Title of the Invention: Composition for use in components requiring a surface appearance of cast iron

Abstract Title: Composition for use in components requiring a surface appearance of cast iron

A non-porous component is disclosed having a surface pattern resembling cast iron and formed from a composition comprising rubber crumbs and a thermoplastic polymer; wherein the rubber crumbs are dispersed in a hard matrix of the polymer, particles of the rubber crumbs being disposed at and protruding from the surface of the polymer matrix to provide a surface resembling cast iron. The component may be a component for a guttering or a drainage system for a building. There is also disclosed a method of preparing a composition comprising a surface having an appearance resembling cast iron, the method comprising combining rubber crumbs and a thermoplastic polymer to form a hard matrix of polymer having dispersed therein particles of rubber crumbs; wherein particles of rubber crumbs are disposed at and extend from the surface of the polymer matrix to provide the surface with the appearance resembling cast iron. In preferred embodiments the thermoplastic is polypropylene or polyvinyl chloride. Pigments such as carbon black or titanium dioxide may be added.
COMPOSITION FOR USE IN COMPONENTS REQUIRING A SURFACE APPEARANCE OF CAST IRON

The present invention relates to a composition for use in providing components with a surface resembling cast iron. The composition of the present invention is of particular use in components for guttering and drainage systems, especially for buildings requiring the use of traditional external components.

Cast iron has traditionally been used for a variety of articles and components, in particular building components. One particular application for cast iron has been in the preparation of components for guttering and drainage systems for building, in particular houses. Many of the uses for cast iron have been replaced by alternative materials, for example other metals and alloys and, more particularly, plastics. Currently a wide range of components for guttering and drainage systems for buildings are formed from plastic, due to its low cost, light weight and ease of manufacture. However, there are a significant number of older buildings that require the use of traditional materials to be used in their maintenance and repair. Indeed, in the United Kingdom, listed buildings are subject to strict rules regarding their outward appearance and, hence, the materials that may be used in their reconstruction and repair. Accordingly, there is a demand for products and components formed from cast iron, especially drainage and guttering components.

Further, many modern and new buildings are constructed in a traditional style. As a result, there is a demand for building components having a traditional appearance. Again, this is particularly the case with components for guttering and drainage systems for buildings, especially houses.
Components formed from cast iron are particularly expensive. In addition, cast iron is a particularly difficult material from which to form components, such as drainage and guttering components. Items formed from cast iron also tend to be brittle, rendering them vulnerable to damage. However, components formed from cast iron tend to have a surface appearance and texture that is particularly distinctive. Hence, cast iron components are readily identifiable from their appearance. Accordingly, there is a need for a material that exhibits the appearance of cast iron or closely resembles cast iron, while not sharing its disadvantage properties.

It is very well known to form components, such as drainage and guttering components, from plastic, such as polyvinyl chloride or polyolefins. It is also known to provide the surface of such plastic components with a pattern and texture having the appearance of cast iron. This is achieved by coating the components to provide their surface with a pattern and texture that resembles cast iron. However, such coatings are vulnerable to damage.

Accordingly, there is a need for an improved way of providing components with an outward appearance resembling or equivalent to cast iron.

Compositions containing rubber crumb and a polymer are known in the art. For example, GB 2,072,200 discloses a moulding composition comprising a PVC polymer, ground rubber and a plasticizer. The composition is for use in shoe soles, shock absorbers and other manufactured products requiring flexibility and wear resistance.

US 2007/0135580 discloses a composition comprising a heterophase copolymer and ground rubber. The heterophase copolymer comprises a thermoplastic phase made from a propylene homopolymer or copolymer and
an elastomeric phase formed from a copolymer of ethylene and an alpha-olefin. The composition is indicated to having an improved elongation at break.

DE 19607281 concerns the recycling of scrap rubbers to produce a composition having thermoplastic elastomer (TPE) properties. The composition comprises milled rubber, thermoplastics, cross-linking agents, fillers and plasticizers.

JP 2002146103 discloses a waste vulcanized rubber-containing composite material. The waste vulcanized rubber is dispersed in a blend of an unvulcanized rubber and a thermoplastic resin.

It has been found that a particular composition comprising rubber crumb and a hard thermoplastic polymer may be prepared that, upon forming into a finished component, provides a surface finish that has an effect closely resembling that of cast iron.

