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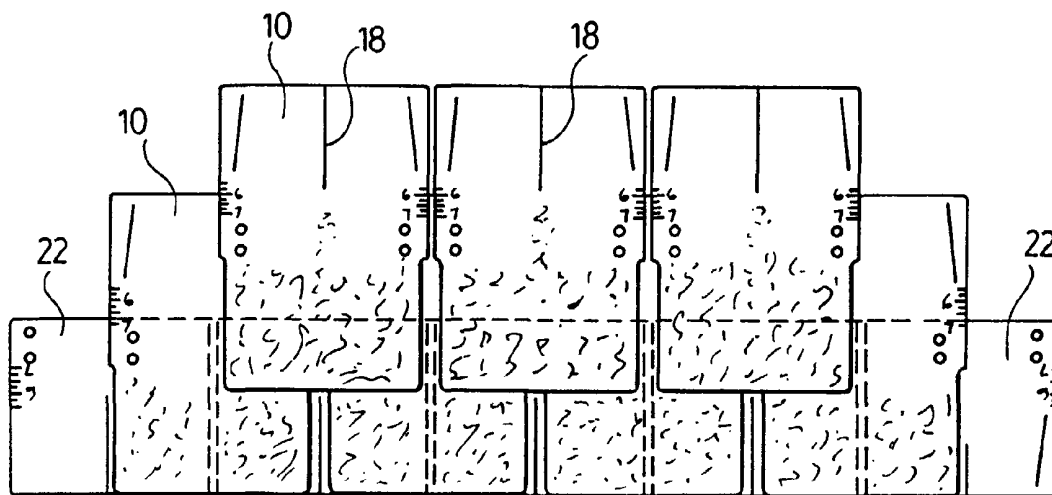
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(54) Title: PLASTIC ROOF TILES



(57) Abstract: The present invention is directed to a shaped plastic roof tile preferably one shaped like a slate tile. The tile is constructed of the combination of a thermoplastic, preferably one or more polyolefin polymers, and a chlorine containing polymer in an amount to provide a final chlorine content to the tile of between 1% and 65% by weight. The polyolefin polymer is preferably a combination of polyethylene and polypropylene derived from recycled material. The chlorine containing polymer is one or more polymers selected from the group consisting of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene dichloride (PVDC), chlorinated polyolefin, acrylate modified PVC, neoprene rubber, copolymers of vinyl chloride with ethylene, propylene, vinyl acetate, vinyl dichloride, and butadiene, copolymers of vinylidene chloride with butyl acrylate and nitrile, and polymer blends of PVC with acrylonitrile-butadiene-styrene (ABS), acrylic-styrene-acrylonitrile (ASA), nitrile rubber, and polyvinyl acetate (EVA). Preferably, the chlorine containing polymer is recycled neoprene rubber.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

TITLE: PLASTIC ROOF TILES

FIELD OF THE INVENTION

5 The present invention is directed to shaped plastic roof tiles, particularly those shaped to have the appearance of slate tiles and the process for manufacturing the tiles.

10 BACKGROUND OF THE INVENTION

There are many different roofing materials presently in use including wood shakes and shingles, asphalt shingles, clay tiles, metal panels and slate tiles. While  
15 asphalt shingles are the most commonly utilized because of their lower cost and weight, other materials are more preferred for their aesthetic appeal. Amongst such materials, clay and slate are particularly desirable for their longevity and appearance. Clay and slate do however  
20 have drawbacks. There is only a limited supply of slate which makes it very expensive as a roofing material. In addition, clay and slate are extremely heavy materials requiring that the roof on which they are to be installed be specially engineered to support the weight, which also  
25 increases the cost of the finished roof.

There have been attempts to construct tiles of plastic material having the appearance of clay and slate but which do not have some of the drawbacks. Such plastic tiles are  
30 of relatively low weight and generally do not require a specially engineered roof, being able to be installed on standard roof construction. Plastic also has an advantage of being able to be formulated to have a long life. Examples of such plastic tiles are described in US Patents  
35 5,992,116; 5,946,877; 5,630,305; 5,615,523 and 5,295,339 among others.

There still remains a need for an economical to manufacture shaped plastic roof tiles having the appearance of more expensive roofing materials such as slate.

5 SUMMARY OF THE INVENTION

The present invention is directed to a shaped plastic roof tile. The tile is constructed of the combination of a thermoplastic and a chlorine containing polymer in an  
10 amount to provide a final chlorine content to the tile of between about 1% and about 65% by weight based upon the total weight of the tile.

In an aspect of the invention, the thermoplastic is a  
15 polyolefin.

