

PATENT SPECIFICATION

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(54) A METHOD OF MAKING A CONCRETE TILE

(71) We, CONCRETE INDUSTRIES (MONIER) LIMITED, a company incorporated under the laws of the State of New South Wales of 6-8 Thomas Street, Chatswood, N.S.W. 2067, Australia, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of making a concrete tile, in particular to the manufacture of cement roof tiles having a polymeric coating. Although the invention will be described herein primarily with reference to the manufacture of roof tiles, it should be understood that the invention is not limited to the manufacture of roof tiles.

Concrete roof tiles are commonly made either by a process of pressing or a process of extrusion, both of which processes are well known. The extrusion process is in general use today since it provides better efficiency by producing more tiles per unit of time.

To cater for consumer demand for tiles having a variety of colours, it is usual to coat cement tiles immediately after their formation with a cement slurry containing a pigment which gives the face of the tile its desired colour. Such a coating is described as a "colour coat". It is also known to apply a polymeric coating over the colour coat to give the tile a more pleasing, shiny surface, and to prevent deterioration of the tile through weathering and through efflorescence which takes place when unprotected colour coat is attacked by atmospheric carbon dioxide and water. Such polymeric coatings have previously been applied as a solution of polymer (such as acrylic esters) in an organic solvent. The use of such solutions has two major drawbacks. The first is that the solvents employed are expensive and contribute significantly to the cost of producing the finished tile. Secondly, these solvents evaporate into the atmosphere where they can cause pollution problems and constitute a fire hazard.

Since polymeric coating materials generally, and acrylic polymers in particular, are readily obtainable in the form of water based emulsions, it would be desirable to employ such water based emulsions for the purpose of applying polymeric coatings to roof tiles and other cementitious substrates. In spite of the benefits which might be expected from the avoidance of organic solvents, previous attempts to apply emulsion coatings to uncured cement slurries of the type previously referred to on a commercial scale have proved unsuccessful.

Tile extrusion machines in commercial use today turn out from 60 to 130 tiles per minute. Standard tiles are 16 inches (about 40 cm) long. Thus, any delay in applying the various coatings to the tile necessitates a production line whose length increases by from 80 to 175 feet (about 26 to 57 metres) for every minute taken in applying the various coatings. It follows that in the commercial production of tiles, it is economically essential that the colour coat and the polymeric coat be applied almost immediately after the tile is formed.

If a polymer emulsion is applied directly on to an uncured cementitious layer (for example a layer which has aged less than five minutes), it has been found that calcium hydroxide formed on the hydration of the cement in the colour coat migrates to the outer surface of the polymer emulsion layer, where it reacts with atmospheric carbon dioxide. This reaction destroys the water repellent properties of the coating, and also ruins its appearance, producing an unsightly film of calcium carbonate.

The present invention resides in the discovery that careful control of the moisture content in the body of the tile enables a

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polymer emulsion coating to be applied over an uncured colour coat, preferably within a matter of seconds of the application of the colour coat itself.

5 According to the present invention, the problems of calcium hydroxide migration may be overcome by producing the body of the tile with such a degree of moisture that water contained in the slurry (colour coat) migrates from the latter to the former and in so doing carries any dissolved salts away from the colour coat, and migration of these soluble salts into the polymer emulsion system is prevented.

10 A body moisture content of 8% by weight or less is usually sufficient to achieve this.

The invention has utility with a variety of polymer emulsions but the preferred polymer emulsions are emulsions of acrylic polymers of the type presently employed (in organic solutions) to coat roof tiles. Preferred emulsions are polymers of acrylate and methacrylate esters which may or may not have undergone some degree of cross linking with other compounds. The types of compounds used for this purpose are well known to those in the industry; typical examples being acrylic acid and glycidyl methacrylates.

20 Other polymers which may be employed include vinyl ester homopolymers (such as polyvinyl acetate); vinyl ester co-polymers such as acetate versatate and acetate itaconate copolymers; copolymers of styrene and acrylate and/or methacrylate esters; polyvinyl chloride; polyvinylidene chloride; copolymers of vinyl chloride and vinylidene chloride; copolymers of vinyl chloride and/or vinylidene chloride with acrylate and/or methacrylate esters.

25 The solids content of the emulsion is not critical, but is preferably such that the total non-volatile content is between 20% and 60% by weight. In practice, it has been found desirable to use an emulsion of the highest solids content which can conveniently be handled.

30 One polymer emulsion which gives particularly satisfactory results contains methyl methacrylate and butyl acrylate in the ratio of 55 to 45 and has a total non-volatile content of 50% by weight.

Description of the Preferred Embodiment

35 The present invention may be performed as a variation of the extrusion process which is generally practised today for the formation of concrete tiles. As in conventional concrete tile extrusion processes, concrete is first deposited by extrusion on to metal pallets. The metal pallets not only provide the support for the tiles during formation and curing but also provide a means of shaping the underside configuration of the tiles. The moisture content of the deposited concrete is lower than in conventional tile

extrusion, however, to produce a green tile having a moisture content below 8% by weight water, and preferably no more than 7.5% by weight.

