GOLF BALL COMPRISING DE-VULCANIZED RUBBER

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ABSTRACT

Golf balls in accordance with the principles of the present invention include a core and one or more cover layers, with the core having a base rubber component that comprises de-vulcanized rubber. The base rubber component may include a blend of polybutadiene with the de-vulcanized rubber, and may also include at least one other type of recycled material. A golf ball of the present invention exhibits performance properties similar to golf balls made using solely non-recycled base rubber as the primary component of the core. For example, a golf ball of the present invention may have a compression of between 20 and 100, and a coefficient of restitution of greater than 0.680 at a test velocity of 125 ft/s.
GOLF BALL COMPRISING DE-VULCANIZED RUBBER

FIELD OF THE INVENTION

[0001] The present invention relates to the field of golf balls.

BACKGROUND OF THE INVENTION

[0002] Golf ball construction has evolved from cores having a soft center and a thread winding comprised of natural rubber or synthetic polyisoprene to the use of solid rubber cores. Currently, almost all commercially-available golf balls include a solid rubber core. These cores generally comprise synthetic polybutadiene, more specifically a high-cis-content polybutadiene, as the base rubber of the core composition.

[0003] In an attempt to keep costs low, recycled material of various types have been incorporated into golf ball cores. Core regrind, which is vulcanized rubber scrap or defect cores that are ground or pulverized into a fine powder, has been used for many years in the construction of solid golf ball cores. Scrap material from the grinding, or Glebar, process has also been used to form golf ball cores. For example, U.S. Pat. No. 6,139,447 describes the use of a vulcanized rubber powder as filler for golf ball core compositions. U.S. Pat. No. 7,141,196 describes the use of “pre-vulcanized” materials as part of the golf ball core composition. In all cases, the use of a “recycled” material has always been limited to a pre-vulcanized material such as ground core scrap and Glebar/grinding dust, or pre-vulcanized materials. Further, the loading levels of the various recycled materials used in previous golf balls has been limited because the use of high levels of loading of either ground core scrap, Glebar/grinding dust, or “pre-vulcanized” rubber results in an increase in the compression of the core ball (resulting in poor feel characteristics) and decrease in the flight performance of the golf ball. Accordingly, the use of recycled pre-vulcanized materials is inherently limited for high performance golf balls due to the negative affects (increased core/ball compression and decreased flight performance) created by the use of such materials.

[0004] Thus, a continuing need exists for a golf ball that utilizes an increased amount of recycled material without significantly decreasing the performance or feel of the golf ball. What is needed is a golf ball that improves the environment by incorporating the use of recycled rubber from environmentally destructive products such as used tires. What is also needed is an environmentally friendly, high performance golf ball that can be produced in a cost effective manner without significantly departing from existing curing processes. A need exists for an environmentally friendly golf ball utilizing recycled materials that satisfies all U.S. Golf Association golf ball requirements.

SUMMARY OF THE INVENTION

[0005] A golf ball in accordance with the principles of the present invention includes recycled de-vulcanized rubber as part of the base rubber of the core, yet the ball exhibits performance properties similar to golf balls made using solely non-recycled base rubber as the primary component of the core. The use of recycled de-vulcanized rubber allows for use of higher levels of overall recycled materials (including ground core scrap, Glebar/grinding dust, etc.) in the golf ball core, thereby producing a more “green,” or environmentally-friendly, golf ball.

[0006] In accordance with the principles of the present invention, the golf ball has a core and one or more cover layers. The base rubber component of the core includes a blend of polybutadiene and de-vulcanized rubber. The de-vulcanized rubber is preferably obtained through de-vulcanization of scrap tires. For example, the recycled de-vulcanized rubber may have a Mooney viscosity of about 55+10 and a specific gravity of about 1.18 to about 1.22.

[0007] The base rubber component may also include at least one other type of recycled material, namely recycled non-de-vulcanized rubber material (i.e., vulcanized rubber material), such as ground core scrap or Glebar/grinding dust. In certain embodiments, the core may include 1 to 25 phr of the other types of recycled non-de-vulcanized rubber material.

