DELABOLE SLATE

The Natural Choice

eight centuries of Cornish craftsmanship

The Delabole Slate Company

fine powders

slate granules

industrial minerals

QUALITY FILLERS AND COATINGS
FROM DELABOLE SLATE

web: www.delaboleslate.co.uk

Delabole Slate is a family owned Cornish Company

slate fillers

INTRODUCTION

Slate powder & granules are purpose-made inert mineral fillers produced from high quality slate, extracted from the Delabole Quarry, situated in North Cornwall. The Delabole Slate company pioneered the production of high performance slate powder in 1908 and now has over 90 years of accumulated experience in the production and application of mineral fillers.

Delabole Slate is of excellent quality, highly resistant to atmospheric attack and meets the exacting requirements of current industry standards, which are particularly concerned with durability.

BENEFICIAL PROPERTIES

- Stability and inertness.
- Its consistency of particle size and the ability to produce a variety of closely sized fractions over a wide overall size range.
- High specific surface.
- Its low absorption characteristics for both oil and water.
- Its relatively low abrasion characteristics.
- Its high specific gravity and bulk density.
- Its low gassing characteristics when heated. Results have been obtained using standard analytical procedures (wet methods).

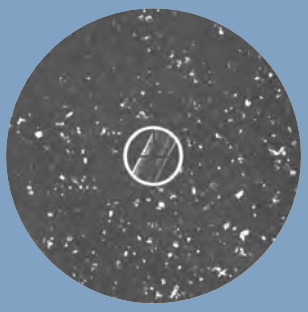
MINERALOGICAL COMPOSITION

The individual mineral crystals in Delabole Slate are not visible to the naked eye. Under the high-power microscope the slate is seen to be a dense, uniform, microcrystalline metamorphic rock, the mineral grains of which have a flaky habit and a thickness of the order of 5 microns (see fig 1). The well developed cleavage of the slate is due to the flaky habit of the mineral crystals formed under intense pressure and matted together in a felt-like mat of sericitic mica, chlorite, quartz and minor proportion minerals all compacted together in parallel orientation. The major proportion minerals and some of the minor ones are listed in Table 1 which also shows the chemical analysis compounds which enter into their composition.

PARTICLE SHAPE

Because of the flaky habit of the component minerals - chiefly sericitic mica, the particles of slate powder & granules are also flaky, not sharp or angular; they have a thickness of one quarter to one tenth of their breadth. In many applications this characteristic has been found to have reinforcing properties. The particle shape gives a high specific surface and consequently good covering capacity.

Fig 1 ***PHOTOMICROGRAPH of Delabole Slate***



- *Magnification 100x*
- *Scale 1mm = 10 microns*
- *Actual diameter of field 0.75 mm.*
- *Inner circle is diameter of human hair, to same scale.*

Fig 2 ***70-200 B.S.S.***

100 B.S.S. (152)

Table 1. CHEMICAL ANALYSIS AND MINERALOGICAL RELATIONSHIPS OF DELABOLE SLATE POWDER AND GRANULES

CHEMICAL ANALYSIS			MINERAL AND CHEMICAL RELATIONSHIPS					
			MAJOR PROPORTION MINERALS			MINOR PROPORTION MINERALS		
			Mica	Chlorite	Quartz	Ilmenite	Rutile	Others
Silica	SiO_2	55.20	✔	✔	✔			✔
Alumina	Al_2O_3	23.52	✔	✔		✔		✔
Ferrous Oxide	FeO	7.14	✔	✔		✔		✔
Ferric Oxide	Fe_2O_3	0.66		✔				✔
Titanium Dioxide	SiO_2	0.95				✔	✔	
Manganese Oxide	MnO	0.10		✔				
Lime	CaO	0.36						✔
Magnesia	MgO	2.50		✔				✔
Potash	K_2O	3.49	✔					✔
Soda	Na_2O	1.23	✔					✔
Water -105°C	H_2O	0.23						
Water +105°C	H_2O	4.12	✔	✔				
Carbon Dioxide	CO_2	-						
Phosphoric Anhydride	P_2O_5	0.13						✔
	TOTAL	99.63						