According to the present invention there is provided a composition for providing a non-porous component with a surface resembling cast iron, the composition comprising rubber crumb and a thermoplastic polymer, wherein the rubber crumb is dispersed in a matrix of the polymer, with particles of the rubber crumb being disposed at and protruding from the surface of the component to provide the surface with an appearance resembling cast iron.

According to the present invention, there is also provided a component having a surface pattern resembling cast iron and formed from a non-porous composition comprising:

rubber crumb; and

a thermoplastic polymer;
wherein the rubber crumb is dispersed in a matrix of the polymer, particles of the rubber crumb being disposed at and protruding from the surface of the polymer matrix to provide a surface resembling cast iron.

It has been found that the inclusion of rubber crumb into a thermoplastic polymer matrix, such that the rubber crumb particles are protruding from the surface of the polymer matrix provides the surface with a riven appearance that resembles the surface of cast iron, in particular cast iron prepared using traditional techniques. The rubber crumb particles protrude as bumps in the surface of the finished component and may either be exposed or coated with a thin layer of the polymer. As noted above, such a surface appearance is particularly sought after for a wide range of components, in particular external components for use with old or traditionally styled buildings and gardens and the like.

The composition of the present invention relies upon the use of a hard thermoplastic polymer present in a single phase to form a matrix in which the rubber crumb is dispersed. It has been found that the cast iron effect is provided when thermoplastic polymers of sufficient hardness are employed. This is in contrast to the known compositions described above, which employ thermoplastic polymers that are soft, that is elastomeric, or are rendered soft by the use of plasticizers or the like. The use of a hard thermoplastic polymer matrix has been found to give rise to the cast iron effect at the surface.

The cast iron effect is also as a result of the processing techniques used to form the finished component. In particular, the effect is produced in a composition comprising a hard thermoplastic matrix and dispersed rubber crumb by subjecting the composition to a surface draw as the composition is worked and/or by subjecting the composition to differential cooling between the rubber crumb and the thermoplastic matrix. The surface draw effect may be produced by a number of processing techniques, such as extrusion.
Different cooling may be applied to the composition in a range of techniques, such as moulding, in particular compression moulding.

The composition of the present invention comprises particles of rubber crumb dispersed and entrapped in a thermoplastic polymer matrix. The polymer may be any suitable polymer for the components formed from the composition. Thermoplastic polymers are particularly preferred, due to their properties allowing a wide range of components to be formed using techniques such as moulding and extrusion. The composition may include any suitable amount of polymer, provided sufficient rubber crumb particles are present at the surface of the component to provide the appearance resembling cast iron. The polymer content of the composition will depend upon the particular thermoplastic polymer being used. Preferably, the polymer content is from 10 to 90% by weight of the composition, more preferably from 20 to 85% by weight, still more preferably from 30 to 80% by weight. In one example, the thermoplastic polymer is polypropylene and is present in an amount of from 10 to 40%, by weight, in particular 30%. In a further example, the thermoplastic polymer is a PVC polymer and is present in an amount of from 75 to 85% by weight, in particular about 78%.

The present invention may use any suitable thermoplastic polymer or mixture of thermoplastic polymers. Suitable thermoplastic polymers are known in the art and are commercially available in a range of grades. As noted above, the thermoplastic polymer is employed as a single phase to form a polymer matrix, in which the rubber crumb is dispersed. As also noted, the thermoplastic polymer is relatively hard, so as to give rise to the cast iron effect at the surface. In this respect, a 'hard' polymer is a reference to a polymer having a hardness of at least 80 Shore A. The polymer may have a greater hardness, for example a hardness of at least 90 Shore A, in particular greater than 100 Shore A hardness. The hardness will be determined by the properties required in the finished article or component.
One preferred thermoplastic polymer is polyvinyl chloride (PVC). PVC is commonly used in gutter, pipes and other components for guttering systems. The PVC used in the composition of the present invention may be virgin PVC, recycled PVC or a blend of the two. It is an advantage of the composition of the present invention that recycled polymers such as recycled PVC can be used in significant amount. PVC is commercially available in a range of different grades and any suitable grade of PVC may be used in the composition. The properties of the PVC used in the composition will be determined by the component to be formed from the composition and its end use. The relative density of the PVC may be in the range of from 1.18 to 1.55. Similarly, the PVC may have a tensile stress of from 10 to 50 MPa, more preferably from 35 to 45 MPa, especially about 40 MPa. The Izod impact test value may be from 2 to 4 KJ/m², more preferably from 2 to 3 KJ/m², with an Izod value of about 2.5 KJ/m² being suitable for many end uses.

