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2,591,988

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was dry ground at the same rate and in the same machine. The following results were obtained from the two grinding operations:

	Bright-ness	p. p. m. Fo	Tinting Strength
Untreated TiO <sub>2</sub> .....	-35	200	185
Treated TiO <sub>2</sub> .....	14	64	185

The brightness values given were obtained visually by comparing pigments rubbed to a paste in oil. The usual arbitrary scale of values runs from about 8 to 20, 16 being of excellent whiteness and suitable for commercial use. One point on this scale is based on the least perceptible difference noticeable to the average trained person. The minus 35 value for the untreated sample was estimated from a set of temporary standards made by contaminating standard pigment and to show the relative improvement arising from the present invention. White pigments with a brightness value of 8 are considered poor. Parallel experiments using commercial "silica gel" of the xerogel class showed no significant preservation of pigment brightness during grinding. The tinting strength values given were obtained from the tests described on page 3 of U. S. Patent 2,046,054.

Example II

A titanium dioxide pigment similar to that used in Example I was mixed with 0.8% of its weight of an alumina aerogel and fed through an 8" stainless steel "micronizer" at ½ pounds per hour. Substantially the same preservation of brightness was obtained as compared with an untreated control. In addition, a marked resistance to discoloration on baking at high temperatures was found to result when the ground alumina aerogel-treated pigment was used in a normal baking enamel formulation.

While use in preferred of aerogels of silica and alumina, other aerogels or mixtures thereof belonging to the class derived from the substantially white, water-insoluble, hydrous oxides can also be employed. The specific elements, the hydrous oxides of which are utilizable herein, include, in addition to silicon and aluminum, titanium, zirconium, magnesium, zinc, cadmium, tin, lead, antimony, bismuth, and the like. Aerogels being in the dry form are usually considered as comprising the anhydrous oxides of the elements mentioned. However, as is known in the case of xerogels, considerable water may be present, either adsorbed or chemically combined. This water may be present in the aerogels herein used as long as the amount thereof is not great enough to cause substantial shrinkage on normal drying, e. g., in a warming oven. Again, while the aerogels contemplated for use herein comprise those prepared by the above-mentioned method of Kistler, if desired other known and available methods of preparing this class of materials can be resorted to, since the invention, obviously, is not restricted to any method of preparing the aerogel.

The pigments to which this invention applies comprise the general class of colored white

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such as calcium carbonate, calcium sulfate, barium sulfate, or siliceous materials, and the like. The TiO<sub>2</sub> may be either in the anatase or rutile crystalline form and may result from the hydrolysis or oxidation processes referred to. While TiO<sub>2</sub> pigments, either alone or extended, are particularly contemplated for treatment herein, other forms of titanium pigments, including the various titanates, are also contemplated for treatment, with advantageous beneficial effects.

It will also be understood that although the invention is especially useful in the dry grinding of pigments in fluid energy or jet types of mills, such as those described in Perry's Chemical Engineers' handbook, 3d edition, pgs. 1145-47, in order to overcome the pigment quality impairment and excessive mill wear particularly experienced in such types of milling equipment, it has general application to other common types of pigment milling means, including ball mills, pebble mills, rod mills, etc., consisting of a rotatable shell containing a large number of loose, tumbling, grinding elements, as well as other forms of milling means in which reduction of pigment particle size can be effected.

The treatment of aqueous slurries of titanium dioxide pigments with alumina hydrate to prevent undesirable paint film characteristics such as baking discoloration, excessive weathering rate, and darkening on exposure to light, is already known (U. S. Pat. 2,187,050). This treatment, however, is limited to wet pigment preparations since, as the patentee points out, the dry addition of alumina does not give the patentee's results, as when alumina is precipitated in the aqueous pigment slurry. It has now been found that by using alumina in the aerogel form as herein contemplated and subjecting the pigment mixture to dry grinding, new and unexpected benefits are realized. Thus, not only is impairment in pigment brightness overcome, and a noticeable increase in tinting strength obtained, but a new, simplified method of rendering titanium dioxide-containing pigments more light and heat-stable in paint films is provided. An unexpected advantage lies in the fact that the use of an aerogel minimizes abrasion and erosion of metal parts in fluid energy mills. This is doubly advantageous in that not only is the mill protected, but the color of the white pigments being ground is preserved. These results are quite unexpected, especially in connection with the alumina aerogels. It is therefore difficult to propose a theory in explanation of the action of this new class of agents. Their behavior may be related to their very low bulk density which suggests very thin-walled capillary structure. These fragile walls may, during grinding, leaf onto the pigment and perhaps also onto the mill surfaces and thus achieve the interesting effects herein accomplished. Another explanation might be that the aerogels are more chemically active than, for example, xerogels, and are able to attach to the surfaces by chemical bonds of perhaps a secondary nature. While proof of these theories is presently unavailable, it is positively established that the beneficial effects obtained herein by grinding in the presence of aerogels cannot be had by substituting xerogels therefor.