SYNTHETIC CONSTRUCTION MATTING

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ABSTRACT

A method of producing extruded synthetic lumber for use in construction matting comprising the steps of first, providing a blend of ground synthetic particles, the blend selected from the group comprising primarily ground high density polyethylene particles and ground polyethylene terephthalate particles in an amount not more than 99.0 percent by weight and a composition of ground styrene-butadiene rubber comprised primarily of tire buffings in an amount from 1.0 percent to about 3.5 percent by weight. The blend is mixed, heated and extruded into dimensional lumber and then cooled. The resulting lumber has a low retained memory and reduced electrostatic potential.
SYNTHETIC CONSTRUCTION MATTING


FIELD OF INVENTION:

[0002] The present invention relates to materials used in fabricating temporary access mats and matting systems and, more particularly, presents a unique formulation of synthetic materials for use in matting for temporary roads and work surface areas.

BACKGROUND OF THE INVENTION:

[0003] Wooden mats have traditionally been utilized in the oil and gas and construction industries to form temporary roads and access areas at drill site locations and other construction sites. Such wooden mats provide a temporary foundation for construction vehicles and for construction equipment such as cranes and draglines. The temporary roads and access areas are formed by laying individual wooden mats in a desired pattern. This pattern of individual mats provides access over and around work areas with poor soil conditions that would otherwise be inaccessible to heavy trucks and construction equipment. When the drilling or construction is completed these mats can be removed for utilization elsewhere.

[0004] Wooden mats are also used in many marine applications. Such applications, include the use of wooden mats or matting to cover the decks of ships, barges and other marine vessels. Wooden matting is also used in the construction of docks, harbors and walkways around such marine structures.

[0005] The use of wooden mats present certain disadvantages. The mats are typically made of layers of wood timbers spiked or bolted together. The timbers forming the mats are subject to splitting, warping, breakage and disposal in compliance with state and federal regulations. Mats having split, broken or warped surfaces can produce imperfections in the matted surfaces that impede the access of the heavy equipment or cause damage to the equipment. The wooden mats used to form the matted surfaces are also expensive, require substantial maintenance, and increase the demand on forests that produce timber and timber products. Wooden mats are also heavy and can be difficult to move, place and store.

[0006] Applicants’ herein propose formulas for blending a combination of synthetic structural materials to produce structural members for use in the construction of mats and matting systems. U.S. Pat. No. 5,653,551 to Scaux suggests a mat system having individual mats comprised of composite materials. Scaux proposes a combination of virgin resins, plastics, re-claimed polyolefins and vulcanized rubber in further combination with strengthening agents such as fiberglass, steel, graphite, nylon or combinations of the materials. However, the Scaux patent makes no suggestion as to a preferred proportion or combination of such composite materials to be used in forming the mat.

[0007] There are many problems associated with the use of structural members comprising synthetic materials in the formation of construction matting. Construction matting is subjected to heavy vehicle loads and, more often than not, is used in areas where poor soil conditions are prevalent. Such mats must be sufficiently rigid to distribute the vehicle loading over the matted area and yet be elastic enough to retain the shape of the matting.

[0008] The loads encountered at a typical construction site often produce pronounced deflections in mats constructed of structural members composed of synthetic materials. Such mats, as a product of such loads and deflection, often retain too much "memory" which results in the creation of a permanent deformation in the matting. This retained memory or deformation reduces the mats ability to distribute the traffic loads to the soil surface and such retained deformation may require frequent replacement of the mats.

[0009] The use of synthetic materials in structural materials for matting may also enhance the electrostatic properties of the matting and thus increase the incidence of sparking with a resulting increased risk of explosion. Mats constructed from structural members made with certain synthetic materials may also present problems due to separation of component parts of the mat when conventional fasteners such as screws, spikes or bolts are used to secure the mat components together. The Scaux patent does not present a formulation of synthetic materials to address these problems.

[0010] Others have suggested the use of synthetic materials, particularly waste plastics and elastomers, for making construction materials. Examples of such are described in U.S. Pat. No. 5,030,662 to Banerjee and U.S. Pat. No. 5,759,680 to Brooks. Both the Banerjee and Brooks patents primarily feature the use of various polyethylene as the bulk of the matrix forming structural member. The Banerjee patent teaches the use of polyolefins in conjunction with compatibilizers, impact modifiers and reinforcing agents in the matrix forming the structural member. The Brooks patent teaches the use of polyolefins in conjunction with cellulose fibers in the matrix of the structural member. Neither patent presents a formulation of synthetic materials to address the aforementioned problems presented when such synthetic materials are used to produce structural members for use in construction matting.