The composition of the present invention may alternatively comprise a polyolefin to form the thermoplastic polymer matrix. Any suitable polyolefin or mixture of polyolefins may be used. The polyolefin may be virgin material, recycled material or a blend of the two. It is an advantage of the composition of the present invention that recycled polymers such as recycled polyolefins can be used in significant amount. Suitable polyolefins and blends thereof are known in the art and are commercially available. Preferred polyolefins are polyethylene and polypropylene, with polypropylene being a particularly preferred polyolefin. The polypropylene is most preferably a homopolymer. Alternatively, polypropylene copolymers may be employed. The properties of the polyolefin used in the composition will be determined by the component to be formed from the composition and its end use.
The composition may comprise low density or high density polyethylene. Polyethylene for use in the composition of the present invention may vary in properties, according to the properties required in the finished component. The polyethylene may have any suitable melt flow index, which will vary according to the density of the polymer. For example, the polyethylene may have a melt flow index in the range of from 1 to 70 g/10min, more preferably from 1 to 20 g/10min. A particularly suitable polyethylene has a melt flow index of about 5 g/10min. The relative density of the polyethylene may be in the range of from 0.91 to 0.94 for low density polyethylene and from 0.95 to 0.97 for high density polyethylene. Similarly, the polyethylene may have a tensile stress of from 15 to 50 MPa, more preferably from 25 to 45 MPa, especially about 40 MPa. The Izod impact test value may be from 2 to 6 KJ/m², more preferably from 3 to 5 KJ/m², with an Izod value of about 5 KJ/m² being suitable for many end uses.

Polypropylene for use in the composition of the present invention may vary in properties, according to the properties required in the composition and the finished component. For example, the polypropylene may have a melt flow index in the range of from 5 to 20 g/10min, more preferably from 10 to 15 g/10min. A particularly suitable polypropylene has a melt flow index of about 12 g/10min. The relative density of the polypropylene may be in the range of from 0.85 to 0.95, more preferably from 0.88 to 0.94, with a relative density of about 0.91 being particularly suitable for many applications. Similarly, the polypropylene may have a tensile stress of from 25 to 50 MPa, more preferably from 35 to 45 MPa, especially about 40 MPa. The Izod impact test value may be from 2 to 4 KJ/m², more preferably from 2 to 3 KJ/m², with an Izod value of about 2.5 KJ/m² being suitable for many end uses.

The composition of the present invention further comprises rubber crumb. The rubber crumb is not pretreated prior to inclusion in the composition of the present invention. The rubber crumb is preferably obtained
from recycled vehicle tyres. Suitable rubber crumb obtained in this manner is known in the art and available commercially. Processes for obtaining rubber crumb from recycled vehicle tyres are also known in the art. One particularly preferred rubber crumb is obtained by a processing involving ambient grinding of recycled rubber tyres. Other suitable processing methods for preparing the rubber crumb include wet grinding and cryogenic grinding.

The rubber crumb included in the composition is most preferably essentially free from fibrous material and metal, in order to provide a satisfactory dispersion and entrapment of the rubber crumb in the polymer matrix. Vehicle tyres contain significant quantities of fibres and metal wire. Accordingly, the rubber crumb is most preferably prepared using a process that removes substantially all metal and fibrous material from the rubber crumb. In this way, the composition may be free from fibrous materials and metal, such as metal wire. For component safety reasons, it is particularly preferred that the composition is substantially free from metal components, such as metal wire present in vehicle tyres. Fibrous material from the recycled tyres may be present in the composition, but preferably in a finely divided form. If present, the fibrous material is present in amounts of no greater than 5% wt, more preferably less than 4% wt, still more preferably less than 3% by weight.

