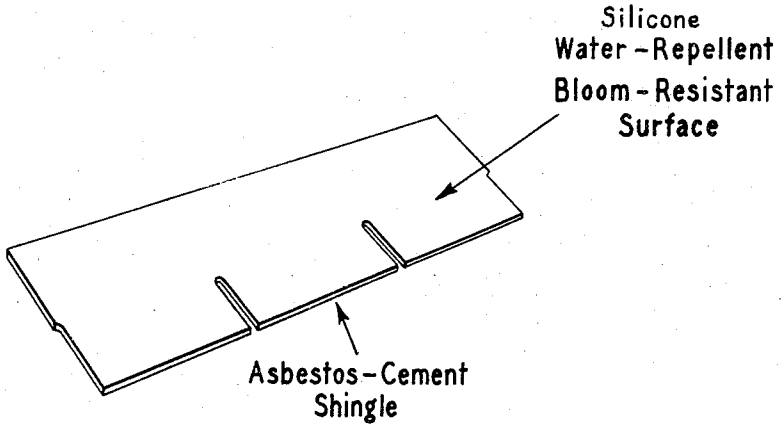
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WATER-REPELLENT ASBESTOS-CEMENT STRUCTURAL ARTICLES AND METHOD OF MAKING

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WATER-REPELLENT ASBESTOS-CEMENT STRUCTURAL ARTICLES AND METHOD OF MAKING

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The invention is concerned with the provision of durable weather-resistant asbestos-cement structural articles, and more particularly it relates to a surface treatment for such articles, which imparts thereto increased resistance to blooming and improved water repellency.

It is well known that asbestos-cement shingles, and other structural parts of similar composition, have a ready tendency to absorb moisture when exposed to rain and weathering conditions. While this does not usually have any deleterious effect upon the over-all durability of such articles, it can produce quite unsatisfactory results in the appearance of shingles and siding material after application to a building, or even in storage before being used. Blooming in asbestos-cement shingles is a common phenomena. This is caused when soluble salts within the shingle leach to the surface by the action of water, and remain thereon as a white deposit. On over-all white shingles this action is of little concern, but on many varieties of colored shingles blooming can produce very noticeable, and detrimental, color changes, particularly about the outer edge portions of a shingle surface. While ways and means of combating this phenomena have heretofore been proposed, the results accomplished so far have been no more than partially effective.

Any surface treatment for asbestos-cement shingles should be one which will prevent blooming both during manufacture and storage, and it should not add appreciably to the manufacturing costs of such articles. The treatment should eliminate with considerable permanence the tendency toward blooming, and it should make possible water-repellent shingles which are substantially unaffected by all weather conditions.

It is the primary object of this invention to accomplish the aforesaid results, by providing an improved surface treatment for asbestos-cement shingles and other similar structural parts, which treatment will impart to such materials better water-repellent, weather-resistant properties, and will also effectively retard deterioration by the alkaline, high humidity, conditions met with during the curing step in the manufacture of these products.

The invention is illustrated in the accompanying drawing showing an asbestos-cement shingle treated in accordance with the present invention to provide a bloom-resistant surface.

The invention is based upon the finding that certain siloxane polymers, commonly known as silicone compositions, are excellent treating agents for asbestos-cement materials. These silicones will produce on shingle-type surfaces a colorless, invisible coating, which has a much longer water-repellent life than prior-known wax coatings, or those obtained by any surface treatments heretofore known for this purpose. More specifically the silicones which have proven most suitable are the polymers made by ordinary hydrolysis and condensation of the higher alkyl silanes. Polymers originating from silanes containing alkyl radicals of four or more carbon atoms are especially useful, and these higher alkyl derivatives, either as homopolymers or copolymers which contain other

silanes or silicon chemicals, have outstanding advantages for the purpose of this invention.

In the manufacture of asbestos-cement products, by either the so-called wet or dry process, a curing of the cement is necessary in order to develop suitable handling strength before use. This is accomplished under very humid storage conditions, and also sometimes by autoclaving. Moreover, for the sake of manufacturing efficiency and economy, any water-repellency treatment of the products generally is made prior to the storage and curing steps. Under these highly humid and alkaline conditions, treatments previously proposed have generally been of very short life in their effectiveness, and this disadvantage has also applied to certain silicone compounds which have been experimented with in this capacity. The water-repellent properties of methyl and ethyl silicones for example, deteriorate rapidly under the usual storage or autoclaving conditions, whereas the silicones derived from butyl and amyl silances, or those of higher alkyl radical content, and their copolymers, survive these conditions, and have much greater permanency. This is apparently due to the much slower attack of alkali on the higher alkyl silicones than on the lower alkyl analogues.

An experiment giving clear evidence of the aforesaid facts is shown in the following table, wherein the water repellency of asbestos-cement shingles, treated with different silicones, is compared after aging at 100% humidity.

Water repellency

Polymer	C/Si Ratio	Loading, g./sq.	6 hr.	4 weeks	7 weeks
Amyl-Methyl Silicone Copolymer.	3	30	Good	Excellent	Excellent.
Ethyl Silicone	2	30	Good	Poor	Wets Readily.
Methyl Silicone	1.5	30	Fair	Wets Readily.	Do.

