

## SPECIFICATION

**Improvements in or relating to methods of forming coatings, coatings so formed and articles coated thereby**

This invention relates to methods of forming coatings, coatings so formed and articles coated thereby and has been devised particularly though not solely for use as a coating for weatherproof building cladding for example roofing tiles.

It is an object of the present invention to provide methods of coating articles coatings so formed and articles coated thereby which will at least provide the public with a useful choice.

Accordingly in one aspect the invention consists in a method of coating articles, said method comprising the steps of applying to a base sheet material, a bitumen primer layer and while the bitumen primer layer is still wet applying a layer of a barrier material of a consistency composition and thickness such that the bitumen primer layer does not bleed through the barrier layer and the barrier layer adheres to the bitumen primer layer and applying a coating of stone chips to the barrier layer in a manner such that the stone chips are partially embedded at least in the barrier layer so that the stone chips are held in position on curing of the bitumen primer and barrier layer but the stone chips are not completely covered by the barrier layer.

In a further aspect the invention consists in a coating for an article when effected according to the preceding paragraph:

In a still further aspect the invention may broadly be said to consist in an article coated according to the preceding paragraph.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

One preferred form of the invention and modifications thereof will now be described with reference to the accompanying drawings in which,

*Figure 1* is a perspective view of one form of uncoated tile usable in the invention,

*Figure 2* is a cross section on AA in *Figure 1*, and *Figure 3* is an enlargement on B in *Figure 2*.

In the preferred form of the invention a roofing tile which may be of a suitable shape such as uncoated tile 1 shown in *Figure 1* and having an upper surface 2 with upturned flange 3 and downturned flange 4 to allow overlapping of adjacent tiles in use.

The uncoated roofing tile 1 is made of galvanised sheet metal and has applied to its upper surface 2, a base layer 5 of bitumen primer, preferably either a polymer modified bitumen emulsion or a bitumastic emulsion. The bitumen primer is preferably applied by a spraying process while wet, that is to say, while still containing enough water so that the material of layer 5 which as shown in *Figure 3* is thicker than the barrier layer will flow under operating conditions.

The thickness of the coating is controlled to give a layer 5. The thickener in part is determined by its water content and ideally the layer 5 is one containing 20% - 40% water, preferably less than 30%. Fillers

may be included in the layer 5 such as calcium carbonate to extend the material and also provide a buffer for alkalinity. Platey fillers such as water ground mica may be added to improve mechanical properties and weathering characteristics and also anti corrosive pigments may be added. The emulsion when polymer modified is preferably polymer modified by adding a styrene acrylic emulsion for example about 20% on solids by weight or any other material having compatible high extensibility and low modulus of elasticity compared with the bitumen emulsion before polymer modification. A barrier layer 6 is then applied. The thickness of the barrier layer 6 is about 100 microns while wet and to substantially prevent excessive intermingling of layers 5 and 6 which would allow bleeding of the bitumen primer layer 5 through the barrier 6 control is exercised by choice of polymer for the barrier layer 6, control of surfactant system in both layers 5 and 6 and moisture content in the bitumen primer layer 5. The surfactants used are based on a mixture of non-ionic and anionic surfactants are used to cause the layers 5 and 6 to be stable in the wet state but excessive surfactant will detract from the properties of layers 5 and 6 themselves. The surfactants in each layer must be reasonably compatible, and act in emulsifying the materials of layers 5 and 6 to give a relatively stable system.

Preferably the bitumen primer layer 5 is not allowed to dry out or if drying is permitted the water content is not reduced below 15% and immediately after the bitumen primer layer 5 has been applied or within a short time after application the barrier layer is applied and this barrier layer preferably comprises an ultra violet opaque material such as an acrylic material and preferably that acrylic material comprises an elastomeric acrylic emulsion for example Rohm & Haas LC 45 or Revertex Revacryl (Registered Trade Mark) EM3608.

The requirement of the bitumen primer layer 5 and the barrier 6 are as follows.

There must be inter layer adhesion as between any zinc coating 7 or the sheet steel 1 and the bitumen primer layer 5 and between the bitumen primer layer 5 and the barrier layer 6. Intermingling of the barrier layer 6 and the bitumen primer layer 5 needs to be within specific limits.

- a. too little will lead to limited adhesion
- b. too much will lead to bleeding of the bitumen primer through the barrier layer 6 and subsequent reduced weather resistance.

Consequently these are the limits of intermingling required and can be controlled by controlling the thickness of the layers, the rheology of the layers, the surfactant system and the time interval between applying the bitumen primer layer and the barrier layer. The intermingling of the layers is effectively on a microscopic scale so that the layers 5 and 6 are in effect separate layers. The wet on wet process outlined above leads to better bonding when compared with a wet on dry process. The preferred

coating system includes a polymer modified bitumen emulsion primer and a filled highly extensible barrier coat utilising polymers such as totally or partly acrylic polymers.