Typically, the rubber crumb will have particles having a range of sizes. The rubber crumb in the composition preferably has a particle diameter of less than 0.85 mm, that is the rubber crumb particles are of a size to pass through a sieve with a U.S. mesh size of 20. Preferably, the rubber crumb has a particle diameter of less than about 0.7 mm (U.S. mesh size of 25), more preferably a particle diameter of less than about 0.6 mm (U.S. mesh size of 30), still more preferably a particle diameter of less than about 0.5 mm (U.S. mesh size of 35). Embodiments of the composition of the present invention, for example those comprising PVC in the polymer matrix, have rubber crumb
particles with smaller sizes, that is less than 0.45 mm in diameter (U.S. mesh size of 40), less than 0.35 mm (U.S. mesh size of 45), less than 0.3 mm (U.S. mesh size of 50), or less than 0.25 mm (U.S. mesh size of 60). The size of the particles of rubber crumb will affect the appearance and properties of the surface of the finished component. Accordingly, the composition may contain particles of a single size or, alternatively, a blend of particle sizes to impart the desired properties and appearance to the surface of the components formed from the composition. In this respect, the desired surface appearance and properties may be determined by routine experimentation of routine polymer type, rubber crumb size and the proportion of rubber crumb in the composition, as well as the particular moulding or forming process, depending upon the precise cast iron appearance required in the finished component.

The rubber crumb is present in the composition of the present invention in an amount of from 10 to 70% by weight, depending upon the type of thermoplastic polymer matrix. In one embodiment, the rubber crumb may be present in an amount of greater than 20% by weight, more preferably greater than 30%, still more preferably greater than 40% by weight. In an alternative embodiment, the rubber crumb may be present in an amount of from 10 to 20% by weight, in particular about 15% by weight of the composition. The ratio of polymer to rubber crumb present in the composition may be varied, in order to obtain the required properties of the composition, such as density, hardness and the like. The amount of rubber crumb present will also vary the surface appearance of the composition and the finished component. It is a particular advantage of the composition of the present invention that significant quantities of rubber crumb can be included, while still providing advantageous properties to the composition and resulting in the finished article having the desired and sought after appearance of cast iron.

Embodyments of the composition in which the thermoplastic polymer is or comprises polypropylene may have the rubber crumb present in an amount of greater than 40% by weight, more preferably greater than 50% by weight, still
more preferably greater than 60% by weight. In an alternative embodiment in which the thermoplastic polymer is PVC, the composition contains from 10 to 30% by weight of rubber crumb, more particularly about 20%.

The composition may consist only of rubber crumb dispersed in the thermoplastic polymer matrix. Alternatively, the composition may comprise one or more fillers and/or modifiers. Suitable fillers and modifiers for inclusion in the thermoplastic polymers are known in the art and are commercially available. As noted above, the composition of the present invention requires the use of a hard polymer matrix. Accordingly, ingredients such as plasticizers and the like that are generally employed to reduce the hardness of the polymers are to be avoided. Further, the composition does not comprise any compatibilisers or other components to enhance the compatibility of the rubber crumb with the thermoplastic polymer, as such components also reduce the cast iron effect or prevent it from forming at the surface of the finished component.

Suitable fillers include generally fine powder minerals. Other filler materials include wood and recovered ash. The fillers are included in the compositions to provide bulk to the composition at reduced cost and are present in amounts sufficient to reduce the overall cost of the product, without significant impairment to the properties of the composition and the finished component. If present, the one or more fillers are preferably present in an amount of less than 40 % by weight, for example in an amount of from 10 to 40% by weight, more preferably from 15 to 30% by weight. Examples of suitable fillers are metal carbonates, in particular calcium carbonate.

Modifiers may be included in the composition to enhance the physical properties of the composition and the finished component for specific end uses. A wide range of modifiers may be used, including oils, waxes and other polymers. The modifiers may be present in an amount sufficient to impart the
desired end properties. Typically, if present, the one or more modifiers are present in an amount of up to 20% by weight, more preferably less than 15% by weight. Examples of suitable modifiers are polymers, in particular ethylene vinyl acetate (EVA).

In addition to the aforementioned components, the composition of the present invention may also comprise further components, as will be apparent to the person skilled in the art. For example, the composition may comprise one or more fire and flame retardants. Suitable fire and flame retardants for polyolefin compositions are known in the art and commercially available. Examples of suitable fire flame retardants include halogenated compounds, such as decbromdiphenyl ether, and metal salts, such as antimony trioxide and aluminium trihydrate.