[0008] The core may include 50 to 95 phr of a polybutadiene having a cis-1,4 content of greater than 90%, 5 to 50 phr of de-vulcanized rubber, 10 to 40 phr of a co-crosslinking agent, 1 to 5 phr of an activator, 0.1 to 3.0 phr of a free-radical initiator, and 0 to 25 phr of non-de-vulcanized rubber, such as core scrap regrind or other recycled material. The core suitably has a compression of between 20 and 100, and a diameter between 1.25 and 1.60 inches.

[0009] The one or more cover layers may be formed of ionomers, highly neutralized ionomers, terpolymers, thermoplastic polyurethanes, or combinations thereof. The outermost cover layer suitably has a Shore D hardness of 45 to 75. The combined thickness of the cover layers is preferably between 0.040 and 0.215 inch.

[0010] In at least one embodiment, the resulting golf ball has a diameter greater than 1.680 inches, a weight between 44.5 and 45.93 grams, a compression of between 60 and 100, and/or a coefficient of restitution of greater than 0.680 at a test velocity of 125 ft/s.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 illustrates a front view of a golf ball in accordance with a preferred embodiment of the present invention.

[0012] FIG. 2 illustrates a cross-sectional view of one embodiment of the golf ball in FIG. 1.

[0013] FIG. 3 illustrates a cross-sectional view of another embodiment of the golf ball in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0014] One aspect of the present invention relates to a golf ball comprising de-vulcanized rubber. More particularly, the golf ball includes a center or core and one or more cover layers, with the de-vulcanized rubber present in the core.

[0015] Vulcanization refers to a specific curing process of rubber involving high heat and the addition of sulfur or other equivalent curatives. Uncured natural rubber is sticky and can easily deform when warm, and is brittle when cold. Vulcanization is a chemical process in which polymer molecules are linked to other polymer molecules by atomic bridges composed of sulfur atoms or carbon to carbon bonds. The end result is that the springy rubber molecules become cross-linked to a greater or lesser extent. This makes the bulk material harder, much more durable and also more resistant to chemical attack. It also makes the surface of the material smoother and prevents it from sticking to metal or plastic chemical catalysts. Conventional products produced of vulcanized rubber include hockey pucks, tires, shoe soles and hoses.
Referring to FIGS. 1-3, a golf ball is indicated generally at 10. FIG. 2 illustrates the golf ball 10 having a core 12 and a one-piece cover layer 14, whereas FIG. 3 illustrates the golf ball 10 having a core 12 and a two-piece cover layer 14, 16. In any case, the core 12 comprises de-vulcanized rubber as part of the base rubber of the core 12. Vulcanization is generally considered to be an irreversible process, similar to other thermosts and is contrasted strongly with thermoplastic processes. However, recent material advancements allow for de-vulcanized recycled rubber material. The golf ball 10 exhibits performance properties similar to golf balls made using solely non-recycled base rubber as the primary component of the core. The use of recycled de-vulcanized rubber does not result in a harder core, as is observed when high levels of regrind/recycled vulcanized filler materials are added to core compositions. Additionally, the use of recycled de-vulcanized rubber does not require significant changes or increases to the curative package of the rubber core that is necessary when vulcanized rubber powders or pre-vulcanized rubber materials are added to golf ball core compositions. Furthermore, the use of the de-vulcanized tire rubber allows for use of higher levels of overall recycled materials (including ground core scrap, Glebar/grinding dust, etc.) in the golf ball core, thereby making a more “green” or environmentally-friendly golf ball.

More specifically, the golf ball core 12 comprises a blend of a high cis-1,4-polybutadiene rubber and de-vulcanized recycled, or “reclaimed,” tire rubber as the base rubber material. For example, the base rubber component of the core composition may include between 50 and 99 phr of the high cis-1,4-polybutadiene rubber and between 1 and 50 phr of de-vulcanized rubber, such that the core 12 itself includes 50 to 95 phr of the high cis-1,4-polybutadiene rubber and 5 to 50 phr of the de-vulcanized rubber.

