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PLASTIC AND METHOD OF MAKING THE SAME

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8 Claims. (Cl. 260—42)

The present invention relates to the manufacture of a new plastic and, more particularly, to a plastic employable as a bonding medium for abrasive articles such as grinding wheels, discs, blocks, pads, etc.

The prime object of the invention resides in the making of a novel plastic utilizable as a bond for manufacturing a new type of abrasive products, the abrasive products being so bonded as to render them suitable for both grinding and polishing action, the products being characterized by being solid in body and yet compressible and capable of following the contour of the object being abraded.

The present application is a division of our application Serial No. 76,756 for "Abrasive articles," filed April 28, 1936, now Patent No. 2,122,691, granted July 5, 1938.

There are two classes of grinding implements in general use, one class consisting of solid, rigid bonded abrasive articles, such as wheels, discs and the like, the other class embracing the so-called flexible set-up polishing wheels, which latter include cloth wheels coated with glue and abrasive, prepared annular abrasive cloth mounted on yielding bodies such as rubber, and felt buffing wheels charged with rouge, etc. There is a commercial demand for this latter class of abrasive articles in the polishing and abrading of irregularly shaped surfaces; and because of their inherent qualities of being somewhat compressible, these abrasive articles produce in effect a cushion for the object being abraded, resulting in producing a very highly finished surface, free from chatters such as are obtained when a relatively inflexible, hard, solid abrasive wheel is used.

These so-called flexible, set-up wheels have been open to serious objection for years due to their having only a few layers of abrasive particles or granules on the periphery of the wheels, resulting in very short wheel life and necessitating frequent renewal of the abrasive layer with consequent interruption of production. Various methods have been proposed and attempts made to produce solid wheels, as well as attached layers or blocks of bonded abrasive in substantial thicknesses on resilient cores, to replace these set-up wheels; but, due to one reason or another, none of these products has assumed commercial importance.

In the practice of the present invention there are produced solid abrasive wheels, as well as wheels mounted on rigid or resilient cores, in which the abrasive granules and the bond are of such substantial volume as to comprise in effect a solid body and not a superficial coating of bonded abrasive particles.

Carothers, Williams, Collins, and Kirby in the Journal of the American Chemical Society of November 5, 1931, at pages 4203 et seq., describe a synthetic product known as chloroprene. Chloroprene is a halogenated derivative of acetylene polymers, more specifically 2-chloro-1, 3-butadiene. Chloro-butadiene derivatives are obtained by combination of mono-vihylacetylene and hydrochloric acid, usually in the presence of proper catalytic agents, polymerization progressing from this point, giving various polymers, such as α-polychloroprene, a fairly soft plastic, up to μ-polychloroprene, which is a rubbery, transparent, elastic mass. Chloroprene polymers are now available commercially under the trade name Duprene. Chloroprene may be used to replace rubber and when so used possesses the known advantages of offering greater resistance to the attack of oils and petroleum solvents, corona resistance, etc.

The use of chloroprene as a bond for abrasive products has also been proposed. We have found, however, that chloroprene alone is not practical as a bond for abrasive particles, for when used as such a bond, chloroprene exhibits the following disadvantages: unduly high stretching or elongation, poor resistance to heat generated in grinding, and substantially no adhesion to the abrasive particles or granules.

It is well known that grinding and polishing wheels tend to expand under the influence of centrifugal force. Such wheels when bonded with chloroprene start to balloon and expand when rotating at such low speeds as 3000 surface feet per minute, due to the extreme elongation or stretching characteristic of the chloroprene bond. Since there is very little, if any, adhesion of this bond to the particles or granules, there is produced under the influence of such centrifugal force an attenuation of the bond. When this occurs, the expanded revolving wheel body vibrates, the loosened abrasive particles or granulates fall out of their bond envelopes and the wheel then breaks.

We have discovered that the formation of co-polymers of a synthetic resin with an incompletely polymerized chloroprene produces a new bonding agent for abrasive articles, having the following unique characteristics: enormous increase in heat resistance, capability of tenacious adhesion to abrasive particles, and the capabil-

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ity of having its elongation and hardness controlled to any extent desired.

