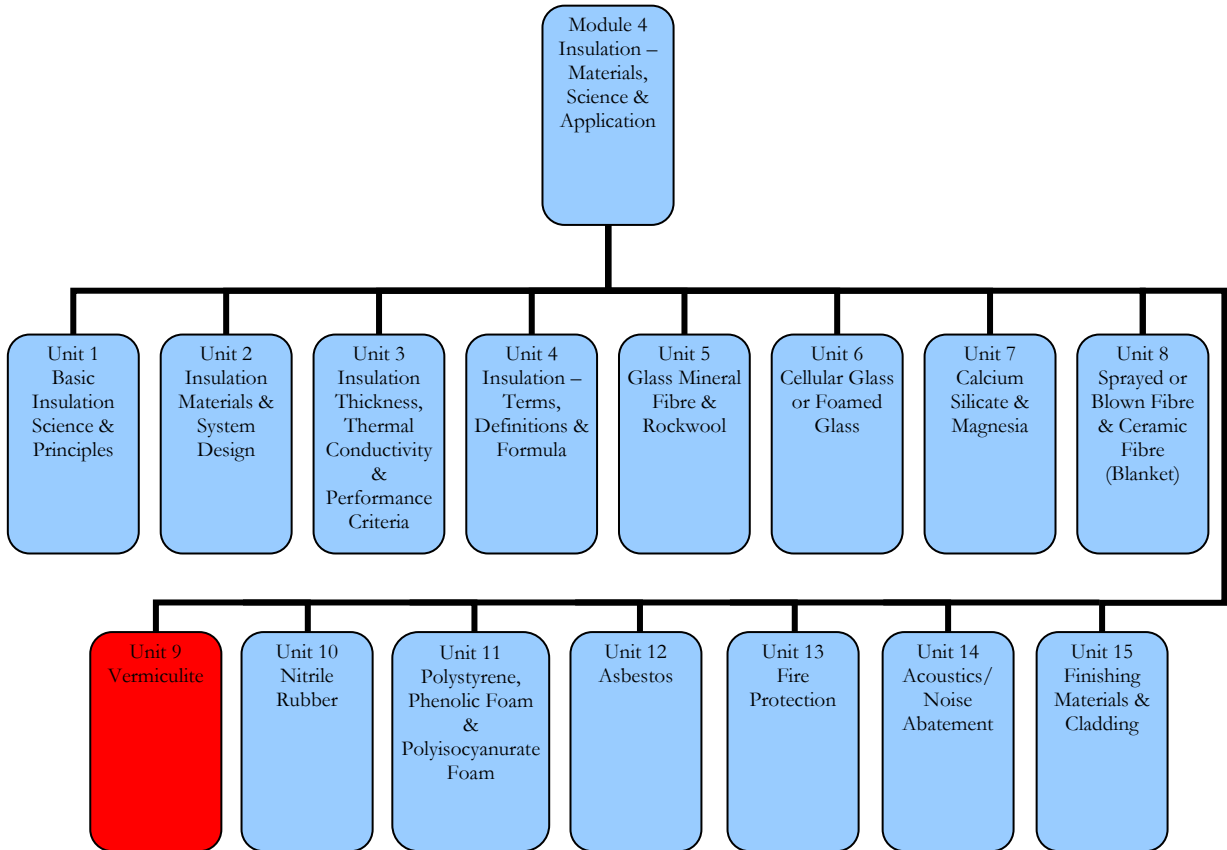
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Introduction

Vermiculite is a mica-like mineral mined around the world. Vermiculite is light, has good insulation properties, and is also fire resistant. Vermiculite in loose-fill form is light brown/grey/gold in colour and is a pebble like material ranging in size from 2 – 10 millimetres in diameter.



Unit Objective

By the end of this unit **each apprentice** will be able to:

- List and describe the properties, uses and applications of vermiculite.
- Identify vermiculite from a selection of samples provided.
- Demonstrate the safe handling and application of vermiculite.

1.0 Vermiculite

Key Learning Points

- Material composition of vermiculite.
- Thickness and density range of vermiculite.
- Temperature range of vermiculite.
- Available forms.
- Typical uses and applications.

1.1 Product Composition and Characteristics

Vermiculite is a naturally occurring group of hydrated aluminium/iron/magnesium silicates with a laminate structure. The raw material is pulverised and is then subjected to direct heat in a furnace. The material ‘exfoliates’ or expands in size, into a form consisting of a series of parallel wafers with air spaces between them.

Exfoliated vermiculite is produced as a granular loose fill which can be bonded to form boards or dry mixed with fillers and binders for spray application.



1.2 Properties and Uses of Vermiculite Insulation

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 properties.
- Absorption capacity.
- Low density and ease of handling.