The core 12 is formulated using a blend of the base rubber material, a co-crosslinking agent, a free-radical initiator, and fillers as necessary to provide acceptable compression, density, and resilience. More particularly, the core 12 may include 10 to 40 phr of the co-crosslinking agent, optionally 1 to 5 phr of an activator such as zinc oxide, and 0.1 to 3.0 or 0.1 to 2.0 phr of the free-radical initiator.

The cis-1,4 content of the polybutadiene is preferably greater than 90%, or greater than 94%. Polybutadiene rubber suitable for use in the core 12 can be synthesized using nickel, cobalt, or neodymium catalysts, for example. Commercially-available examples of polybutadiene materials made using neodymium catalyzed materials include Europrene® NEOCIS® BR-40, produced by Polimeri Europa, and Neodene® BR-40, produced by Karbochem. Commercially-available examples of polybutadiene materials made using nickel catalyzed materials include Budene® 1207, produced by the Goodyear Tire and Rubber Company, and Kumho® KBR-01, produced by Kumho Tire and Rubber.

The de-vulcanized rubber material is preferably obtained through de-vulcanization of scrap tires. The recycled tire rubber is obtained from a process including the following steps:

1. Grinding/smashing of old tires to break the tires into small pieces.
2. A magnetic separation step to remove any metal material from the tire scrap.
3. A further grinding step to reduce the scrap tire rubber into fine particles.

A de-vulcanization step to break down crosslinks from the scrap rubber and revert it to a curable state.

A refining/forming step to form the de-vulcanized tire rubber into a solid/bale form for ease of handling/processing.


One example of de-vulcanized tire rubber suitable for use in the golf balls of this invention is produced (“reclaimed”) by Yaw Shuen Ind. Co., Ltd. In particular, one preferred material is YS100 reclaimed rubber, a de-vulcanized tire rubber having a Mooney viscosity of about 55±10 and a specific gravity of about 1.18 to about 1.22.

The co-crosslinking agent may be any suitable agent known in the art, such as metal salts of acrylate esters. The co-crosslinking agent is preferably a zinc salt of an unsaturated acrylate ester. Zinc diacrylate is a preferred metal salt. Additionally, the co-crosslinking agent may include a level of fatty acid salt of from 10 to 50% of the total co-crosslinking agent. For example, a level of about 7% to 10% of a fatty acid salt such as zinc stearate or zinc palmitate may be preferred. Commercially-available materials suitable for use as the co-crosslinking agent are produced by Sartomer, Inc. and Kuo Ching Chemical Company, Limited, for example.

Any free-radical initiator known in the art may be utilized, including other than peroxides. In particular, peroxides such as dicumyl peroxide, tert-butyl peroxycarbonate, butyl 4,4’-di-tert-butylperoxy valerate, and 1,1-di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane are suitable for use. Commercially-available free-radical initiators suitable for use in the core 12 include dicumyl peroxide, sold by Akzo Nobel Chemicals under the trade name Pernox BC, and 1,1-di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane, sold by Akzo Nobel Chemicals under the trade name Trigonox® 29/40 and Trigonox® 29A-88.

Fillers suitable for use in adjusting the density of the core 12 to achieve a desired weight may be either inorganic or organic materials. Preferred materials for adjusting the density of the core 12 include inorganic materials such as zinc oxide, barium sulfate, titanium dioxide, calcium carbonate, magnesium carbonate, and mixtures thereof.

In addition to the de-vulcanized rubber material, the core 12 may also include one or more other types of non-de-vulcanized (i.e., vulcanized) recycled materials, such as core scrap regrind and Glebar/grinding dust. In particular, the core 12 may include 0 to 25 phr, or in certain embodiments 1 to 25 phr, of vulcanized recycled material.

The core 12 preferably has a diameter between 1.25 and 1.60 inches, a density between 1.10 and 1.30, and a compression of between 20 and 100.

As noted above, the cover layer may include one or more separate layers 14, 16, which may have differing compositions and properties so as to maximize the desired qualities of the golf ball 10 of the invention. Materials suitable for forming the cover layers include, but are not limited to, ionomers, highly neutralized ionomers (such as 100% neutralized ionomers), terpolymers, polyurethanes, polyesters, polylefins, ethylene-methacrylic acid copolymers, ethylene-acrylic
acid copolymers, and combinations thereof. One example of a commercially-available cover layer material is a family of co- or terpolymers manufactured by DuPont under the trade name DuPont HPF®. These terpolymers comprise ethylene, acrylic acid, and in one embodiment, n-butyl-acrylate; preferably 100% of the terpolymers' acid groups are neutralized with metal ions.

