

DECORATIVE TILE AND METHOD FOR ITS MANUFACTURE

The present invention relates to tiles to be bonded to walls for interior decoration, and to a method for manufacturing them.

Decorative tiles which are bonded to columns
5 and walls of a building have almost always been porcelain tiles bearing various patterns and colours.

However, porcelain tiles have drawbacks. For example, their manufacture is complex and they are expensive because the manufacturing process includes
10 a high temperature treatment step.

Metal tiles have been proposed for use instead of porcelain tiles, but they are expensive for two reasons; first, the raw materials are expensive and, secondly, their manufacture includes a complex plating
15 step. Furthermore, metal tiles have the drawback that they cannot be directly bonded to a concrete wall because they are attacked by exuded alkaline liquids.

The present invention provides tiles, especially decorative tiles, which can be directly bonded to
20 concrete walls without fear of corrosion problems. The invention also provides a cheap and simple method for manufacturing decorative tiles which have the luxury and grandeur of metal tiles.

According to the present invention a decorative tile
25 comprises a refractory tile blank with a rough surface coated by a metal or ceramic layer by spraying, a surface of the metal layer being coated with a coating material. The spraying process may use for example, copper, brass, a nickel alloy, stainless steel, ceramic or the like and, if
30 necessary or desirable, the tile may be patterned.

The tile blank may be made of ceramic, calcium silicate or slate.

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The surface of the refractory tile blank must be sufficiently rough for sprayed metal or ceramic to adhere to its surface; such a rough surface is sometimes known in the art as a "sand-like" or "pear-skin like" surface. Thereafter the coated surface is further coated with a coating compound, such as a resin, so that oxidation of the metal coating can be prevented.

Ceramic materials, as opposed to metals, which may be used in the spraying step include synthetic materials (e.g. oxides and spinel) such as alumina (Al_2O_3 ; dialuminium trioxide), magnesia (MgO ; magnesium oxide), zirconia (ZrO_2 ; zirconium dioxide) and spinel ($\text{MgO} \cdot \text{Al}_2\text{O}_3$; magnesium oxide-dialuminium trioxide), all of which are workable through spraying. Plasma spraying may be used for ceramics with particularly high melting points.

For a better understanding of the present invention, and to show how it may be put into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 shows a top view of a first embodiment of a decorative tile in accordance with the present invention;

Figure 2 shows a sectional view taken along the line II-II in Figure 1;

Figure 3 shows an enlarged view of a portion indicated by III in Figure 2;

Figures 4, 5 and 6 show perspective views in successive steps during fabrication of a decorative tile in accordance with a second embodiment of the present invention;

Figure 7 shows a sectional view of the tile shown in Figure 6 showing the lamination of metal layers; and

Figures 8 to 17 show views taken during the steps of manufacture of a decorative tile in accordance with a third embodiment of the present invention; Figures 10, 12 and 17 are sectional views, on an enlarged scale, of Figure 9, 11 and 16 respectively.

Figures 1, 2 and 3 show a first embodiment of the present invention. Abrasive particles are blown against the surface of a refractory tile blank 1 which is in the form of a suitably shaped (for example, square) plate and which is made of such material as ceramic, calcium silicate or slate. As a result, the tile blank 1 has a sand-like or pear-skin-like surface. Thereafter the sand-like or pear-skin-like surface of the tile blank 1 is coated with a layer 2 of metal such as copper, brass, stainless steel or a nickel alloy, or ceramic by a spraying process to a thickness of about 0.15 - 0.2 mm. The layer 2 will be referred to as the "metal layer". Next, a layer 3 of a resin such as polyester or any other suitable coating material is coated over the metal layer 2 so that the gloss of the metal layer 2 can be maintained, oxidation of the metal layer 2 can be prevented and the surface appearance of the metal layer 2 can be enhanced. Thus a decorative tile 4 is provided.

When the metal layer 2 is to be formed from metal with a high melting point such as stainless steel, it is preferable from the point of view

of adhesion that, first, a metal with a low melting point (such as zinc alloy) is sprayed as an under-coat over the sand-like or pear-skin-like surface of the tile blank 1 and that, secondly, the metal with a higher melting point is sprayed over it. This enhances the adhesion of the metal layer 2. This is because whereas metal with a high melting point shrinks a great deal after having been sprayed and sticks poorly to the tile blank 1, metal with a low melting point does not shrink much after being sprayed and adheres well to the tile blank 1.