[0011] Scrap rubber has also been suggested for use as a component in the formulation of synthetic building materials. In U.S. Pat. No. 5,439,735 to Jamison rubber is suggested as a component material for particle board products, because of its resistance to decay, water, rot, insects, and its thermal and acoustic properties.

[0012] In U.S. Pat. No. 4,244,841 to Franklin and a method of using grindings of scrap tire rubber is proposed for producing structures such as paving stones, floor coverings, resilient bumpers for highway guardrails, and railroad ties. In U.S. Pat. No. 4,851,500 to Lhawan teaches a process for blending scrap as a component of the material used in making roofing, walkway pads, and tiling. U.S. Pat. No. 5,886,978 to Sullivan et al. discloses the use of polymeric composites comprising thermoplastic polyolefins, a thermoplastic polymeric component such as styrene-butadine rubber in amounts greater than 4.0 percent by weight and reinforcing filler as a replacement for wood for use as railroad ties.

[0013] None of the aforementioned disclose the unique combination of rubber and synthetic components having the structural and physical properties of flexibility, the resil-
iencey and reduced retained load memory and the low electrostatic characteristics that were found by applicants to be suitable for temporary mating to be used in the oil and gas and in the construction industries.

SUMMARY OF INVENTION

The present invention presents a unique formulation for synthetic structural material blended and extruded primarily from high density polyethylene (HDPE), polyethylene terephthalate (PET), and styrene-butadiene rubber (SBR). The unique formulations presented herein, when appropriately specified and blended, offer structure building materials that are long lived, flexible, without retaining load “memory” and that are resistant to ultraviolet light, ozone, weather, insect and microbial degradation and electrostatic buildup. A further desired characteristic of the structural materials blended and extruded as described and claimed herein is that such materials have a low electrostatic potential. This reduces the incidence of sparks associated with electrostatic potential and as a result reduces the chance of associated explosion and fire.

The formulations described and claimed herein also impart qualities to the structural members so produced that facilitate their use as construction material as they accommodate the use of traditional tools and traditional fasteners such as spikes, nails, screws and bolts. In addition, the formulations described and claimed result in producing structural materials having excellent compressive, shear and tensile strength, and high moduli of elasticity and rupture as determined by ASTM standard test methods.

While the precise amounts of each of the components above may vary according to the desired properties of the ultimate matrix, and while particle sizes and particle preparation may affect the characteristics of the final product material, it is thought that the formulations included herein, within the general range, and percentages of materials described, will achieve the specific listed and desired material characteristics for use as construction matting.

The primary components of Applicants’ formulations, high density polyethylene (HDPE), polyethylene terephthalate (PET), and styrene-butadiene rubber (SBR), can be obtained from virgin materials manufacturers and/or distributors. In addition to component availability through new material suppliers, these components are widely available through recovered materials markets. The reutilization of these polymers is widely recognized to be of paramount importance to conserve energy, landfill space, and other resources given that such materials represent a considerable percentage of the overall waste stream and volumes are generally increasing every year. Although many modern composite materials that specify SBR prefer to utilize “devulcanized” feed stocks owing to their much improved cross-linking/bonding abilities, for most of the applications addressed herein, simple, physical preparations and detail to particle size results in products achieving the desired characteristics.

Ground or granulated rubber from vehicle tires known as “tire buffings” and particularly tire buffings made from truck tire treads provide an adequate and desirable source of SBR for use in Applicants’ formulations. In addition to SBR, tire buffings may include natural rubber, cis-polybutadiene rubber and cis-polyisoprene rubbers. Tire buffings also typically include accelerators such as zinc oxide, lead monoxide, magnesium oxide, stearic acid, oleic acid and pine tar; antioxidants including paraaminophenol, phenyl-alphanaphthylamine, phenylbetaanaphthylamine; carbon disulfide as an anti-ozone additive; sulfur as a vulcanization agent for the natural rubber components; and carbon black as a reinforcing material that imparts high tensile strength to the rubber combination to increase its resistance to abrasion and cutting and reduce electrostatic potential. When tire buffings are used as source of the SBR composition set forth in Applicants’ formulations, the tire buffings serve to impede the build up of static electricity in structural members produced with the formulations and the incidence of sparks associated with the structural members so produced.