In another aspect of the invention, the polyolefin polymer is a combination of polyethylene and polypropylene derived from recycled material.

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In yet another aspect of the invention, the chlorine containing polymer is one or more polymers selected from the group consisting of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene  
25 dichloride (PVDC), chlorinated polyolefin, acrylate modified PVC, neoprene rubber, copolymers of vinyl chloride with ethylene, propylene, vinyl acetate, vinyl dichloride, and butadiene, copolymers of vinylidene chloride with butyl acrylate and nitrile, and polymer blends of PVC with  
30 acrylonitrile-butadiene-styrene (ABS), acrylic-styrene-acrylonitrile (ASA), nitrile rubber, and polyvinyl acetate (EVA).

In yet another aspect of the invention, the chlorine  
35 containing polymer is recycled neoprene rubber.

## BRIEF DESCRIPTION OF THE DRAWINGS

5 A preferred embodiment of the present invention is illustrated in the attached drawings in which:

Figure 1 is a top plan view of a plastic slate-like tile of the present invention;

Figure 2 is a top plan view of the tile of Figure 1 being installed on a roof.

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## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 A preferred embodiment of a plastic roof tile of the present invention is illustrated in the attached figures generally indicated by the numeral 10. The roof tile is sized approximately equal to that of traditional slate tiles having a width of approximately 12 inches and a total  
20 height of approximately 18 inches. The bottom portion 12 of the roof tile 10 has a slightly reduced width relative to the top portion of the roof tile 10 to provide for the proper reveal for the esthetic appearance of the tile 10 once it is installed on the roof. This bottom portion 12  
25 of the roof tile is also provided with a slate like appearance by texturing the surface of the roof tile to provide for the appearance of slate. The reduced width bottom portion 12 extends upwardly approximately 6 inches from the bottom of the tile and the slate texture extends  
30 upwardly to approximately half of the height of the plastic tile 10. The plastic tile 10 is provided with guide marks 14 on either side to allow for proper alignment of the tile 10 and thereby provide for the proper reveal of the tile 10 as desired. Traditionally slate tiles are laid with  
35 either a 6 or 7 inch reveal and rule markings are provided on either side of the tile 6 to 7 inches down from the top edge of the tile. The use of these markings will be explained below.

The tile 10 is also preferably provided with one or more fastening guides 16 to indicate to the installer the proper location for the fasteners for attaching the roof tile to the roof surface. Preferably the tile is attached to the roof surface with suitable nails and nailing points are provided on either side of the tile in the proper position for a 6 or 7 inch reveal of the tile. To further aid in the installation of the tile courses, each of the tiles is provided with a vertical guide line 18 centrally located in the upper portion of the tile and extending vertically downwardly. There may be circumstances when it is desired to clip the top corners of the tile and score lines 20 may be provided to allow this to be accomplished in an easier manner.

15

To allow the plastic tile 10 of the present invention to be utilized in hip and ridge locations where two roof surfaces meet at an angle, a special hip and ridge tile may be provided with a bend line provided extending vertically through the centre of the tile. This would allow the tile to be easily bent inwardly or outwardly along the bend line to accommodate hip and ridge applications.

A typical installation of the shaped plastic tile 10 of the present invention on a roof surface is illustrated in Figure 2. To provide a suitable starter course 22, the bottom portion of a series of tiles 10 are cut off and the top portions rotated 180° and attached to the roof surface leaving a suitable spacing, generally on the order of a quarter to one eighth of an inch, between each of the starter tiles. The first tile course is laid over the starter course with each tile 10 of the first tile course centrally located to overlie the gap between the starter course tiles. The tiles 10 are attached to the roof in a suitable manner leaving a one eighth to one quarter inch space between the upper edges of the tiles. The succeeding courses are then laid on top of the previous tile course in a similar manner. Due to the presence of the centering line 18 and the graduated exposure line or guide marks 14,

the installation of the succeeding courses of the tiles 10 is simple and no guidelines or guide boards need be provided on the roof. The tile 10 for the second tile course is centered between the two centering lines of the tiles 10 of the first course with the reveal lines of the second tile for the required reveal lining up with the top edges of the tiles of the first tile course. The tiles 10 are then nailed to the roof and the rest of the roof is laid in a similar manner.