We have discovered that cresol-formaldehyde-tung oil complexes (hereinafter referred to as CFTO complexes) form co-polymers with incompletely polymerized chloroprene. These CFTO complexes are soluble in incompletely polymerized chloroprene, forming therewith plastics capable of further polymerization to transparent bodies ranging from flexible rubbery materials to firm, leathery, but still pliable products. A grinding or polishing wheel formulated with a co-polymer of incompletely polymerized chloroprene and CFTO complex as a bond is characterized by the following advantages: The binder assumes a leathery but very pliable characteristic. The elongation or stretch of the binder is reduced to as low as 100%, as compared with 800% for straight chloroprene. The resistance to heat is increased to a point where the wheel is unaffected by the heat generated in grinding. The adhesive qualities of the binder are such that continuous flexing during grinding does not set free the abrasive particles prematurely. However, the binder is still capable of being somewhat distended under pressure in grinding or polishing so that any ununiformities in the article being ground are abraded and polished at the same time. In addition, the binder assumes such a physical state that the grinding wheel can be operated at normal grinding speeds without distension resulting in expansion and subsequent rupture due to centrifugal force. Fairly thin wheels of this type have been revolved as high as 15,000 surface feet per minute without rupture.

One of the most important advantages manifested is the feature of being able to produce very free, cool cutting wheels and at the same time retain a burnishing or buffing action equal to the best so-called set-up wheels without the serious disadvantages of the latter type.

In the grinding and polishing of stainless steel fabricated equipment as heretofore practiced, the welded seams are first abraded with a rigid coarse grain wheel to remove excess metal. The ground surface after this operation is rough and deeply scored. To restore this surface to the original polished finish it is then necessary to use two or three additional polishing operations with successively finer abrasives, using the so-called set-up polishing wheels. We have found that with wheels made in accordance with our invention, the required grinding and polishing finish may be obtained in one operation, at a great saving in time and labor. Moreover, our wheels being solid, or substantially so, there is no necessity for frequent renewal of the abrasive surface as has heretofore been the case.

A preferred example of the CFTO complex we employ is as follows:

	Parts by weight
Cresol (boiling range 200 to 204°)	100
Formaldehyde (aq. sol., 40% by vol.)	50
Sulphuric acid	¼

These reagents are charged into a suitable jacketed kettle equipped with a reflux condenser. Heat is applied and the reagents boiled with refluxing for approximately thirty minutes, after which time there will be a distinct layer of resin and a layer of water in the kettle. The residual water is removed by decanting or distillation. The resinous mass is then heated to approximately 160° C., a specimen of which when cooled should be clear and brittle. At this time 100 parts of tung oil is added and heating continued until any desired viscosity is attained. Depending on the length of heating, the resinous mass may be viscous and sticky or a brittle solid. Five parts of hexamethylenetetramine is then added to the mass, by stirring if the mass is left in a viscous condition or by grinding in a ball mill if the solid brittle modification is used. This CFTO complex is then capable of further polymerization with heat to a tough, leathery, infusible product.

Although the above example calls for a cresol of 200–204° boiling range (substantially meta para) other cresols work equally as well, although they are not quite so reactive. We may use low or high boiling xylenols, crude cresylic acid, or any combination thereof. The amount of tung oil may be varied at will, but we prefer to use from 50 to 200 parts, depending up on the amount of flexibility we desire to impart to the chloroprene polymer.

Other synthetic resins are capable of forming co-polymers with chloroprene and may be used in accordance with our invention, but perhaps not as advantageously, as for example, phenol aldehyde resins, and resins derived from phthalic anhydride and polyhydric alcohols.