**[0034]** The outermost cover layer 14/16 of the golf ball 10 (layer 14 in FIG. 2, layer 16 in FIG. 3) has a surface comprising numerous dimples, such as between 250 and 500 dimples, and the surface of the ball 10 is preferably coated with a protective coating comprising either a urethane-based paint system or an acrylic-based paint system. The outermost cover layer 14/16 has a Shore D hardness between 45 and 75, and a combined thickness of all cover layers 14, 16 is preferably between 0.040 and 0.215 inch.

**[0035]** The United States Golf Association (U.S.G.A.) has specific requirements for golf ball performance. See "The Rules of Golf" as approved by the United States Golf Association, Appendix III—Effective Jan. 1, 2008. These requirements are designed to limit the performance of the golf ball. The currently proscribed requirements for a golf ball to be listed for play in a U.S.G.A. sanctioned event include a maximum weight of 1.62 oz. (45.93 grams) and a minimum diameter of 1.68 in (42.67 mm). Thus, the golf ball 10 of the invention suitably has a diameter of at least 1.680 inches, and a weight between 44.5 and 45.93 grams. Furthermore, the golf ball 10 suitably has a Shore D hardness (as measured on the curved surface of the ball) of between 45 and 75, a compression of between 60 and 100, and a coefficient of restitution (at a test velocity of 125 ft/s) of greater than 0.680.

**EXAMPLES**

**[0036]** Golf balls using de-vulcanized rubber as a portion of the rubber component of the core 12 were made as set forth below.

**[0037]** Cores for the invention were mixed according to the formulas specified in Table 1. Three different levels of de-vulcanized rubber content were used. These three test cores were compared to a conventional golf ball core (Example C-1). Properties of the cores made using various levels of de-vulcanized rubber, as well as properties of the conventional core, are also included in Table 1.

**TABLE 1**

<table>
<thead>
<tr>
<th>Material</th>
<th>Core Formulas/Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Karbochem Neodene-40</td>
<td>90</td>
</tr>
<tr>
<td>YS100 Reclaimed Rubber</td>
<td>10</td>
</tr>
<tr>
<td>Sartomer SR416D ZDA</td>
<td>27</td>
</tr>
<tr>
<td>Zirc Oxide</td>
<td>5</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>6</td>
</tr>
<tr>
<td>Barium Sulfate</td>
<td>18</td>
</tr>
<tr>
<td>Trigonox 20/40</td>
<td>1.75</td>
</tr>
<tr>
<td>Diameter (inches)</td>
<td>1.530&quot;</td>
</tr>
<tr>
<td>Weight (grams)</td>
<td>37.01</td>
</tr>
<tr>
<td>Deflection (200 lb. load)</td>
<td>0.102&quot;</td>
</tr>
<tr>
<td>Compression (ADC)*</td>
<td>78.8</td>
</tr>
<tr>
<td>C.O.R. (125 ft/s)</td>
<td>0.786</td>
</tr>
</tbody>
</table>

*Compression for golf ball cores is measured using ADC compression tester.

**[0038]** Karbochem Neodene 40 is a neodymium catalyzed high-cis-content polybutadiene rubber produced by Karbochem (PTY) Ltd.

**[0039]** YS100 Reclaimed Rubber is a de-vulcanized tire rubber produced by Yaw Shuein Ind. Co., Ltd.

**[0040]** Sartomer® SR416D is a Zinc Diacrylate (92% ZDA) level produced by Sartomer Corporation.

**[0041]** Trigonox® 29/40 is 1,1-Di-(butylperoxy)-3,3,5-trimethylcyclohexane (40% active) produced by Akzo Nobel Chemicals, Inc.