10

The plastic roof tiles of the present invention are constructed of the combination of a thermoplastic, preferably a polyolefin based polymer, and a chlorine containing polymer in an amount to provide a final chlorine content to the tile of between about 1 percent and about 65 percent by weight. The provision of the chlorine content in the tile provides the tile with suitable fire retardant property. Preferably, the polyolefin polymer is one or more polymers selected from a polyethylene and a polypropylene, most preferably a combination of a polyethylene and a polypropylene. The polypropylene may be a homopolymer or a copolymer with another suitable thermoplastic elastomer such as EPDM, ethylene propylene terpolymer. The polyethylene may be high density polyethylene (HDPE) low density polyethylene (LDPE) or linear low density polyethylene (LLDPE). While the polyolefin polymer may be virgin material, it is preferred that the polyolefin be derived from recycled material. By utilizing recycled material, the cost for the tile is greatly reduced.

The chlorine containing polymer is preferably one or more polymers selected from the group consisting of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene dichloride (PVDC), chlorinated polyolefin, acrylate modified PVC, neoprene or polychloroprene rubber, copolymers of vinyl chloride with ethylene, propylene, vinyl acetate, vinyl dichloride, and butadiene, copolymers of vinylidene chloride with butyl

acrylate and nitrile, and polymer blends of PVC with acrylonitrile-butadiene-styrene (ABS), acrylic-styrene-acrylonitrile (ASA), nitrile rubber, and polyvinyl acetate (EVA). Once again, while the chlorine containing polymer  
5 may also be virgin material, it is preferred for reasons of economy that the chlorine containing polymer also be derived from recycled material. Particularly preferred chlorine containing polymers are polyvinyl chloride or neoprene rubber, most preferably neoprene rubber. The  
10 neoprene rubber may be virgin or recycled material, virgin material generally being not cross-linked while recycled material is generally cross-linked. Cross-linked recycled neoprene rubber is most preferred as the chlorine containing polymer.

15

The polyolefin based polymer is generally present in an amount of 50 to 95 percent by weight and the chlorine containing polymer is generally present in the amount of 5 to 50 percent by weight. Preferably, the polyolefin  
20 polymer is present in an amount of 60 to 75 percent by weight and the chlorine containing polymer is present in an amount of 25 to 40 percent by weight. Most preferably the polyolefin based polymer is present in an amount of 65 to 70 percent by weight and the chlorine containing polymer in  
25 an amount of 30 to 35 percent by weight.

When the polyolefin based polymer is a combination of polyethylene and polypropylene it is preferred if the formulation contains 5 to 75 percent polyethylene with the  
30 balance being polypropylene. More preferably the formulation contains 20 to 50 percent by weight of polyethylene and 50 to 80 percent by weight of polypropylene. In order to improve the impact resistance of the tile formulated from the material, it is preferred  
35 if the polypropylene is a rubber or EPDM modified polypropylene.

The shaped plastic roof tiles of the present invention may be colored to any desired color by the addition of

pigments commonly employed in the manufacture of molded thermoplastic materials. Depending upon the nature of the recycled material used for the shaped plastic tile, additional pigments may or may not be required.

5

The plastic roof tiles are manufactured by mixing the polyolefin or other thermoplastic based polymer and the chlorine containing polymer to provide for a relatively uniform mixture and then molding the mixture into the roof tile shape. When utilizing virgin material in the form of powder, pellets or flakes, the polyolefin based polymer powders and chlorine containing polymer powder are mixed and then molded utilizing either compression molding or injection molding.

10  
15

When utilizing recycled material it may be necessary to regrind the material prior to the molding depending upon the physical nature of the recycled material. If the recycled material is provided in a small enough particle size it may be handled in a manner similar to virgin material by merely mixing, then melting and molding the material utilizing compression molding or injection molding. If the recycled material has not been reduced in particle size or bulk it is generally necessary to first reduce the bulk in particle size by grinding or densifying the material into suitable size particles for the molding operation.

As noted above the shaped plastic tile of the present invention is most preferably constructed of 65 to 70 percent by weight of a polyolefin based polymer containing 20 to 50 percent by weight polyethylene and 50 to 80 percent polypropylene in combination with 30 to 35 percent neoprene rubber as a chlorine containing polymer. The use of the neoprene rubber as a chlorine containing polymer provides other advantages such as providing a suitable gray scale to the colour of the tile. In addition, the carbon black present in the rubber also provides UV protection for the tile. The polyolefin based polymer and neoprene rubber

are preferably recycled material which are mixed together in the proper proportion and densified to reduce the bulk and particle size. The densification operation may be accomplished by any method known in the art such as the use  
5 of a screw extruder or utilizing suitable knives in a chopping apparatus. During the densification operation utilizing suitable knives, the heat generated by the friction between the knives and the polymers melts the plastic and causes the plastic to stick to the rubber  
10 particles. Once the bulk and particle size has been reduced, the mixture may be cooled with water then ground into smaller particle sizes. These smaller particle sizes are remelted, and molded using compression molding or injection molding. For compression molding, the particles  
15 are melted and placed into a compression mold having the suitable shape and features for the roof tile and then pressed to form the final roof tile. The roof tile may also be formed by an injection molding operation utilizing a suitable injection mold.