As a specific example of a grinding or polishing wheel formulated with a co-polymer of chloroprene and CFTO complex, we may use the following materials in the proportions specified:

	Parts by weight
Duprene (chlorprene polymer made by Du Pont Corp.)	10
CFTO complex	3
Zinc oxide	½
Magnesium oxide	½
Rosin	½
Sulphur	1/6
Artificial alumina or silicon carbide of desired size	150

The Duprene and the CFTO complex are first mixed on rubber mill rolls until the heat of mastication dissolves the CFTO complex in the Duprene, forming a transparent plastic. The zinc oxide, magnesium oxide, rosin and sulphur are added and rolled until dispersed homogeneously throughout the mass. The abrasive grains are then added in small increments until absorbed and distributed uniformly, forming a plastic sheet. Wheels or discs may then be cut, punched, or otherwise formed from this sheet. The formed articles are then heated from 1 to 5 hours at 310° F. to further polymerize the co-polymers, as for example between press platens or in a suitable oven.

The use of zinc oxide, magnesium oxide, rosin and sulphur as activating ingredients is well known to those versed in the art of compounding chloroprene.

It is to be understood that we do not limit ourselves to the proportions cited, as all or any of them may be varied and still remain within the scope of this invention. We have found, however, that 10% to 50% of the CFTO complex by weight of the chloroprene polymer are the most desirable proportions. In these proportions the tensile strength remains substantially constant, in the order of 2200 to 2500 pounds per square inch, whereas the elongation decreases and the hardness increases in direct proportion to the amount of CFTO complex used.

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This feature makes it practical to formulate polishing wheels to any degree of resiliency desired.

We also do not limit ourselves to mixing on rolls, as it is advantageous in specific cases to mix by other methods to eliminate the crushing action of mixing rolls on the abrasive grains. We can accomplish this by dissolving the co-polymers in a solvent, as for example, xylol or benzol, and stirring in the abrasive grains in a dough mixer with subsequent elimination of said solvent. As an alternative, we have produced water dispersions of the co-polymers by the use of Bentonite clay, casein, glue, etc., as is well known to those versed in the art, and stirring in the abrasive particles in a dough mixer, with subsequent removal of the water by drying.

We claim:

1. A plastic comprising a co-polymer of an incompletely polymerized chloroprene and a synthetic resin, the synthetic resin acting to controllably reduce the elongation or stretch of the chloroprene.

2. A plastic comprising a composition of an incompletely polymerized chloroprene and a cresol-formaldehyde-tung oil complex.

3. A plastic comprising a co-polymer of an incompletely polymerized chloroprene and a synthetic resin, the synthetic resin acting to controllably reduce the elongation or stretch of the chloroprene, the synthetic resin being from 10% to 50% by weight of the chloroprene.

4. The method of making a plastic utilizable as a bond for abrasive products and the like which consists in dissolving an incompletely polymerized chloroprene and a synthetic resin and forming therefrom a composition consisting of a co-polymer of the chloroprene and the resin, the synthetic resin acting to controllably reduce the elongation or stretch of the chloroprene.

5. The method of making a plastic which consists in dissolving a cresol-formaldehyde-tung oil complex in an incompletely polymerized chloroprene, the cresol-formaldehyde-tung oil complex acting to controllably reduce the elongation or stretch of the chloroprene.

6. The method of making a bond for abrasives and the like which consists in masticating under the influence of heat a cresol-formaldehyde-tung oil complex in an incompletely polymerized chloroprene to form a plastic, the cresol-formaldehyde-tung oil complex being from 10% to 50% by weight of the chloroprene.

7. The method of making a plastic utilizable as a bond for abrasive products and the like which consists in dissolving an incompletely polymerized chloroprene and a synthetic resin and forming a composition therefrom consisting of a co-polymer of the chloroprene and the resin, the synthetic resin acting to controllably reduce the elongation or stretch of the chloroprene, the synthetic resin being from 10% to 50% by weight of the chloroprene.

8. A plastic comprising a composition of an incompletely polymerized chloroprene and a cresol-formaldehyde-tung oil complex, the cresol-formaldehyde-tung oil complex being from 10% to 50% by weight of the chloroprene.

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