**[0042]** An analysis of the properties of the molded cores of Examples 1 through 3 as compared to the conventional golf ball core (Example C-1) follows:

**Example 1**

**[0043]** Core Example 1 includes a blend of 90 phr Neodene 40 and 10 phr of de-vulcanized tire rubber. The resultant core has comparable compression and slightly reduced coefficient of restitution (C.O.R.) compared to control core C-1. A decrease in C.O.R. of about 0.014 is observed.

**Example 2**

**[0044]** Core Example 2 includes a blend of 80 phr Neodene 40 and 20 phr of de-vulcanized tire rubber. The resultant core has comparable compression and lower C.O.R. compared to control core C-1. A decrease in C.O.R. of about 0.034 is observed.

**Example 3**

**[0045]** Core Example 3 includes a blend of 60 phr Neodene 40 and 40 phr of de-vulcanized tire rubber. The resultant core exhibits an increase in compression of about 6 points and a lower C.O.R. of about 0.081 compared to control core C-1.

**[0046]** The golf ball cores described in Table 1 demonstrate that the use of the de-vulcanized tire rubber does not have a significant effect on ball compression. There is a decrease observed in C.O.R., as for every 10 phr of high-cis polybutadiene replaced with de-vulcanized rubber a decrease of about 0.016 in C.O.R. is observed.

**[0047]** Golf balls were molded with cores 5 and 6 according to the formulas specified in Table 2, and with Value and Range cover layers as described in Table 3.

**TABLE 2**

<table>
<thead>
<tr>
<th>Material</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karbochem Neodene-40</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>YS100 Reclaimed Rubber</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>K-Cure 339 ZDA</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Zirc Oxide</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Barium Sulfate</td>
<td>14.5</td>
<td>11</td>
</tr>
<tr>
<td>Trigonox 20/40</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Diameter (inches)</td>
<td>1.541&quot;</td>
<td>1.540&quot;</td>
</tr>
<tr>
<td>Weight (grams)</td>
<td>36.70</td>
<td>36.70</td>
</tr>
<tr>
<td>Deflection (200 lb. load)</td>
<td>0.104&quot;</td>
<td>0.033&quot;</td>
</tr>
<tr>
<td>Compression (ADC)</td>
<td>79.6</td>
<td>76.7</td>
</tr>
<tr>
<td>C.O.R. (125 ft/s)</td>
<td>0.781</td>
<td>0.764</td>
</tr>
</tbody>
</table>

**[0048]** K-Cure 339 is a Zinc Diacylate (92% ZDA level) produced by Kuo Ching Chemical Company, Limited.

**[0049]** Trigonox® 29A-88 is 1,1-di-(butylperoxy)-3,3,5-trimethylcyclohexane (88% active) produced by Akzo Nobel Chemicals, Inc.
TABLE 3

<table>
<thead>
<tr>
<th>Cover ID</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Iotek 8030/Iotek 7010 @ 50/50</td>
</tr>
<tr>
<td>Range</td>
<td>Surlyn 8940/Surlyn 9910/Surlyn 8320 @ 33/33/34</td>
</tr>
</tbody>
</table>

**[0050]** Iotek® 8030 is a copolymer comprising ~85% by weight of ethylene and ~15% by weight of acrylic acid. Approximately 35% of the acrylic acid groups are neutralized with sodium ions.

**[0051]** Iotek® 7010 is a copolymer comprising ~85% by weight of ethylene and ~15% by weight of acrylic acid. Approximately 35% of the acrylic acid groups are neutralized with zinc ions.

**[0052]** Surlyn® 8940 is a copolymer comprising ~85% by weight of ethylene and ~15% by weight of methacrylic acid. Approximately 29% of the methacrylic acid groups are neutralized with sodium ions.

**[0053]** Surlyn® 9910 is a copolymer comprising ~85% by weight of ethylene and ~15% by weight of methacrylic acid. Approximately 58% of the methacrylic acid groups are neutralized with zinc ions.

**[0054]** Surlyn® 8320 is a terpolymer comprising ~67-70% by weight of ethylene, ~10% by weight of methacrylic acid, and ~20-23% by weight of n-butyl acrylate. Approximately 55% of the methacrylic acid groups are neutralized with sodium ions.