CHEMICAL ANALYSIS

The chemical analysis of Delabole Slate powder & granules is given in Table 1. Much of the silica in Delabole Slate fillers is locked up in very stable chemical compounds, ie, silicates of alumina, iron, magnesium, potash, etc. These compounds appear as minerals, such as the abundant sericitic mica and chlorite and minor proportion minerals which give Delabole Slate fillers special, desirable physical properties. Table 1 shows the distribution of the chemical analysis compounds in the component slate minerals. It is these abundant, stable, low abrasive, low moisture absorption, smooth, platy minerals, which make slate powder & granules an ideal mineral filler or carrier for many purposes.

Water soluble salts

Sodium Oxide	=	0.006%
Potassium Oxide	=	0.037%
Calcium	=	0.002%
Magnesium	=	0.005%

Total insolubles and solubles

Soluble (Hydrochloric Acid)	=	13.1%
Insoluble (Hydrochloric Acid)	=	86.9%

FINE FILLERS (POWDER)

Fineness Grading

Delabole Slate powders are produced in a wide range of sieve and sub-sieve fineness grades. The standard gradings and their typical particle size analyses are listed in Table 2. Fig. 3 illustrates the typical particle size analyses graphically. Photomicrographs of the coarsest and finest gradings are shown in Figures 1 and 2 respectively, and to give an idea of scale the insets show a human hair to the same scale.

These illustrations clearly show the wide fineness range of standard gradings which are maintained within narrow commercial limits.

Table 2. **PARTICLE SIZE ANALYSIS OF STANDARD GRADES OF DELABOLE SLATE POWDER.**

Sieve Opening/Microns	B.S. 410 Sieve	PERCENT PASSING										
		'F' 20 Micron	99% - 350 B.S.S.	99% - 300 B.S.S.	99% - 240 B.S.S.	99% - 200 B.S.S.	95% - 200 B.S.S.	90% - 200 B.S.S.	85% - 200 B.S.S.	80% - 200 B.S.S.	75% - 200 B.S.S.	70% - 200 B.S.S.
422	36											99.6
353	44											99.0
295	52											98.0
251	60									99.9	99.9	97.0
211	72							99.9	99.7	99.5	98.5	94.0
178	85							99.7	99.0	98.0	95.0	90.0
152	100						99.9	99.5	98.5	95.0	92.0	87.0
124	120					99.9	99.5	99.0	96.0	91.0	87.0	81.0
104	150				99.9	99.5	98.5	97.0	92.0	88.0	83.0	78.0
89	170				99.7	99.3	97.0	94.0	89.0	84.0	79.0	74.0
76	200			99.9	99.5	99.0	95.0	90.0	85.0	80.0	75.0	70.0
64	240		99.9	99.7	99.0	97.0	92.0	86.0	81.0	76.5	72.0	67.0
53	300	99.9	99.5	99.0	97.0	94.0	88.0	82.0	77.0	72.0	67.0	62.0
44	350	99.0	99.0	98.0	95.0	90.0	83.0	77.0	7230	68.0	63.0	58.0
20		97.0	85.0	80.0	73.0	67.0	62.0	58.0	54.0	51.0	47.0	42.0
10		88.0	57.0	53.0	49.0	46.0	43.0	40.0	38.0	35.0	32.0	28.0
5		68.0	26.0	26.0	24.0	23.0	21.5	20.0	19.0	18.0	17.0	15.0
2		36.0	6.0	5.5	5.2	4.7	4.3	4.2	4.0	3.7	3.6	3.0