The ingredients of the composition, such as flame retardants and the like, may be included in the composition by way of pre-formulated masterbatches. Flame retardant masterbatches for use with polymer compositions are available commercially.

The fire and flame retardant may be present in any suitable amount to provide the required resistance to fire. The fire and flame retardant may be present in an amount of up to 25% by weight, more preferably up to 10% by weight.

Further, the composition may comprise one or more pigments. Again, suitable pigment ingredients and compositions for inclusion in polyolefin compositions are known in the art and are commercially available. For example, suitable pigments for inclusion in the composition of the present invention include metal oxides, such as titanium oxide (TiO₂) and carbon black. For many end products, it is preferred that the composition is black in
appearance. However, other colours may be obtained using the corresponding pigments, as required by the end user and customer.

The pigments are included in the composition in the amount required to provide the desired colouration and pigmentation of the completed component. The total pigment content of the composition may be up to 10% by weight, more preferably up to 5% by weight.

It is a particular advantage of the composition of the present invention and the finished components that they may be formed using a minimum of components. Thus, the composition comprises thermoplastic polymer and rubber crumb in the amounts hereinbefore described, optionally with one or more fillers and/or modifiers, flame retarders and pigments. The composition of the present invention does not require the use of ingredients required in the preparation of similar compositions of thermoplastic polymers as is generally known in the art, such as coupling agents. Indeed, it is preferred that such ingredients are not present in the composition of the present invention. Further, as mentioned above, it is particularly preferred that the rubber crumb is free from fibres and metal.

In a further aspect, the present invention provides a method of preparing a component comprising a surface having an appearance resembling cast iron, the method comprising:

combining rubber crumb and a thermoplastic polymer to form a matrix of polymer having dispersed therein particles of rubber crumb; wherein particles of rubber crumb are disposed at and protrude from the surface of the polymer matrix to provide the surface with the appearance resembling cast iron.

The thermoplastic polymer and rubber crumb may be combined by any suitable technique. For example, the polymer is heated to above its melting
point. The melting point of the polymer will depend upon its composition and grade. For example, for polypropylene, the melting point is approximately 165°C, again depending upon its molecular weight. For PVC, the melting point is above about 160°C, depending upon the grade. The molten polymer may then be combined with the rubber crumb by mixing. Should other ingredients be included in the composition, as aforementioned, these may be added to the molten polymer and rubber crumb mixture. The ingredients may be added directly, or by way of masterbatches, as known in the art. The ingredients of the composition may be combined before the component is formed, for example by mixing and subsequent forming into pellets, from which the final component is prepared, for example by moulding or extrusion. Alternatively, the ingredients may be combined during the process of forming the component, for example by extrusion or moulding.

15 Once the composition has been prepared, the composition may be used to form a final component or product using any suitable technique. Suitable techniques are known in the art. Examples of suitable techniques include injection moulding, compression moulding, rotational moulding, extrusion and stamping. It has been found that extrusion is particularly suitable for forming components using the composition and method of the present invention to provide the components with a surface having a cast iron effect. Extrusion is particularly suitable for forming guttering and pipes for use in guttering and drainage systems. Alternatively, moulding techniques, such as injection moulding and, more preferably, compression moulding may also be employed.

The composition of the present invention may be used to form a wide range of components and finished products that require a surface appearance and pattern resembling that of cast iron. In particular, the composition is useful in forming components of drainage and guttering systems for buildings. As noted above, many older buildings, in particular houses, and newer
buildings constructed in a traditional style require drainage and guttering components having a traditional appearance in keeping with their style and/or age. Further, local authority regulations require certain older buildings, that is so-called 'listed buildings' to be finished with components having a traditional appearance consistent with the age of the building. The composition of the present invention is especially useful in forming such components. In particular, the composition comprises the benefits of the appearance of cast iron, while also benefitting from the improved properties of modern thermoplastic polymer materials, in particular ease of manufacture, ease of working and installation, longevity and resistance to decomposition. Examples of components that are advantageously formed from the composition of the present invention include components of guttering systems for the exterior of buildings, including guttering, downpipes, hoppers, pipe bends, branches, joints and sockets. The composition may also be used to prepare other pipework, such as soil pipes and the like. The components may be formed with any desired or required shape or configuration, including having cross-sectional forms that are circular, rectangular or square. Other items that may be formed from the compositions of the present invention include, for example, bollards, railings, gates and the like. In addition, the compositions may be used to form items of furniture, including tables, chairs, benches, stools and the like, again having a surface appearance resembling cast iron. Other applications for the compositions of the present invention where a surface appearance of cast iron is required or desired will be readily apparent.