DESCRIPTION OF PREFERRED EMBODIMENTS

FORMULA I

It is thought that structural members extruded to a desired size from the formulations consisting primarily of the following component materials, in the following proportions, ground to a desired particle size and blended together by weight in the absence of water (i.e., <0.5% by weight) would be suitable for use in construction matting and would have the desired characteristics of reduced electrostatic potential and reduced load memory:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>RANGE OF PREFERRED PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDPE</td>
<td>At least 90.0 percent by weight</td>
</tr>
<tr>
<td>An SBR composition comprised primarily of tire buffings</td>
<td>In the range of 1.0–3.5 percent by weight</td>
</tr>
<tr>
<td>PET</td>
<td>At least 90.0 percent by weight</td>
</tr>
<tr>
<td>An SBR composition comprised primarily of tire buffings</td>
<td>In the range of 1.0–3.5 percent by weight</td>
</tr>
</tbody>
</table>

PET and HDPE may be used as a filler in Formula I or Formula II, respectively. The components in Formula I and Formula II should be mixed in the specified range of percentages, then heated and extruded into dimensional lumber and then cooled in a water bath. While a precise grading or gradation of component particles comprising the blend of Formula I and Formula II is not thought to be required, the particle size so blended would be thought to pass a 2.5 cm sieve.

It is thought that the materials as listed and described in Formula I and Formula II when blended as described would produce a synthetic lumber building mate-
rial with the structural characteristics shown in Table I when tested as indicated:

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>TEST METHOD</th>
<th>RANGE OF VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity</td>
<td>ASTM D790</td>
<td>140,000 psi - 183,000 psi</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D3198</td>
<td>1,453 psi - 1,587 psi</td>
</tr>
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</table>

**TABLE I**

**FORMULA III**

As an alternative embodiment, it is thought that structural members extruded to a desired size from a formulation consisting primarily of the following component materials, in the following proportions, ground to a desired particle size and blended together by weight in the absence of water (i.e., <0.5% by weight), would be suitable for use in construction matting and have the desired characteristics of reduced electrostatic potential and reduced load memory:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>RANGE OF PREFERRED PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDPE</td>
<td>in an amount not more than 75.0% by weight</td>
</tr>
<tr>
<td>An SBR composition comprised primarily of tire buffings</td>
<td>in the range of 1.0-3.5 percent by weight</td>
</tr>
<tr>
<td>PET</td>
<td>in an amount not more than 40.0% by weight</td>
</tr>
</tbody>
</table>

It is thought that the components in Formula III when mixed and blended in the specified range of percentages and then heated and extruded into dimensional lumber and then cooled in a water bath would also produce a synthetic lumber with a desired electrostatic potential and with the desired structural flexibility and load memory.

One of significant characteristic of the synthetic lumber boards extruded from the blends in accordance with the above formulas is that it is thought that the electrostatic potential of the synthetic lumber will be lowered by increasing the amount of tire buffings. However, the desire to achieve the characteristic of a lower electrostatic potential for the synthetic lumber must be balanced with the resulting increase in flexibility and, consequently, the increase in the retained “memory” from a deflection or deformation of the synthetic lumber under loading imparted when the amount of tire buffings utilized in the blend is increased.

It is thought that synthetic structural members produced from the materials specified and blended as described herein would produce construction matting that, when exposed to the environment, would long out live construction matting produced with popular alternatives such as matting made from wood or from “single component” recovered plastics. In addition, and as a consequence of the lowered electrostatic potential of the formulations, matting made from the composite materials outlined herein could be safely utilized in environments where electrostatic arching must be avoided (i.e., hazardous materials storage areas, oil and gas locations and other potentially explosive/flammable areas).

It is thought that the formulations for synthetic structural material and method of the present invention and many of its attendant advantages will be understood from the foregoing descriptions. It is also thought that various changes or modifications may be made to the methods and formulations presented without departing from the spirit and scope of the present invention.