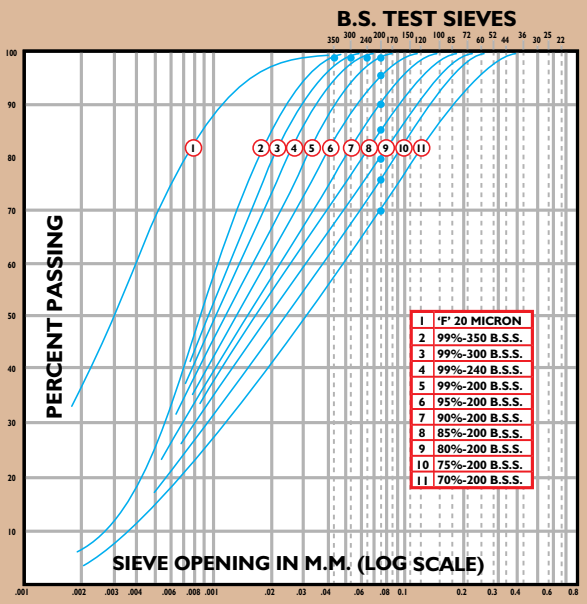


Fig 3 ***PARTICLE SIZE ANALYSIS OF STANDARD GRADES OF DELABOLE SLATE POWDER.***

Note: table above shows typical grading only; there may be some variations.

PRODUCT RANGE

99/350, 99/300, 99/240, 99/200, 90/200, 85/200, 80/200, 75/200, 70/200.

COARSE FILLERS & COATINGS (GRANULES)

Granules are available in a range of sizes. Produced by dry sieving, all granules are tested on BS 410 mesh sizes.

PRODUCT RANGE

6-8, 8-14, S12 and S30

Table 3
PARTICLE DISTRIBUTION

PRODUCT	SPECIFICATION	
	size (mm)	% by weight
6-8	+ 2.80 - 2.80 + 2.00 - 2.00	0 - 10% 80 - 100% 0 - 10%
8-14	+ 2.00 - 2.00 + 1.18 - 1.18	0 - 10% 80 - 100% 0 - 10%
S12	+ 1.40 - 1.40 + 0.425 - 0.425	0 - 10% 80 - 100% 0 - 10%
S30	+ 0.500 - 0.500	0 - 10% 90 - 100%

APPLICATIONS

Slate Powder

Delabole Slate powder is used as a mineral filler, carrier, or surface dusting agent in the following products:

Bituminous Mixes

- Asphaltic Floorings
- Roofing Felts
- Airfield Carpets
- Bituminous Paints
- Expansion Jointings
- Damp-proof Courses
- Pipe Protective Coatings
- Mastics

Fertilizers, Filling Compounds, Insecticides, Paints & Printing Inks, Pigmented Powders.

Plastics • Shellac based • Epoxy Resin, and others

Sealing Compounds • Adhesives

Rubber

Slate Granules

Delabole Slate granules are used as mineral fillers, and extenders in the following products:

Reconstituted Roofing Tiles, Roofing Felt, Surface Coatings/Dressings

slate
powder & granules

QUALITY FILLERS FROM DELABOLE SLATE

performance

MOISTURE CONTENT & ABSORPTION

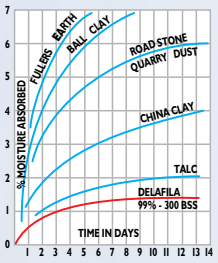
Moisture absorption in accordance with BS: 812: Part 2: 1975, where appropriate.
The moisture absorption was found to increase with fineness but with a very close range between the finest and the coarsest grade; the moisture absorption did not exceed 1.7%. The material was sealed in a container under maximum humidity conditions to achieve this result.

OIL ABSORPTION

In accordance with BS: 3483:
Part B7: 1982
The oil absorption value will vary according to fineness of the filler.

The range is as follows:
99/350 Grade = 44.1 ml per 100 gms
70/200 Grade = 33.9 ml per 100 gms

Fig 4



pH VALUE

In accordance with BS: 1975: 1976
99/350 Grade 9.2
70/200 grade 9.1

SPECIFIC SURFACE

In accordance with BS: 4550 : Part 3: Section 3.3.
The specific surface will vary according to fineness and particle shape. As 'Delafila' has a flaky particle shape the Specific surface is relatively high.
The ranges are as follows:
99/350 grade = 10,975 cm^2/gram
70/200 grade = 7,210 cm^2/gram

RELATIVE DENSITY

In accordance with BS: 812 : Part 2 : 1975
The relative density of 'Delafila' is 2.8

BULK DENSITY

In accordance with BS: 812 : Part 2 : 1975
Bulk density will vary according to particle shape, size etc.
The ranges are as follows:

		F20 Grade	70/200 Grade
In toluene	=	0.23 g/ml	0.56 g/ml
Loose state	=	444 kg/m^3	833 kg/m^3
Compacted state	=	1273 kg/m^3	1595 kg/m^3

MOHS HARDNESS

The hardness of the powder is a function of the minerals present and will vary from 2 - 7.