In a further aspect, the present invention provides a component formed from a composition according to the present invention and as described hereinbefore.

The composition of the present invention may be used without any additional coating to form the final component. Alternatively, the component
may be formed from a plurality of layers, with a composition according to the present invention being used to provide the surface layer and provide the components with the desired external appearance of cast iron. Other compositions may be used to form the remainder of the component, so as to impart different properties to the component not achievable using a composition of the present invention.

In a further aspect, the present invention provides the use of composition as hereinbefore described for providing a component with a surface having an appearance resembling that of cast iron.

In a still further aspect, the present invention provides a method of providing a component with a surface appearance resembling that of cast iron, the method comprising providing the component at its surface layer with a composition as hereinbefore described.

The method of this aspect of the invention allows the composition and method of this invention to be used to provide a surface finish to components. The outer or surface layer may be any suitable thickness, provided it is thick enough to allow the cast iron effect to be formed at the surface of the component. Typically, the thickness of the layer is from 1 to 30 % of the wall thickness of the component, more preferably from 2 to 20%. A thicker layer may be employed in order to improve the resistance of the layer to abrasion. A thinner layer may be employed for components that are not likely to suffer abrasion during installation or use.

The composition of the present invention will be further described, by way of illustration only, in the following example of specific embodiments, having reference to the accompanying figures, in which:
Figure 1 is a cross-sectional representation of a panel formed from a single layer of one embodiment of the composition of the present invention; and

Figure 2 is a photograph of the surface of a panel prepared from a composition of the present invention.

EXAMPLE 1

A composition was prepared having the following components (all percentages being in % weight of the final composition):

Polypropylene homopolymer 41.0%

Rubber Crumb 41.0%

(particle diameter up to 0.24 mm)

Flame Retarder 15.0%

White Pigment (TiO₂) 2.0%

Black Pigment (carbon black) 1.0%

The polypropylene was heated to above its melting point (about 165°C) until molten. The rubber crumb was added, together with the flame retarder (as a masterbatch) and the pigments, with mixing. The resulting mixture was formed into pellets, which were cooled and collected. The resulting pellets were used to form a panel comprising a single layer of the composition using an injection moulding process. The polypropylene had a hardness in excess of 80 Shore A.

The panel was inspected and found to have a black, riven surface closely resembling that of traditional cast iron. The composition is very
suitable for the preparation of components of a guttering system requiring a traditional appearance of cast iron by moulding or extrusion. In particular, the panel was found to comprise a matrix of polypropylene having dispersed therethrough the particles of rubber crumb. The particles of rubber crumb were present at the surface of the panel and extended therefrom to form a rough surface having the appearance of cast iron. The structure of the panel is indicated by the cross-sectional representation shown in Figure 1. As can be seen, the panel, generally indicated as 2, comprises a continuous matrix of polypropylene 4 with particles of rubber crumb 6 dispersed therein.

At the surface 8 of the panel, rubber crumb particles extend from the surface to provide the rough, riven appearance of cast iron. A photograph of the surface of the panel was taken and is shown in Figure 2. As can be seen, the presence of the rubber crumb particles and the thermoplastic polymer matrix at the surface provide the panel with a surface pattern and effect that closely resembles the surface of cast iron components, in particular those formed from cast iron using traditional techniques. A material having such a surface is particularly suitable as a replacement for cast iron in many situations, in particular in guttering and drainage systems for installation on the exterior of a building.

EXAMPLE 2

A composition was prepared having the following components (all percentages being in % weight of the final composition):

- Polypropylene homopolymer 30.0%
- Rubber Crumb 6.0%
- (particle diameter up to 0.84 mm)
- Flame Retarder 7.0%
White Pigment (TiO₂)  2.0%
Black Pigment (carbon black)  1.0%

The polypropylene was heated to above its melting point (about 165°C) until molten. The rubber crumb was added, together with the flame retarder (as a masterbatch) and the pigments, with mixing. The resulting mixture was formed into pellets, which were cooled and collected. The resulting pellets were used to form a panel comprising a single layer of the composition using an injection moulding process. The polypropylene had a hardness in excess of 80 Shore A.