If a decorative tile 4 with a pattern 5 is required, a desired pattern consisting of ridges and valleys is formed, prior to the coating of the metal layer 2, at the surface of the tile blank 1, which is then baked. Thereafter, abrasive particles are blown against the surface of the tile blank 1 so that the tile blank 1 has a sand-like or pear-skin-like surface. Next, the metal layer 2 is coated in the manner described above and its surface of the metal layer 2 is polished with wire wool or a polishing cloth so that the ridge-and-valley pattern 5 becomes visible. In this way, the pattern 5 as shown in Figure 1 can be obtained. The pattern 5 on the metal layer 2 may be coloured with a paint or pigment so that the pattern 5 is clearly visible.

The decorative tile 4 which has been manufactured in the manner described above can be directly bonded at its back surface to a concrete wall of a building with mortar, cement or resin adhesive.

Figures 4 to 7 show a second embodiment of the present invention. A pattern 5 is formed by laminating metal layers. More particularly, the surface of the tile blank 1 is coated with the metal layer 2 in the manner described above, and then a layer 6 of a metal having a different colour from that of the metal layer 2 is coated by a metal spraying process so as to form the pattern 5. Thereafter the metal layers 2 and 6 are coated with a layer 3 of a coating material to form a decorative tile 4.

As is the case of the first embodiment described above with reference to Figures 1, 2 and 3, abrasive particles are blown against a surface of a suitably shaped (for example, square) refractory tile blank 1 so that it acquires a sand-like or pear-skin-like surface. A metal 2 such as a white ceramic is melted and sprayed over the sand-like or pear-skin-like surface of the tile blank 1 (to a thickness of about 1.5 - 2 mm). Thereafter a resin paste is coated over the metal layer 2 (except pattern portions 2a) and a bright metal such as brass, stainless steel or the like having a different colour from that of the metal layer 2 is melted and sprayed over the pattern portions 2a, whereby a pattern layer is formed as shown in Figure 6. After the pattern 5 has been produced by this screen printing process, the resin paste is removed from the surface of the metal layer 2 and the surfaces of the metal pattern layers 6 are polished. Thereafter the whole surface of the tile blank 1 is coated with a layer 3 of a transparent

coating material so as to prevent oxidation of the metal pattern layers 6 (see Figure 7). As described above, a decorative tile with the pattern consisting of the metal layers 6 can be simply provided.

5 A method for removing the resin paste from the surface of the metal layer 2 is to immerse the tile blank 1 into a hot water bath so as to swell or saturate the resin paste. This method is employed in the manufacture of a decorative tile in accordance with a third embodiment of the present invention, to
10 be described below with reference to Figures 8 to 17.

The third embodiment as shown has a pattern different from that of the second embodiment described above with reference to Figures 4 to 7, but it is of
15 course to be understood that the third embodiment may have the same pattern as the second embodiment.

First, abrasive particles are blown against a surface of a refractory tile blank 1 so that the tile blank 1 has a sand-like or pear-skin-like
20 surface. The sand-like or pear-skin-like surface of the tile blank 1 is coated with a metal layer 2 by a metal spraying process. A water soluble resin-paste 7 is applied over all the surface of the metal layer 2 except pattern portions 2a by a screen
25 printing process (see Figure 10). After the resin paste 7 has dried, a metal 6 having a different colour from that of the metal layer 2 is melted and sprayed over the surface of the tile blank 1, whereby a pattern is formed by the lamination of the metal
30 layers 2 and 6 (see Figures 11 and 12). The above-

described steps are substantially similar to those of the second embodiment described with reference to Figures 4 to 7.

One of the features of the third embodiment resides in the fact that after the pattern or the pattern metal layers 6 have been formed, the tile blank 1 is immersed into a hot water bath 8 as shown in Figure 13 so that hot water 9 causes the resin paste 7 to swell or saturate. After the resin paste 7 is sufficiently swollen or saturated, the tile blank 1 is taken out of the hot water bath 8 and placed upon a conveyor 10 which travels in the direction indicated by the arrow 'a' in Figure 14. While the conveyor 10 transports the tile blank 1, high-pressure and high-temperature water is forced through a nozzle 11 against the surface of the tile blank 1, whereby the resin paste 7 is removed from the surface of the metal layer 2. Therefore, the metal which adhered to the resin paste 7 is also removed (see Figure 15).

After the resin paste 7 has been removed in the manner described above, the surfaces of the metal pattern layers 6 are polished, rinsed and dried. Thereafter, the surface of the tile blank 1 is coated with a layer of a resin or waterglass coating material for preventing oxidation of the metal layers 2 and 6 (see Figures 16 and 17).