The first silicone polymer in the above table is typical of those intended to be covered by this invention. This was made from equal mole proportions of amyltrichlorosilane and methyltrichlorosilane, by first reacting with anhydrous alcohol to form the alkoxy derivatives, and then hydrolyzing and condensing this intermediate under the usual conditions employed in making silicone products. The other two silicones compared are conventional poly- of ethyltrichlorosilane and methyldimethyl chlorosilances respectively.

Loading as referred to in the table indicates the amount of silicone, in grams, which was used to treat a square of shingle surface, or 114 square feet. The actual amount of silicone needed to obtain satisfactory results, can, of course, be varied, but for economical reasons the loading should be kept as low as possible. With the higher alkyl siloxanes of this invention comparatively low loading will be found suitable. Overall this may range from 7 to 60 grams of silicone per square of surface, depending upon the particular shingle composition being dealt with but generally a loading of 20 to 40 grams per square will be sufficient to provide excellent water repellency. The method of applying the silicone to the shingle surface can also be adapted to suit other manufacturing procedure, but this can be done either with a complete solution of the silicone or in an emulsion liquid. The emulsion application, which emulsion can be made by known emulsifying technique, is especially desirable, and has provided a ready way of controlling the loading most suitable for various asbestos-cement shingle compositions.

Another illustration of a preferred embodiment of the invention is given in the following example:

A silicone copolymer was prepared by mixing 6.5 moles of amyltrichlorosilane with one mole of tetraethylsilicate in a volume of isopropyl ether about equal to that of the chlorosilanes. Water to the extent of about 11.1 moles was added, and the mixture was refluxed to evolve HCl. The residue was neutralized by adding excess sodium bicarbonate, and this mixture was then filtered. The clear filtrate was concentrated to 100% resin by vaccum stripping.

This silicone in an amount of 300 grams was made into an aqueous emulsion by standard technique, using an emulsifying agent such as morpholine and oleic acid, and with the final emulsion concentrate containing 40% of the silicone. The concentrated emulsion was then diluted to 4% silicone content, and this liquid was applied to asbestos-cement shingles at loadings of 20 and 40 grams of silicone per square of shingles. In 24 hours excellent water repellency had developed. The shingles were then placed in a 100% relative humidity chamber at 50° C., and after 109 days' storage the shingles still had excellent repellency. This clearly indicates that this treatment, with both silicone loadings as indicated, provides adequate resistance to the alkalis in the shingle composition. Such results also show a striking improvement over what can be accomplished with the lower alkyl silicones, when, as indicated in the previous table, a similar kind of treatment with both a methyl and ethyl silicone product was entirely ineffective in water repellency after a shingle storage of four weeks or less, under 100% relative humidity and at room temperature.

Other higher alkyl silicone homopolymers, as well as the copolymer compositions of the aforesaid examples, have also been tested, and have been found to exert excellent water repellency action. This includes silicones made from starting materials such as normal and secondary butyl trichlorosilane, amyltrichlorosilane and nonyltrichlorosilane. A copolymer of amyltrichlorosilane with a silanic hydrogen containing silane, such as triethoxysilane, is another type of silicone which will serve the purposes intended by this invention, and other suitable copolymer compositions are such as can be made from nonyltrichlorosilane and tetraethyl silicate, or dodecyl trichlorosilane and tetraethyl silicate. Thus the actual silicone treating agent may be one of a large number of such products which may be now available on the market, or can readily be made in accordance with the silicone polymer technique.

We claim:

1. An asbestos-cement shingle having a water-repellent bloom-resistant surface formed by coating said surface with a silicone composition, in a loading amount of from 20 grams to 40 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and methyltrichlorosilane in about equal mole proportions.

2. An asbestos-cement shingle having a water-repellent bloom-resistant surface formed by coating said surface with a silicone composition, in a loading amount of from 20 grams to 40 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and tetraethyl silicate in mole proportions of about 6.5 to 1 respectively.

3. Method of producing a water-repellent bloom-resistant surface on asbestos-cement structural units which comprises applying to said surface an alkyl silicone composition, in a loading amount of from 20 grams to 40 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and methyltrichlorosilane in about equal mole proportions.

4. Method of producing a water-repellent bloom-resistant surface on asbestos-cement structural units which comprises applying to said surface an alkyl silicone composition, in a loading amount of from 20 grams to 40 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and tetraethyl silicate in mole proportions of about 6.5 to 1 respectively.

5. An asbestos-cement shingle having a water-repellent bloom-resistant surface formed by coating said surface with a silicone composition, in a loading about of from 7 grams to 60 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and a silane taken from the group consisting of methyltrichlorosilane and tetraethylsilicate.

6. Method of producing a water-repellent bloom-resistant surface of asbestos-cement structure units which comprises applying to said surface a silicone composition, in a loading amount of from about 7 grams to 60 grams per square of surface, said silicone being the hydrolysis and condensation copolymer product of amyltrichlorosilane and a silane taken from the group consisting of methyltrichlorosilane and tetraethylsilicate.

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