The panel was inspected and found to have a black, riven surface closely resembling that of traditional cast iron. The composition is very suitable for the preparation of components of a guttering system requiring a traditional appearance of cast iron by moulding or extrusion. In particular, the injected panel was found to comprise a matrix of polypropylene having dispersed therethrough the particles of rubber crumb. The particles of rubber crumb were present at the surface of the panel and protruded therefrom to form a rough surface having the appearance of cast iron. This is believed to have been due to the differential cooling from the moulding tool.

The finished panel had a structure and appearance as shown in Figures 1 and 2 and described above.

EXAMPLE 3
A composition may be prepared by analogy with Example 1 having the following components (all percentages being in % weight of the final composition):

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>48.5.0%</td>
</tr>
<tr>
<td>Rubber Crumb</td>
<td>48.5.0%</td>
</tr>
<tr>
<td>(particle diameter up to 0.24 mm)</td>
<td></td>
</tr>
<tr>
<td>White Pigment (TiO₂)</td>
<td>2.0%</td>
</tr>
<tr>
<td>Black Pigment (carbon black)</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

The PVC is heated to above its melting point (above 160°C) until molten. The rubber crumb is added, together with the pigments, with mixing. The resulting mixture may be formed into pellets, which are cooled and collected. The resulting pellets may be used to form a panel of the composition using an injection moulding process. The PVC has a hardness in excess of 80 Shore A.

The panel of material prepared in this way has a black, riven surface closely resembling that of traditional cast iron. The composition is very suitable for the preparation of components of a guttering system requiring a traditional appearance of cast iron by moulding or extrusion.

EXAMPLE 4

A composition was prepared having the following components (all percentages being in % weight of the final composition):

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>78.0%</td>
</tr>
<tr>
<td>Rubber Crumb</td>
<td>19.0%</td>
</tr>
</tbody>
</table>
(particle diameter up to 0.42 mm)
White Pigment (TiO₂) 2.0%
Black Pigment (carbon black) 1.0%

The PVC was heated to above its melting point (about 160°C) until molten. The rubber crumb was added, together with the pigments, with mixing. The resulting mixture was formed into pellets, which were cooled and collected. The resulting pellets were used to form a panel of the composition using an extrusion moulding process. The PVC had a hardness in excess of 80 Shore A.

The panel of material prepared in this way had a black, riven surface closely resembling that of traditional cast iron. The composition was found to be very suitable for the preparation of components of a guttering system requiring a traditional appearance of cast iron by moulding or extrusion. In particular, the extruded panel was found to comprise a matrix of PVC having dispersed therethrough the particles of rubber crumb. The particles of rubber crumb were present at the surface of the panel and protruded therefrom, drawn to the surface by friction of the extruding tool to form a rough surface having the appearance of cast iron.

It has also been found that this cast iron effect may also be achieved by coextruding the composition of this Example as an outer layer of the extruded component. The outer layer formed 15% of the overall thickness of the wall of the component.

EXAMPLE 5
A composition was prepared for co-extrusion having the following components (all percentages being in % weight of the final composition):

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>85.0%</td>
</tr>
<tr>
<td>Rubber Crumb (particle diameter up to 0.42 mm)</td>
<td>14.0%</td>
</tr>
<tr>
<td>Black Pigment (carbon black)</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

The PVC was heated to above its melting point (about 160°C) until molten. The rubber crumb was added, together with the pigment, with mixing. The resulting mixture was formed into pellets, which were cooled and collected. The resulting pellets were used to co-extrude a gutter pipe from the composition using an extrusion process. The PVC had a hardness in excess of 80 Shore A.