- 5 After the bitumen primer layer 5 and the barrier layer 6 have been applied a stone chip material 8 such as that as used at present on Decramastic (trade mark) tiles and Harveytile tiles (trade mark) is applied to the still wet surface of the barrier layer 6
- 10 and the chip material 8 is such that the chips 8 are embedded but only partly embedded within at least the barrier layer 6 and possibly extending into the bitumen primer layer 5. The barrier coat 6 viscosity and surface tension must be such that the barrier
- 15 coat 6 capillarises part way up the side 9 of the chips 8 but without totally covering the chips 8. A moderately high viscosity is required but must be below a certain limit so that the material will flow out but then structure up to reduced sag. Many acrylic
- 20 coatings will achieve this property and the barrier layer must be controlled by selection of surface tension and viscosity characteristics so that the relatively thin barrier coat (within the range of 70 microns to 130 microns) is not excessively depleted
- 25 by excessive capillarisation. The chip specification needs to be such that reasonable grip is provided by the barrier layer 6 of the chips 8, that is to say, the chips 8 must not be so big that only a small portion thereof is embedded in the barrier layer which would
- 30 result in excessive loss of chip in use.

After the chip has been applied an overglaze layer 10 is applied and such overglaze layer 10 preferably comprises a transparent overglaze such as an acrylic emulsion overglaze such as a 100% unfilled acrylic

35 overglaze.

- It is desirable that the water content increases upwardly through layers 5, 6 and 10 to ensure adequate drying. Thus layer 5 may have a water content of 20%-40%, layer 6 a water content of
- 40 40%-50% and layer 10 a water content of 50%-60%.

The advantages of the above coating system include

1. An improved chip bond as compared with present products. Because of the capillary attraction
- 45 between chip and barrier there is no depression therebetween in which growth such as lichen can take hold.
2. Improved weather resistance due to, in particular, the bitumen rich layer being protected from
- 50 ultra violet degradation by the barrier layer.
3. Improved fungal resistance.
4. Improved scuff resistance during handling and fixing resulting in a better weathering property over a longer period of time.
- 55 5. Lower cost compared with all acrylic coatings.
6. Pre-treatment of galvanized surface can be minimized without substantial deleterious effect.

#### CLAIMS

- 60 1. A method of coating articles, said method comprising the steps of applying to a base sheet material, a bitumen primer layer and while the bitumen primer layer is still wet applying a layer of a
- 65 barrier material of a consistency composition and

thickness such that the bitumen primer layer does not bleed through the barrier layer and the barrier layer adheres to the bitumen primer layer and applying a coating of stone chips to the barrier layer

70 in a manner such that the stone chips are partially embedded at least in the barrier layer so that the stone chips are held in position on curing of the bitumen primer and barrier layer but the stone chips are not completely covered by the barrier layer.

- 75 2. A method as claimed in Claim 1, wherein said bitumen primer layer comprises a polymer modified bitumen emulsion layer.

3. A method as claimed in Claim 1, wherein said bitumen primer layer comprises a bitumastic emulsion layer.
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4. A method as claimed in any one of the preceding claims, wherein said barrier coating comprises an acrylic emulsion.

5. A method as claimed in any one of the preceding claims, wherein the water content of the bitumen layer is between 20% and 40% by weight when the barrier coating is applied.
- 85

6. A method as claimed in Claim 5, wherein said water content is between 20% and 30%.

- 90 7. A method of coating articles, substantially as hereinbefore described with reference to the accompanying drawings.

8. An article having a coating whenever produced using a method in accordance with any one of the preceding claims.
- 95

9. An article as claimed in Claim 8, wherein said article comprises a roofing tile.

10. An article as claimed in Claim 8 or 9, wherein the coating is finally covered with a layer of a transparent or translucent material.
- 100

11. An article, substantially as hereinbefore described with reference to the accompanying drawings.

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After the chip has been applied an overglaze layer 10 is applied and such overglaze layer 10 preferably comprises a transparent overglaze such as an acrylic emulsion overglaze such as a 100% unfilled acrylic overglaze.

It is desirable that the water content increases upwardly through layers 5, 6 and 10 to ensure adequate drying. Thus layer 5 may have a water content of 20%-40%, layer 6 a water content of 40%-50% and layer 10 a water content of 50%-60%.

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2. Improved weather resistance due to, in particular, the bitumen rich layer being protected from ultra violet degradation by the barrier layer.
3. Improved fungal resistance.
4. Improved scuff resistance during handling and fixing resulting in a better weathering property over a longer period of time.
5. Lower cost compared with all acrylic coatings.
6. Pre-treatment of galvanized surface can be minimized without substantial deleterious effect.

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thickness such that the bitumen primer layer does not bleed through the barrier layer and the barrier layer adheres to the bitumen primer layer and applying a coating of stone chips to the barrier layer in a manner such that the stone chips are partially embedded at least in the barrier layer so that the stone chips are held in position on curing of the bitumen primer and barrier layer but the stone chips are not completely covered by the barrier layer.

2. A method as claimed in Claim 1, wherein said bitumen primer layer comprises a polymer modified bitumen emulsion layer.

3. A method as claimed in Claim 1, wherein said bitumen primer layer comprises a bitumastic emulsion layer.

4. A method as claimed in any one of the preceding claims, wherein said barrier coating comprises an acrylic emulsion.

5. A method as claimed in any one of the preceding claims, wherein the water content of the bitumen layer is between 20% and 40% by weight when the barrier coating is applied.

6. A method as claimed in Claim 5, wherein said water content is between 20% and 30%.

7. A method of coating articles, substantially as hereinbefore described with reference to the accompanying drawings.

8. An article having a coating whenever produced using a method in accordance with any one of the preceding claims.

9. An article as claimed in Claim 8, wherein said article comprises a roofing tile.

10. An article as claimed in Claim 8 or 9, wherein the coating is finally covered with a layer of a transparent or translucent material.

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