

1

2

3,476,576

**PROCESS FOR OBTAINING A SIZE REDUCTION OF NON-LAMELLAR MATERIALS**

Paul S. Sennett, Macon, Kenneth Lamar Turner, Gordon, and Horton Harold Morris, Macon, Ga., assignors to Freeport Sulphur Company, New York, N.Y., a corporation of Delaware

No Drawing. Filed Jan. 26, 1967, Ser. No. 611,836

The portion of the term of the patent subsequent to Mar. 2, 1982, has been disclaimed

Int. Cl. C09c 1/02; C09d 7/08; C08h 17/04

U.S. Cl. 106—309

9 Claims

**ABSTRACT OF THE DISCLOSURE**

A process for reducing the particle size of a non-lamellar mineral. An aqueous slurry of the mineral is agitated with particles of a nonabrasive resilient grinding media. The grinding media has a specific gravity less than two and a particle size smaller than one quarter inch but larger than 200 mesh in diameter.

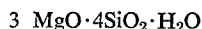
The present invention relates to a process for effecting a size reduction of non-lamellar minerals, including aggregates of non-lamellar minerals. Our invention is particularly useful for effecting a size reduction of non-lamellar talc and non-lamellar calcium carbonate, and of reducing the viscosity of a calcium carbonate dispersion.

It is very desirable that pigmented coating mixes being applied to paper have a relatively low viscosity. Paper is normally coated at very high speeds, so the coating mix must be thin enough to flow smoothly onto the sheet and so give a uniform coating. The viscosity of pigmented coating mixes may be lowered by the addition of water but this procedure adds significantly to the cost of the operation since this water must be subsequently removed by thermal evaporation. Some calcium carbonates, although a satisfactory paper coating pigment in other respects, are so viscous when incorporated into a coating formula that they cannot be used.

Non-lamellar minerals are in a distinct category. Thus lamellar minerals are those crystalline materials which show a pronounced cleavage perpendicular to 1 (and only one) crystalline axis. This arises as a result of much weaker bonding forces parallel to this particular crystallographic axis. When subjected to stress these lamellar materials tend to break along the planes where the bonding energy between adjacent planes is weakest. In contrast non-lamellar minerals do not show a pronounced cleavage perpendicular to one crystalline axis. As a result non-lamellar minerals are not cleaved readily.

Non-lamellar calcium carbonate is a mineral having the chemical composition represented by the formula  $\text{CaCO}_3$ . It is a mineral found in nature as calcite (as in limestone, chalk, and marble) and aragonite. It is used extensively as a pigment, pigment extender, and filler. It is also useful in dentifrices and pharmaceuticals.

Non-lamellar talc is a mineral having the chemical composition represented by the formula:



The term "talc," as it is used in this application, is intended to include also a number of silicate minerals having physical properties similar to the true talc mineral. For example, since talc and pyrophyllite have similar physical properties and end uses they are not considered separately for statistical evaluation in the annual "Minerals Yearbook" published by the U.S. Bureau of Mines.

The talc of commerce may be a relatively pure talc

mineral or anthophyllite, pyrophyllite, serpentine or tremolite or mixtures of these minerals. In addition, commercial talcs may be contaminated with varying amounts of accessory minerals such as magnesite, dolomite, calcite, diopside, chlorite and quartz.

As mined, talc and calcium carbonate are in the form of rocklike lumps that, for most commercial applications, must be ground to varying degrees of fineness depending on their intended end use. Frequently a purification process such as hand sorting of the crude material or flotation of the ground material must be used. The cost of grinding contributes appreciably to the cost of converting the raw ore into a commercially useful product. The crude ore, after preliminary crushing, is usually dry ground in ball or roller mills and air-floated to give the desired fine particles.

"Ultra-fine" talcs are produced by further grinding in fluid energy mills, the cost of fluid energy grinding adding significantly to the overall processing cost due to the high energy requirements of the grinding method.

Talc and calcium carbonate may exist in several forms including the granular and fibrous forms. A market for such minerals as well as other non-lamellar minerals exists in the field of paper coatings. Thus, it is common practice in the paper industry to coat paper with a mixture of pigment and adhesive in order to provide a smooth surface for printing. High quality reproduction of color photography requires a surface smoother than can normally be obtained from paper pulp alone. Although non-lamellar talc, calcium carbonate and other non-lamellar materials as non-lamellar barium sulfate, titanium dioxide and zinc oxide have been used to some extent as a pigment in paper coatings, it has been found necessary to finely grind these materials prior to their use with an adhesive. This can be burdensome and time consuming.

An object of the present invention is to provide a process for obtaining size reduction of non-lamellar minerals, including aggregates of non-lamellar materials, which minerals are suitable as pigments and extenders in oil and water base systems and in paper coatings.

Yet another object of the present invention is to provide an efficient low cost means for obtaining size reduction of talc.

Still another object of the present invention is to provide a process for lowering the viscosity of a calcium carbonate slurry, and for obtaining a size reduction of calcium carbonate particles.

Other objects and advantages of the invention will be apparent to those skilled in the art from the following description and examples.

In accordance with the present invention, a liquid slurry of a mineral, the particles of the mineral generally being of minus 20 mesh, are subjected to a milling in the absence of any adhesive but in the presence of a fine milling media, to break up aggregates of the mineral and reduce particle size. Removal of the media yields an extender and pigment that is excellent for use in paints and in other products; moreover the pigment brightness is not affected by our process.

The mineral used in our process can be a relatively coarse non-lamellar talc, non-lamellar calcium carbonate and/or certain non-lamellar minerals, i.e., those non-lamellar minerals suitable as pigments or extenders in the paint or paper industries, e.g., barium sulfate, titanium dioxide and zinc oxide. Calcium carbonate and particularly talc are preferred in our process.

The milling media is a fine, non-abrasive, resilient grinding media. The milling action is a combination of viscous shear milling due to agitation of the mixture of liquid, milling media and the mineral; percussive milling due to the multiplicity of impacts of the fine media with