The pipe produced in this way had a black, riven surface closely resembling that of traditional cast iron. The composition was very suitable for the outer co-extrusion layer of a guttering system requiring a traditional appearance of cast iron by moulding or extrusion. In particular, at 2% of the overall wall thickness, the co-extruded outer layer of the gutter was found to comprise a matrix of PVC having dispersed therethrough the particles of rubber crumb. The particles of rubber crumb were present at the surface of the gutter and extended therefrom, drawn to the surface by friction of the extruding tool to form a rough surface having the appearance of cast iron.
CLAIMS

1. A non-porous component having a surface pattern resembling cast iron and formed from a composition comprising:
   rubber crumb; and
   a thermoplastic polymer;
   wherein the rubber crumb is dispersed in a hard matrix of the thermoplastic polymer, particles of the rubber crumb being disposed at and protruding from the surface of the hard polymer matrix to provide a surface resembling cast iron.

2. The component according to claim 1, wherein the thermoplastic polymer is selected from polyvinylchloride or a polyolefin.

3. The component according to claim 2, wherein the polyolefin is polyethylene or polypropylene.

4. The component according to any preceding claim, wherein the thermoplastic polymer comprises recycled polymer.

5. The component according to any preceding claim, wherein the thermoplastic polymer is present in an amount of from 10 to 90% by weight of the composition.

6. The component according to any preceding claim, wherein the rubber crumb is from recycled vehicle tyres.

7. The component according to claim 6, wherein the rubber crumb is prepared by the ambient grinding of recycled rubber tyres.
8. The component according to any preceding claim, being substantially free from fibrous material and metal.

9. The component according to any preceding claim, wherein the rubber crumb has a particle size of less than 0.85 mm.

10. The component according to any preceding claim, wherein the rubber crumb is present in an amount of from 10 to 70% by weight.

11. The component according to claim 10, wherein the rubber crumb is present in an amount of at least 15% by weight.

12. The component according to any preceding claim, wherein the composition further comprises one or more fillers.

13. The component according to any preceding claim, wherein the composition further comprises one or more pigments.

14. A method of preparing a non-porous composition to form a component comprising a surface having an appearance resembling cast iron, the method comprising:

   combining rubber crumb and a thermoplastic polymer to form a hard matrix of polymer having dispersed therein particles of rubber crumb; wherein particles of rubber crumb are disposed at and protrude from the surface of the polymer matrix to provide the surface with the appearance resembling cast iron.

15. The method according to claim 14, wherein the thermoplastic polymer is melted and the rubber crumb combined with the molten polymer with mixing.
16. The method according to either of claims 14 or 15, further comprising extruding or moulding the composition.

17. A component according to any of claims 1 to 13 or prepared by a method according to any of claims 14 to 16, wherein the component is for a guttering or drainage system, is a bollard or an item of furniture.

18. The component according to claim 17, wherein the component for a guttering or drainage system is a downpipe, a hopper, a bend, branch or socket for a pipe, or a soil pipe.

19. A composition for providing a surface appearance resembling cast iron substantially as hereinbefore described having reference to the accompanying figure.

20. A component having a surface appearance resembling that of cast iron substantially as hereinbefore described having reference to the accompanying figure.

21. A method for forming a component having an appearance resembling cast iron substantially as hereinbefore described.
Application No: GB1021734.7
Claims searched: 1-21
Examiner: Mr Jason Scott
Date of search: 23 March 2011

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

<table>
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<th>Category</th>
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| X        | 1-7, & 9-17        | US 6007269 A 
MARINELLI See whole document and especially col. 3, ll. 23-35 and claim 3 showing materials used for a road side guard rail. |
| X        | 1-16               | WO 93/20132 A 
INTERVEST See whole document and especially claims 26 and 31 summarizing the formation of a thermoplastic crumb rubber blend. |
| X        | 1-18               | WO 02/24795 A 
UNIV MASSACHUSETTS See whole document and especially the examples teaching blending PP with recycled tyre rubber and p.3, ll. 3-9 teaching the use for forming pipes. |
| X        | 1, 4-18 at least   | US 2007/264495 A 
PIRELLI See whole document and especially the examples showing crumb rubber in thermoplastic and paragraph [0086] teaching uses such as pipes and watering systems. |

Categories:

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| A       | Document indicating technological background and/or state of the art. |
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| E       | Patent document published on or after, but with priority date earlier than, the filing date of this application. |

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

Worldwide search of patent documents classified in the following areas of the IPC
C08L; E01F; E04D

The following online and other databases have been used in the preparation of this search report
WPI, EPODOC, TXTE, TXTF, TXTG, TXTWOT
### International Classification:

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