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3,519,453
**CLAY PRODUCTS AND METHOD OF
 PRODUCING SAME**

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8 Claims

ABSTRACT OF THE DISCLOSURE

New clay products having a novel and improved combination of properties including opacifying powers, particle size, surface area, oil absorption, G.E. brightness and color as well as low abrasion and comprising individual clay platelets adhered together providing increased void volume and high bulking properties that make them useful and uniquely desirable alone as paper fillers, prime or top coating pigments and particularly in combination with other well-known filler, prime or top coating pigments. The new clays also reduce pigment costs for obtaining high opaque papers and can be applied as top or prime coatings at low coat weights.

A method of producing the novel clay products, advantageously from coarse kaolin clay fractions which have been delaminated and which are substantially free of undelaminated aggregates and booklets, by heating the fractions in a specified manner until the combined properties, including opacity, particle size, surface area, oil absorption, G.E. brightness, color and abrasion are changed to form a unique and desirable structural product having clay particles adhered together, thereby providing a product having increased void volume within its structure. The method is also applicable to fine domestic kaolin clay fractions which have been delaminated.

BACKGROUND OF THE INVENTION

The art to which this invention pertains concerns clay pigments and method of producing same.

Attempts have previously been made to subject coarse as well as fine kaolin clay fractions to calcination for the purpose of producing paper fillers or paper coating pigments. Such clay products have been found unsatisfactory since desirable values for one or a combination of the above properties were not present—thus severely limiting their acceptance and use in the paper industry.

U.S. Pat. No. 3,171,718 discloses a method of first preparing a delaminated kaolin clay product and then subsequently subjecting the product to calcination. The term "calcination," as conventionally used, means the heating of clay to bring about the sharp exothermic reaction, as shown in conventional differential thermal analysis curves. The patentee found that by subjecting the delaminated clay to calcination, the calcined clay product possessed unusually high G.E. brightness and abrasion indices lower than undelaminated clay which is subsequently calcined in a similar manner.

SUMMARY OF THE INVENTION

The new clay products of this invention are comprised of a multiplicity of individual clay platelets substantially free of conventional stacks or booklets or undelaminated stacks or booklets in which the majority of the individual platelets are adhered together into numerous larger aggregates which can be likened to small popcorn balls. The individual platelets of more than two microns in diameter or size predominate on a weight basis and have a ratio of diameter to thickness, as determined by an electron microscope in excess of about

six. The ratio of diameter to thickness increases as the diameter of the platelets increases. The adhered aggregates of individual platelets are retained and not destroyed when subjected to normal and conventional mixing and coating forces, resulting in a coated or filled paper having increased void volume or bulking characteristics, thus giving increased opacity while retaining all of the other advantageous properties of the new clay product, such as color, brightness, ink receptivity, and so forth.

The improved combinations of properties, particularly improved opacity, of the new clay of this invention can be achieved in various manners in the paper making and coating art. The new clay can be used as a paper filler pigment, as a prime paper coating pigment, as a top coating paper pigment, alone or in combination with other conventional paper filler or coating pigments.

The invention further includes paper and paper board having a prime coating adhered thereto containing the new clay product of this invention as the sole pigment or in combination with other conventional paper coating pigments.

The invention further includes paper and paper board having a top coating adhered thereto containing the new clay product of this invention as the sole pigment or particularly in combination with other conventional paper coating pigments with or without a prime coat containing the new clay product.

The invention further includes paper containing the new clay product as a filler pigment alone and particularly in combination with other conventional paper filler pigments and with or without prime coats and top coats containing the new clay product.

This invention further relates to a method of producing a domestic clay product having an improved combination of properties, as those above mentioned, by first preparing a delaminated domestic kaolin clay from coarse domestic clay fractions that is substantially free of undelaminated aggregates and booklets and is composed substantially of individual platelets, according to the process set forth in U.S. Pat. No. 3,171,718 to produce a clay product as therein defined. The delaminated clay thus formed is heated at least until an endothermic reaction begins but the heating is stopped prior to the initiation of an exothermic reaction to form the new clay product described above.

The new clay products of this invention are particularly advantageous when produced from coarse domestic kaolin clay fractions (having in the order of 60 percent of its aggregates below two microns in size), but very satisfactory results are also obtained when fine fractions (85 to 95 percent of its aggregates below two microns) are subjected to the novel method above indicated.

These improved combinations of properties are obtained even at low coat weights (three to five pounds per ream) on light weight paper such as a twenty-three pound (25" x 38"—500 count or 3300 ft.²) catalog base stock, thus not only reducing the cost of a high opaque coated paper, but possibly even more important, significantly reducing the total weight.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of the method of this invention;

FIG. 2 is a differential thermal analysis curve of delaminated domestic kaolin clay;

FIGS. 3 and 4 are a graphic illustration of various properties of heated and calcined delaminated kaolin clay;

FIGS. 5, 6 and 7 are electron-micrographs of the product of this invention;

FIG. 8 is a graph of various properties of a heated and calcined fine filler or No. 3 coating clay.