**[0055]** Surlyn® ionomers described above are produced by E.I. duPont de Nemours and Company.

**[0056]** Iotek® ionomers described above are produced by ExxonMobil Chemicals, Inc.

**[0057]** Golf balls were formed of various combinations of cores 5 and 6 from Table 2 and core C-1 from Table 1 with the cover layer formulations from Table 3. Properties of the resulting balls are provided in Table 4.

**TABLE 4**

<table>
<thead>
<tr>
<th>Cover</th>
<th>Physical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EX-1</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td>Size (in.)</td>
<td>1.6885&quot;</td>
</tr>
<tr>
<td>Weight (grams)</td>
<td>45.53</td>
</tr>
<tr>
<td>Compression C.O.R. (175 ft/s)</td>
<td>87.5</td>
</tr>
<tr>
<td>Impact Dur. (175 ft/s)</td>
<td>0.729</td>
</tr>
<tr>
<td>Ball Flight Properties</td>
<td></td>
</tr>
<tr>
<td>Carry (yd)</td>
<td>250.5</td>
</tr>
<tr>
<td>Total (yd)</td>
<td>269.7</td>
</tr>
<tr>
<td>Max Height (yd)</td>
<td>29.6</td>
</tr>
<tr>
<td>Spin (rpm)</td>
<td>2701</td>
</tr>
<tr>
<td>Ball Velocity (mph)</td>
<td>152.5</td>
</tr>
</tbody>
</table>

*Impact durability tested by shooting balls into a steel plate at a test velocity of 175 ft/s. The number of hits until failure is noted.

**[0058]** An analysis of the properties of cores 5, 6, and C-1 in combination with the Value and Range cover layers follows:

**Example EX-1**

**[0059]** The golf ball of Example EX-1 was molded using core 5 (comprising 10 phr de-vulcanized rubber loading) and Range cover (Surlyn® ionomer blend). The resultant ball had compression comparable to the range control ball C-R. The golf ball of Example EX-1 exhibited lower C.O.R. than the control range ball, and a decrease in ball velocity of about 0.6 mph compared to range control C-R. However, only a minimal decrease in ball distance (less than 2 yards) was observed. The golf ball of Example EX-2 also exhibits a slight increase in impact durability (hits to failure) of about 10% compared to the range control C-R.

**Example EX-2**

**[0060]** The golf ball of Example EX-2 was molded using core 6 (comprising 20 phr de-vulcanized rubber loading) and Range cover (Surlyn® ionomer blend). The resultant ball had compression comparable to the range control ball C-R. The golf ball of Example EX-2 exhibited lower C.O.R. than the control range ball, and a decrease in ball velocity of about 1.1 mph compared to range control C-R. However, only a minimal decrease in ball distance (less than 3 yards) was observed. The golf ball of Example EX-2 also exhibits an increase in impact durability (hits to failure) of about 40% compared to the range control C-R.

**Example EX-3**

**[0061]** The golf ball of Example EX-3 was molded using core 6 (comprising 20 phr de-vulcanized rubber loading) and Value cover (Iotek® ionomer blend). The resultant ball had compression comparable to the value control ball C-V. The golf ball of Example EX-3 exhibited the same C.O.R. as the value control ball C-V, and a decrease in ball velocity of about 1.4 mph compared to value control ball C-V. However, only a minimal decrease in ball distance (less than 3 yards) was observed. As observed on the range ball example (Example EX-2), the value ball of Example EX-3 also exhibits an increase of roughly 40% in impact durability.

**[0062]** Overall, the addition of de-vulcanized tire rubber to the core composition results in a loss (or no change) in C.O.R., but minimal loss in flight distance performance. The addition of the de-vulcanized tire rubber to the core also results in a significant increase in the impact durability of the golf ball. **[0063]** It should be understood that various changes and modifications to the preferred embodiments described herein would be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without demeaning its attendant advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

What is claimed is:
1. A golf ball comprising: a core; and
   one or more cover layers, the core comprising a blend of polybutadiene and de-vulcanized rubber as a base rubber component, the golf ball configured to meet the golf ball requirements of The Rules of Golf provided by the U.S. Golf Association.
2. The golf ball of claim 1, wherein the de-vulcanized rubber is obtained through de-vulcanization of scrap tires.