ABRASION

The abrasive properties of mineral fillers depend on two factors:
a) mineral composition b) fineness grading
A fine powder is less abrasive than a coarse powder of the same mineralogical composition. Delafila 99/350 grade is about half as abrasive as Delafila 70/200 BSS. A quartz powder can be 7-10 times as abrasive as 99/300 BSS, and some commercial talcs are more abrasive than Delafila.

ELECTRICAL CONDUCTIVITY

Carried out on 1% w/v in de-ionised water.
Conductivity will vary according to particle size for a suspension.
The ranges are as follows:
99/350 grade = 7.87 (uS/cm)
70/200 grade = 15.50 (uS/cm)

environment health & safety

ENVIRONMENTAL HEALTH & SAFETY

Slate is a naturally occurring material that is inert and non-polluting in its solid state. Pollution prospects arise from powdered slate, which should be kept slurrified or confined.

Waste disposal
Unwanted material should be disposed of in accordance with the "Duty of Care – Control of Waste Regulations", and any local Government requirements (Note: pollution prospects of powders as above).

Hazards to health
Hazards are generally associated with poor handling and dust. Prolonged exposure to dust can be harmful to health.

Precautions - Handling:
- operating lifting capabilities must exceed 25kg.
- use mechanical devices where possible
- avoid the generation of dust
- use wet, if process allows
- if dust occurs, use a suitable dust mask

specification

COMPOSITION & CHEMICAL PROPERTIES

The basic raw material for the production of powder and granules is Delabole Slate, which is of excellent quality and highly resistant to atmospheric attack. The silica content, whether it is 'free' or 'combined' determines to a large extent the mineral content and the properties of the filler.

POWDER

Most of the silica in 'Delafila' is locked up in very stable chemical compounds such as silicates of alumina, iron, magnesium and potash. It is these compounds which give 'Delafila' its special and desirable physical properties of inert stability, low abrasiveness, low moisture absorption and smoothness, thus making it an ideal mineral filler or carrier for many purposes.

GRANULES

Delabole Slate granules are manufactured from high quality graded slate. The selected rock from which the granules are prepared is renowned for its consistency, durability and strength. The chemical and mineralogical composition ensures a material of high resistance to atmospheric conditions and complies fully with BS: 680. The nature and cleavage of the rock ensures that the granules are flat and flaky with low porosity, possessing a high cover capacity.

COLOUR

Delabole Slate powder & granules are grey in colour when dry, becoming much darker when wet. Although of a fairly homogeneous colour, customers are reminded that natural products are subject to some colour variation.

MANUFACTURING PROCESS

The process involves the crushing of off-cuts and broken slate in a jaw crusher, grinding in a hammer mill, drying in a rotary kiln, screening to produce granules and re-grinding undersize in Raymond mills to produce powder. Close size control is obtained by the use of air classifiers. Both granules and powders are produced in a range of particle sizes. (see tables 2 & 3).

general

PACKAGING

Available in nominal 25kg bags + bulk bags.

Bulk Supplies
Where facilities exist, bulk supplies utilising pneumatically discharged road tankers can be arranged. This method of delivery can substantially reduce reception, storage and internal handling costs where large tonnages are involved. Silos of the most popular grades are also available.

Sack marking
A minimum of 10% of sacks are marked to indicate the contents. All sacks in small consignments are marked for the purpose of transit identification. Paper sacks can be specially marked to customers' own requirements. Batch numbers are marked on bags for easy identification through to production.

HANDLING & STORAGE

Bags should be kept in a moisture-free storage area.

MISCELLANEOUS

Prices for this specialist product are competitive. Shipments can be arranged by land or sea, via containers.
For further information or samples. please don't hesitate to contact our sales office on the number below. Visits to the quarry can be arranged by appointment.

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