20

The use of the chlorine containing polymer results in a chlorine content in the formulation in the range of 1 to 65 percent by weight. The presence of the chlorine provides for increased resistance of the tiles in a fire  
25 situation. Should the tiles be exposed to an open flame, hydrogen chloride would be released during the burning of the chloride polymer. Further flame development would be interrupted by the hydrogen chloride reaction with hydrogen atoms and hydroxyl radicals thus providing a suitable fire  
30 rating to the roofing material. In addition, the presence of the chlorine also reduces dripping of the thermoplastic elastomer especially polyolefins during burning.

The shaped roofing tiles of the present invention  
35 provide for an economical manufactured roof tile that replicates the classic look of more expensive materials such as slate without the added weight or cost of traditional materials. A roofing system utilizing the roofing tiles of the present invention is as easy to

install as conventional asphalt shingles and requires no added substructure as would be the case for slate tiles as well as some other imitation tile.

- 5           Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those of skill in the art that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

## WE CLAIM:

1. A shaped plastic roof tile, the tile being formed of a combination of a thermoplastic and a chlorine containing polymer in an amount to provide a final chlorine content to the tile of between 1% and 65% by weight.
2. A roof tile according to claim 1 wherein the thermoplastic is one or more polyolefin polymers.
3. A roof tile according to claim 1 wherein the polyolefin polymer is a combination of polyethylene and polypropylene derived from recycled material.
4. A roof tile according to claim 2 wherein the chlorine containing polymer is one or more polymers selected from the group consisting of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyvinylidene dichloride (PVDC), chlorinated polyolefin, acrylate modified PVC, neoprene rubber, copolymers of vinyl chloride with ethylene, propylene, vinyl acetate, vinyl dichloride, and butadiene, copolymers of vinylidene chloride with butyl acrylate and nitrile, and polymer blends of PVC with acrylonitrile-butadiene-styrene (ABS), acrylic-styrene-acrylonitrile (ASA), nitrile rubber, and polyvinyl acetate (EVA).
5. A roof tile according to claim 3 wherein the chlorine containing polymer is PVC or recycled neoprene rubber or combinations of PVC and neoprene rubber.
6. A roof tile according to claim 1 wherein the polyolefin polymer is present in an amount of from 50 to 95 percent by weight and the chlorine containing polymer is present in an amount of from 5 to 50 percent by weight.
7. A roof tile according to claim 5 wherein the polyolefin polymer is present in an amount of from 60 to 75

percent by weight and the chlorine containing polymer is present in an amount of 25 to 40 percent by weight.

8. A roof tile according to claim 6 wherein the  
5 polyolefin polymer is present in an amount of 65 to 70 percent by weight and the chlorine containing polymer in an amount of 30 to 35 percent by weight.

9. A roof tile according to claim 7 wherein the  
10 polyolefin polymer is a combination of polyethylene and polypropylene.

10. A roof tile according to claim 8 wherein the  
polyolefin polymer comprises from 5 to 75 percent by weight  
15 polyethylene and 25 to 95 percent by weight polypropylene.

11. A roof tile according to claim 8 wherein the  
polyolefin polymer comprises from 20 to 50 percent by  
weight polyethylene and 50 to 80 percent by weight  
20 polypropylene.

12. A roof tile according to claim 11 wherein the  
polypropylene is a rubber modified polypropylene.



# INTERNATIONAL SEARCH REPORT

Int	I Application No
PCT/01/01	01/00243

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 E04D1/20 C08F255/02 C08L27/06 C08F14/06

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 E04D C08F C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Y	column 2, line 4 -column 2, line 39 figures 1-3,5,6	4,5,12
Y	---	
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A	column 2, line 24 -column 3, line 40 claims 1-3	6-11
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Y	EP 0 089 182 A (UNIROYAL INC) 21 September 1983 (1983-09-21)	5
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Y	EP 0 474 926 A (ADVANCED ELASTOMER SYSTEMS) 18 March 1992 (1992-03-18)	12
A	the whole document	1-3,6-11
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Further documents are listed in the continuation of box C.       Patent family members are listed in annex.

° Special categories of cited documents :

<p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p>	<p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>*&amp;* document member of the same patent family</p>
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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  Hendrickx, X
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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/CA 01/00243

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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