1. A method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas, which comprises the step of producing an extruded synthetic structural member comprising primarily:
   (i) synthetic material selected from the group consisting of high density polyethylene and polyethylene terephthalate in an amount not more than 99.0 percent by weight; and
   (ii) a composition of styrene-butadiene rubber comprised primarily of tire buffings in the range from 1.0 percent to about 3.5 percent by weight.

2. A method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas as recited in claim 1 wherein, said high density polyethylene, said polyethylene terephthalate and said composition of styrene-butadiene rubber comprised primarily of tire buffings, when combined, have a water content of less than 0.5 percent by weight.

3. A method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas as recited in claim 2 wherein, said range of said composition of styrene-butadiene rubber comprised primarily of tire buffings is from about 2.0 percent to about 3.5 percent by weight.

4. A method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas, which comprises the step of producing an extruded synthetic structural member comprising:
   (i) ground high density polyethylene in an amount greater than 90.0 percent by weight; and
   (ii) a composition of ground styrene-butadiene rubber comprised primarily of tire buffings in an amount from about 1.0 percent to about 3.5 percent by weight.

5. The method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas as recited in claim 4 wherein, said high density polyethylene and said composition of styrene-butadiene rubber comprised primarily of tire buffings, when combined, have a water content of less than 0.5 percent by weight.

6. The method of producing a synthetic structural material for use in constructing mats for temporary roads and access areas which comprises the step of producing an extruded synthetic structural member comprising:
   (i) ground high density polyethylene in an amount not more than 75.0 percent by weight;
   (ii) a composition of ground styrene-butadiene rubber comprised primarily of tire buffings in the range from about 2.0 percent to about 3.5 percent by weight; and
   (iii) ground polyethylene terephthalate in an amount not more than 40.0 percent by weight.

7. A method of producing extruded synthetic lumber comprising the steps of:
   (i) first, providing a blend of ground synthetic particles, said blend comprising primarily ground synthetic particles selected from the group consisting of ground high
density polyethylene particles and ground polyethylene terephthalate particles in an amount not more than 99.0 percent by weight of said blend and a composition of ground styrene-butadiene rubber comprised primarily of tire buffings in an amount from 1.0 percent to about 3.5 percent by weight of said blend;

(ii) next, mixing said blend;
(iii) then, heating said blend; and
(iv) extruding said blend into dimensional lumber; and
(v) then cooling said extruded dimensional lumber.

8. The method of producing extruded synthetic lumber as recited in claim 7 wherein, said range of said ground styrene-butadiene rubber comprised primarily of tire buffings is from 2.0 percent to 3.5 percent by weight.

9. The method as recited in claim 8 wherein said particles of said blend of ground synthetic particles are sized to pass a 2.5 cm sieve.

10. The method of producing extruded synthetic lumber as recited in claim 9 wherein, said blend of ground synthetic particles has a water content of less than 0.5 percent by weight.

11. A method of producing synthetic mats for temporary roads and access areas, which comprises the step of producing an extruded synthetic structural member from a blend of ground synthetic material, said blend of ground synthetic material comprising:

(i) a composition consisting primarily of ground high density polyethylene in an amount greater than 90.0 percent by weight;
(ii) a composition consisting primarily of ground styrene-butadiene rubber comprised primarily of tire buffings in an amount from 1.0 percent to 3.5 percent by weight; and
(iii) a composition consisting primarily of ground polyethylene terephthalate as a filler.

12. The method as recited in claim 11 wherein, in said blend of ground synthetic material, said composition of ground high density polyethylene and said composition of ground polyethylene terephthalate, together, is no more than 99.0 percent by weight of said blend and said composition consisting primarily of ground styrene-butadiene rubber comprised primarily of tire buffings is in the range from about 1.0 percent to about 3.5 percent by weight of said blend.

13. The method as recited in claim 12 wherein said step of producing said extruded synthetic structural member from said blend of ground synthetic material includes the steps of:

(i) mixing said blend;
(ii) then, heating said blend;
(iv) then, extruding said blend into dimensional lumber; and
(v) then cooling said extruded dimensional lumber.

14. The method as recited in claim 13 wherein blend of ground synthetic material is sized to pass a 2.5 cm sieve.

15. The method as recited in claim 14 wherein said blend of ground synthetic material has a water content of less than 0.5 percent by weight.