3. The golf ball of claim 1, wherein the de-vulcanized rubber has a Mooney viscosity of about 55±10 and a specific gravity of about 1.18 to about 1.22.

4. The golf ball of claim 1, wherein the core comprises 50 to 95 phr of a polybutadiene having a cis-1,4 content of greater than 90%; 5 to 50 phr of de-vulcanized rubber; 10 to 40 phr of a co-crosslinking agent; 1 to 5 phr of an activator; 0.1 to 3.0 phr of a free-radical initiator; and 0 to 25 phr of core scrap regrind.

5. The golf ball of claim 1, wherein the core has a compression of between 20 and 100.

6. The golf ball of claim 1, wherein the core has a diameter between 1.25 and 1.60 inches.

7. The golf ball of claim 1, wherein the one or more cover layers comprise a material selected from the group consisting of ionomers, highly neutralized ionomers, terpolymers, thermoplastic polyurethanes, and combinations thereof.

8. The golf ball of claim 1, wherein an outermost cover layer has a Shore D hardness of 45 to 75.

9. The golf ball of claim 1, wherein the golf ball has a diameter greater than 1.680 inches.

10. The golf ball of claim 1, wherein the golf ball has a weight between 44.5 and 45.93 grams.

11. The golf ball of claim 1, wherein the golf ball has a compression of between 60 and 100.

12. The golf ball of claim 1, wherein the golf ball has a coefficient of restitution of greater than 0.680 at a test velocity of 125 ft/s.

13. A golf ball comprising:
   a core; and
   at least one cover layer, the core comprising a base rubber component that includes a blend of polybutadiene, recycled de-vulcanized rubber, and at least one other type of recycled material.

14. The golf ball of claim 13, wherein the core comprises 50 to 95 phr of a polybutadiene having a cis-1,4 content of greater than 90%; 5 to 50 phr of de-vulcanized rubber; and 1 to 25 phr of the at least one other type of recycled material.

15. The golf ball of claim 13, wherein the at least one other type of recycled material comprises at least one of the group consisting of ground core scrap and Glebar/grinding dust.

16. The golf ball of claim 13, wherein the de-vulcanized rubber is obtained through de-vulcanization of scrap tires.

17. The golf ball of claim 13, wherein the at least one cover layer has a Shore D hardness between 45 and 75 and a combined thickness of between 0.040 and 0.215 inch, and comprises at least one of the group consisting of ionomers, highly neutralized ionomers, terpolymers, thermoplastic polyurethanes, and combinations thereof.

18. The golf ball of claim 13, wherein the golf ball has a compression of between 60 and 100.

19. The golf ball of claim 13, wherein the golf ball has a coefficient of restitution of greater than 0.680 at a test velocity of 125 ft/s.

20. A golf ball comprising:
   a core having a base rubber component comprising de-vulcanized rubber; and
   at least one cover layer,
   wherein the core has a compression of between 20 and 100, and the golf ball has a coefficient of restitution of greater than 0.680 at a test velocity of 125 ft/s.

21. The golf ball of claim 20, wherein the de-vulcanized rubber is obtained through de-vulcanization of scrap tires.

22. The golf ball of claim 20, wherein the core further comprises recycled non-de-vulcanized rubber material.

23. The golf ball of claim 22, wherein the recycled non-de-vulcanized rubber material comprises at least one of the group consisting of ground core scrap and Glebar/grinding dust.

24. The golf ball of claim 20, wherein the core comprises 50 to 95 phr of a polybutadiene having a cis-1,4 content of greater than 90%; 5 to 50 phr of de-vulcanized rubber; and 0 to 25 phr of recycled non-de-vulcanized rubber material.

25. The golf ball of claim 20, wherein the core has a diameter of 1.25 to 1.60 inches.

26. The golf ball of claim 20, wherein an outermost cover layer has a Shore D hardness of 45 to 75.

27. The golf ball of claim 20, wherein the golf ball has a diameter greater than 1.680 inches.

28. The golf ball of claim 20, wherein the golf ball has a weight between 44.5 and 45.93 grams.

29. The golf ball of claim 20, wherein the golf ball has a compression of between 60 and 100.

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