Uses

- Boards, panels and pre-mixed coatings.
- Refractory and high temperature insulation.
- Packaging materials.
- Silicate bonded shapes and blocks.
- Construction industry: bitumen coated screeds, lightweight concretes and vermiculite plasters.

1.3 Thickness and Density Range

Vermiculite is available in pre-formed pipe sections with a wall thickness of 30mm, 40mm and 50mm. In board form the thickness can vary from 3mm to 80 mm depending on the manufacturer.

The normal density range of vermiculite is 50 to 150 kg/m³.

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

Typical Physical Properties Of Exfoliated Vermiculite

1.4 Service Temperature Range

The approximate maximum operating temperature of vermiculite is 1100°C. Reference should always be made to the manufacturer’s literature before specifying a material.

1.5 Reaction to fire characteristics.

Vermiculite is non-combustible. It is used extensively for the fire protection of structural elements in buildings such as steel beams and columns.

2.0 Industrial Applications

Key Learning Points

- Typical uses and applications.
- Method of application.
- Identify vermiculite from a selection of samples provided.

2.1 Vermiculite Used in Industry

Boards, Panels and Pre-Mixed Coatings

Vermiculite-based products range from factory made boards and panels to pre-mixed 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

Special coatings are produced with vermiculite milled before or after exfoliation according to a 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 fire resistance of organic foams and other polymer based systems. Exfoliated vermiculite can be coloured to suit its end use.

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 the type and application can withstand temperatures of up to 1100°C. The type of refractory products made using vermiculite are:

- Pre-fired clay bonded insulation firebricks.
- Castable high alumina concretes for backup insulation.
- High alumina bonded bricks, slabs and special shapes.
- Silicate bonded insulating shapes and moulded products.

Steelworks and Foundries

Due 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.

Loose Fill Insulation

Loose fill vermiculite can be used between joists in attics for house insulation. The free flowing properties of exfoliated vermiculite makes installation very simple. The insulating properties of vermiculite significantly reduce the loss of heat in cold weather and keep the house cool in hot weather. It also functions as a sound absorbing material.

3.0 Health and Safety

Key Learning Points

- Demonstrate the safe handling of these materials.
- Use of personnel protective equipment.
- Health risks and safe handling techniques.
- Product information gathering and organisation.

3.1 Health Risks Associated with Vermiculite Insulation

- Inhalation: Inhalation of dust may cause irritation to the upper airways.
- Ingestion: Exposure to dust can irritate mucous membranes and respiratory tract.
- Skin: Exposure to dust may irritate the skin and cause reddening.
- Eyes: Exposure to dust may cause eye irritation.

3.2 First Aid Measures

- Inhalation: Move the exposed person to fresh air at once, apply artificial respiration if needed. Encourage the person to cough, spit out, and blow nose to remove dust. If the person has difficult breathing call for medical assistance at once.
- Skin contact: Wash the affected area thoroughly without applying pressure. If irritation persists or the skin is broken seek medical attention.
- Eye contact: Flush the eye with water or eye wash for 15 minutes, do not rub or apply pressure. If the irritation persists seek medical assistance.
- Ingestion: Do not induce vomiting, seek medical assistance at once.

3.3 Handling and Storage

When using vermiculite insulation and vermiculite based products, provide general or local ventilation systems as needed, to maintain airborne dust concentrations below the regulatory limits. Local vacuum collection systems are preferred since it prevents the release of contaminants into the work area by controlling it at source.

- Handling: Avoid generation of dust. Wash hands before eating, drinking, smoking or using the toilet.
- Storage: If storing for long periods, protect the product from the weather.
- Hands: Wear gloves – rubber or plastic gloves are recommended.
- Eye protection: Wear safety glasses with side shields or dust goggles.

- Ventilation: Use local exhaust ventilation when handling materials..
- Work area: Keep the work area clean at all times to avoid trip hazards due to materials left on the floor. Develop a positive attitude towards working with insulation products and know the risks involved.
- Information: Always refer to the manufacturer’s data sheets for information on health and safety and precautions required when using the product.

3.4 Product Information

Always refer to the manufacturer’s data sheets before using vermiculite or other insulation materials. These data sheets provide the relevant information required to use the products in a safe manner.

Summary

Vermiculite is a naturally occurring group of hydrated aluminium /iron/magnesium silicates with a laminate structure. Exfoliated vermiculite is produced as a granular loose fill which can be bonded to form boards or dry mixed with fillers and binders for spray application. It is available in boards, panels, bonded shapes and blocks. It is non-combustible and has a maximum operating temperature of 1100 °C, which makes it a good refractory and high temperature insulation product.

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