40 The tile machine is part of a closed conveyor circuit which receives a stream of metal pallets. As the pallets are propelled through the machine, a release agent is sprayed on to the upper surface of each pallet. During the forward movement of both pallet and deposited concrete, a power driven roller is engaged. This roller primarily reduces the concrete to a partly compacted ribbon lying on the stream of pallets. Running against the outgoing surface of the roller is a wedge-shaped plate known as a slipper. The ribbon of concrete is thus trapped, and during the forward movement of the pallet stream and the ribbon of concrete, both roller and slipper impart the desired contour to the top surface of the tile. A cross configuration guillotine knife divides the ribbon at each pallet joint into the separate tiles.

45 The cut tiles, still in stream, then pass under a surface finishing device which applies the "colour coat" in the form of a coloured cementitious slurry. Although it is not essential to do so, the cut tiles may be heated immediately before the colour coat is applied. It is believed that such heating has the effect of partially drying the colour coat as soon as it is applied, and assisting the withdrawal of moisture into the body of the tiles.

50 Within seconds of applying the colour coat, the cut tiles pass through a coating zone at which a polymer emulsion according to the method of the invention is applied. The polymer emulsion may be applied by any suitable means, such as a spray or a rotary brush. Such means have previously been employed for coating tiles with organic polymer solutions.

55 It has been found advantageous to employ some means of drying the emulsion immediately after its application. This may be achieved, for example, by means of a hot air blower, or by infrared or microwave radiation. It has been found that such accelerated drying enhances the water repellency of the polymer coating, and it is believed that this is a result of the quicker breaking of the emulsion under forced drying.

60 In one embodiment of the invention, an improved polymeric coating may be obtained by the application of heat to the colour coat immediately before the emulsion coating is applied. Such heating may be achieved by means of a hot air blower, by infrared or microwave radiation, or by other suitable means. It is believed that heating at this stage promotes more rapid breaking of the emulsion, possibly by partial drying

of the colour coat which consequently draws water from the emulsion.

WHAT WE CLAIM IS:—

1. A method of making a concrete tile
5 comprising the steps of casting, extruding, drawing or otherwise forming the concrete body of the tile, applying a cementitious slurry to the surface of said body and, before the slurry layer has cured, applying to
10 said layer an aqueous emulsion of a film-forming polymeric material, the body of the tile being formed with a moisture content of less than 8% by weight.
2. A method according to claim 1,
15 wherein the moisture content of the body is less than 7.5%.
3. A method according to claim 1 or 2, wherein said body is heated immediately before the slurry is applied.
- 20 4. A method according to any preceding claim, wherein the slurry layer is heated immediately before the emulsion is applied.
5. A method according to any preceding
25 claim, wherein the surface of the tile is heated after the emulsion is applied to enhance breaking of the emulsion.

6. A method according to any preceding claim, wherein said polymeric material is one or more of acrylic polymers, vinyl 30 ester homopolymers and copolymers, copolymers of styrene with acrylate and/or methacrylate esters, polyvinyl chloride, polyvinylidene chloride, copolymers of vinyl chloride and vinylidene chloride, and co- 35 polymers of vinyl chloride and/or vinylidene chloride with acrylate and/or methacrylate esters.

7. A method according to claim 6, where said emulsion has a total non-volatile content of from 20% to 60% by weight. 40

8. A method according to claim 6 or claim 7, wherein said polymeric material comprises a polymer of acrylate and methacrylate esters which may or may not have 45 undergone some degree of crosslinking with other compounds.

9. A concrete tile made by the method claimed in any one of claims 1 to 8.

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1. A method of making a concrete tile
5 comprising the steps of casting, extruding, drawing or otherwise forming the concrete body of the tile, applying a cementitious slurry to the surface of said body and, before the slurry layer has cured, applying to
10 said layer an aqueous emulsion of a film-forming polymeric material, the body of the tile being formed with a moisture content of less than 8% by weight.
2. A method according to claim 1,
15 wherein the moisture content of the body is less than 7.5%.
3. A method according to claim 1 or 2, wherein said body is heated immediately before the slurry is applied.
- 20 4. A method according to any preceding claim, wherein the slurry layer is heated immediately before the emulsion is applied.
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25 claim, wherein the surface of the tile is heated after the emulsion is applied, to enhance breaking of the emulsion.

6. A method according to any preceding claim, wherein said polymeric material is one or more of acrylic polymers, vinyl 30 ester homopolymers and copolymers, copolymers of styrene with acrylate and/or methacrylate esters, polyvinyl chloride, polyvinylidene chloride, copolymers of vinyl chloride and vinylidene chloride, and co- 35 polymers of vinyl chloride and/or vinylidene chloride with acrylate and/or methacrylate esters.

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