As described above, in the third embodiment, the water soluble resin paste is applied over all the surface of the metal layer 2 except the pattern

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portions 2a, and then another metal is melted and sprayed over the surface of the tile blank 1 so as to form a pattern. Therefore the adhesion of the pattern metal to the parts of the surface other than the pattern portions 2a can be prevented; and the pattern metal which adhered to the resin paste 7 can be removed together with the resin paste 7 when high-pressure, high-temperature water is forced against the surface of the tile blank 1. As a result, only the pattern metal layers 2a remain on the tile blank 1. The pattern can be formed with a high degree of dimensional accuracy.

It is to be understood that the present invention is not limited to the preferred embodiments described above and that various modifications can be made. For instance, the thickness of the first metal layer 2 can be increased or decreased depending upon the pattern and the desired strength of the decorative tile. The colour of the first metal layer 2 is not limited to white; the first metal layer 2 may be of any colour. Moreover, after the first metal layer 2 is formed, its surface may be polished and washed with hot water and a suitable paste 7 may be applied.

Effects, features and advantages of the present invention can be summarized as follows:

(I) The decorative tiles in accordance with the present invention are simple to manufacture without employing a complicated metal plating step. Furthermore, the quantity of metal used can be very low. As a result, decorative tiles of the present invention are inexpensive.

(II) The tile blank has a sand-like or pear-skin-like surface so that the molten metal sprayed strongly adheres to the surface of the tile blank. As a consequence, the metal layer does not generally
 5 separate from the surface of the blank even when the metal layer is polished. When the metal layer is thin, the surface of the metal layer also becomes a sand-like or pear-skin-like so that the quality of the surface is enhanced. That is, the decorative
 10 tiles are a treat to look at and are acceptably stable.

(III) The metal layer is coated with a layer of a coating material so that the lustre of the metal layer can last for a long time and the surface strength can be increased.

15 (IV) The back surface of the decorative tile is made of a ceramic or the like so that the decorative tile is not attacked even when it is directly bonded to a concrete wall.

20 (V) The method for manufacturing decorative tiles in accordance with the present invention does not include a high-temperature treatment step, which is used in the case of the manufacture of porcelain tiles. As a result, energy can be saved. Furthermore, the number of manufacturing steps is less. As a
 25 consequence decorative tiles of the present invention are inexpensive.

30 (VI) No flammable material need be used in the manufacture of decorative tiles of the present invention. As a consequence, decorative tiles of the present invention are not flammable and are

therefore refractory.

5 (VII) A pattern appears in strong relief against the surface of the metal layer so that decorative tiles of the present invention are attractive. Furthermore, even an unskilled person can produce a correct pattern.

10 (VIII) When a screen printing process is employed, not only but also various complex patterns, including family crests or emblems, may be formed.



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CLAIMS

1. A decorative tile comprising a refractory tile blank with a rough surface coated with a metal or ceramic layer by spraying, a surface of the metal layer being coated with a coating material.
2. A decorative tile according to Claim 1, wherein the tile blank is made of ceramic, calcium silicate or slate.
3. A decorative tile according to Claims 1 or 2, wherein the metal is copper, brass, a nickel alloy or stainless steel.
4. A decorative tile according to Claims 1, 2 or 3, wherein the coating material is resin or waterglass.
5. A decorative tile according to any one of Claims 1 to 4, wherein a pattern consisting of a layer of metal or ceramic formed by spraying is interposed between the said metal layer and the coating material.
6. A method for manufacturing a decorative tile which comprises roughening a surface of a refractory tile blank, forming, to a desired thickness, a layer of a metal or ceramic over the roughened surface by spraying, and coating the metal or ceramic layer with a coating material to enhance the lustre of the metal or ceramic layer.



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7. A method according to Claim 6, wherein a pattern is formed over the said metal or ceramic layer by forming a laminate of a metal or ceramic having a different colour from that of the said metal or ceramic layer, and wherein the said metal or ceramic layer and the pattern are coated with a coating material.

8. A method according to Claim 7, wherein a paste is applied over all the surface of the said metal or ceramic layer except the pattern portions, a metal or ceramic having a different colour from the said metal or ceramic layer is melted and sprayed over the pattern portions and the paste is removed.

9. A method according to Claim 8, wherein the paste is removed by immersing the tile blank into hot water so as to swell or saturate the paste and by forcing high-pressure water against the swollen or saturated paste.

10. A tile substantially as described with reference to the drawings.

11. A method for manufacturing a tile substantially as described with reference to the drawings.
