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(54) **GOLF BALL**

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(57) **ABSTRACT**

A golf ball **2** includes a center **8**, a mid layer **10**, a cover **6** and dimples **12**. The cover **6** has a Shore D hardness of 30-50. The golf ball **2** has an amount of compressive deformation of 3.0-5.0 mm. The ball **2** meets a mathematical formula (I):

$$0.80 \le ((L1+L2)/2) \le 0.95 \quad (I).$$

L1 represents a ratio of a lift coefficient CL1 relative to a drag coefficient CD1, the lift coefficient CL1 and the drag coefficient CD1 being measured under conditions of a Reynolds number of 1.290×10^5 and a spin rate of 2820 rpm. L2 represents a ratio of a lift coefficient CL2 relative to a drag coefficient CD2, the lift coefficient CL2 and the drag coefficient CD2 being measured under conditions of a Reynolds number of 1.771×10^5 and a spin rate of 2940 rpm.

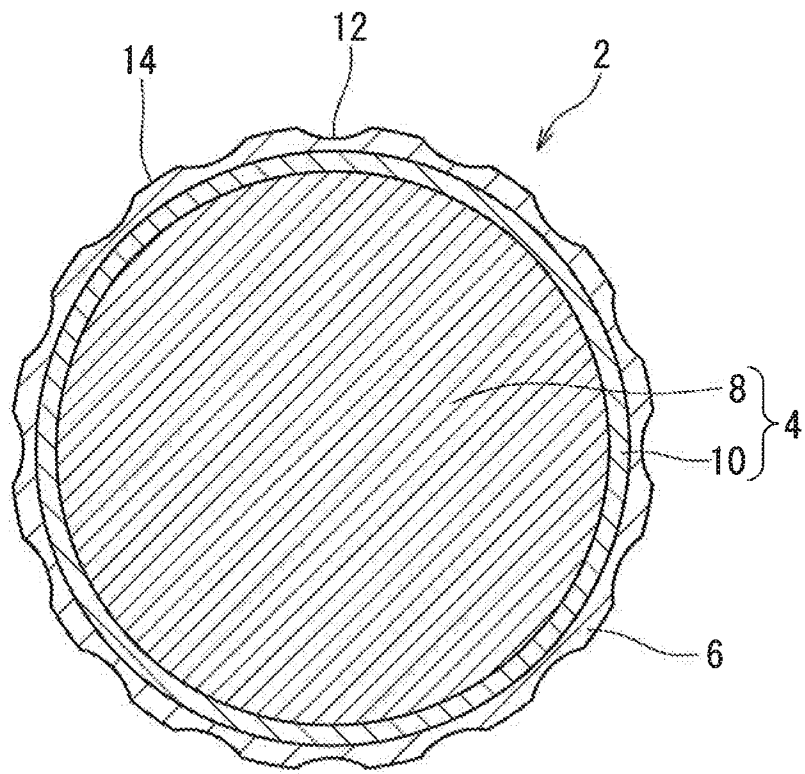

FIG. 1

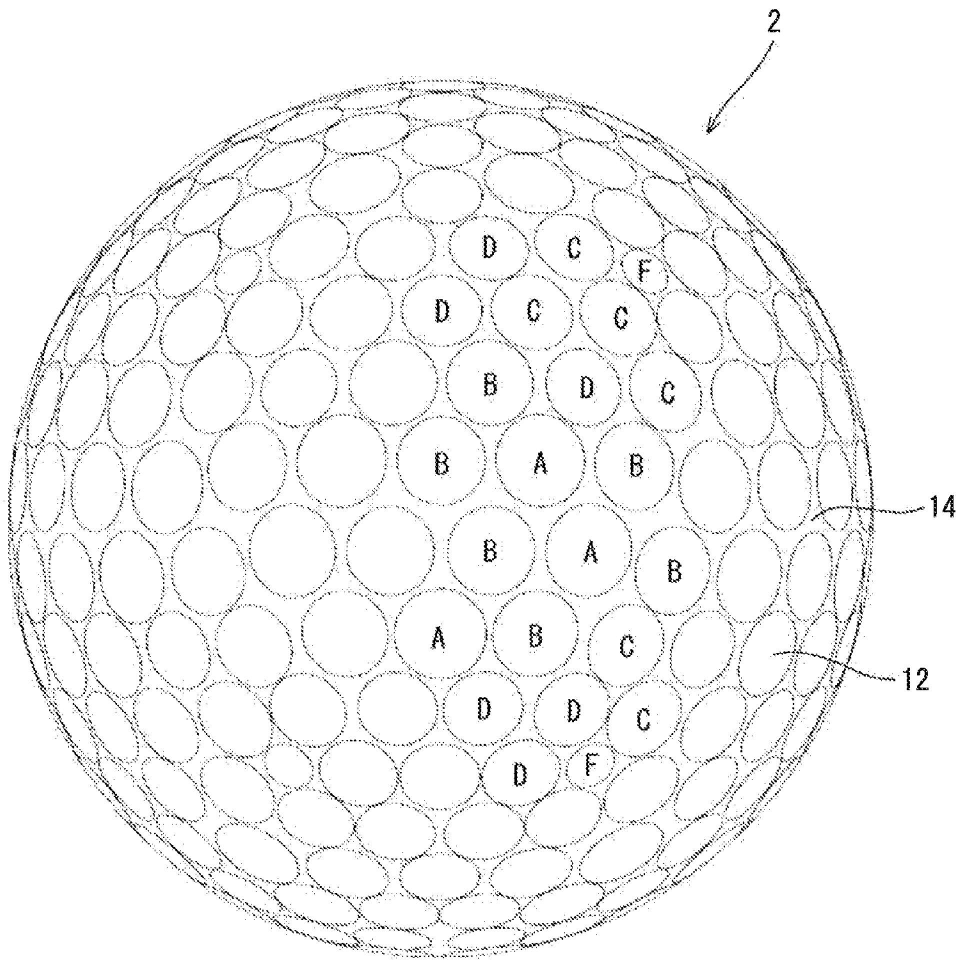

FIG. 2

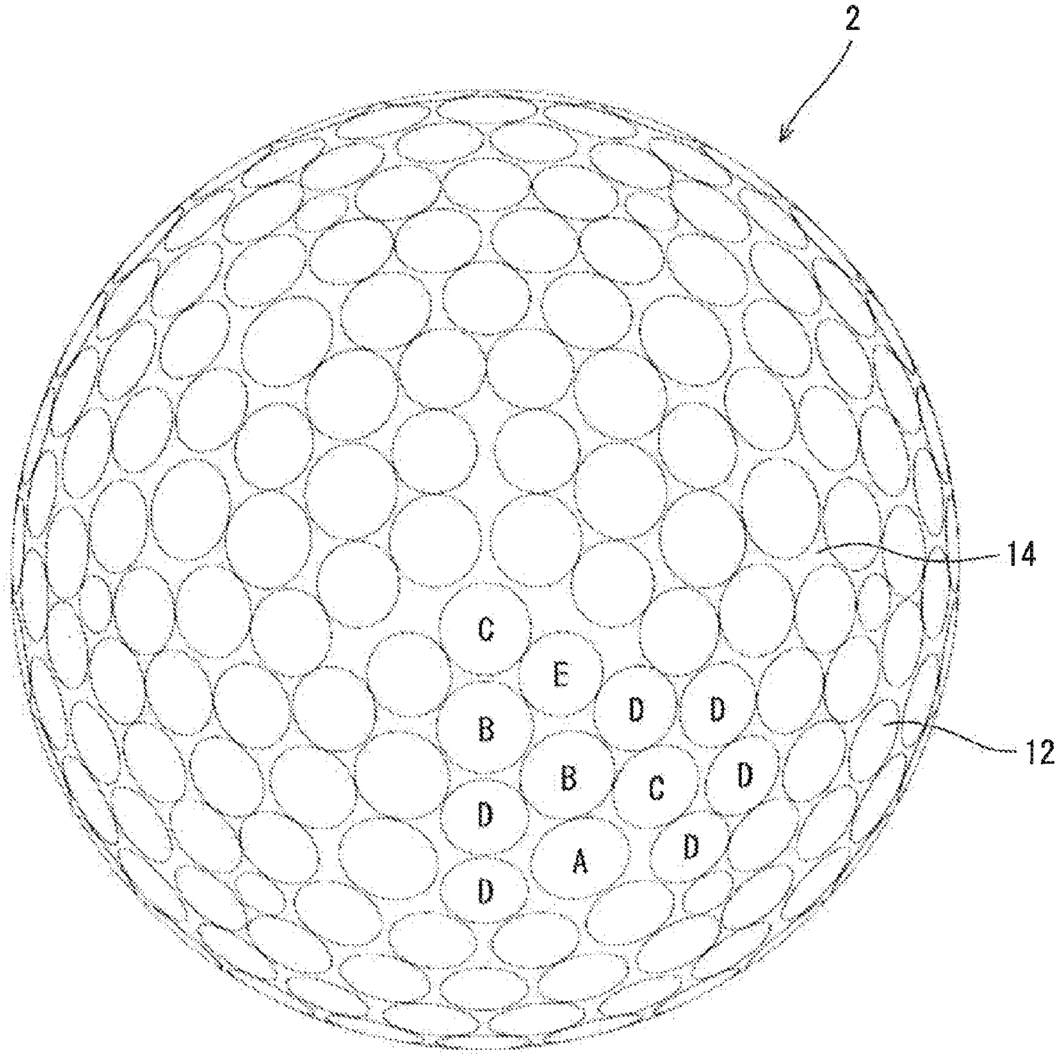

FIG. 3

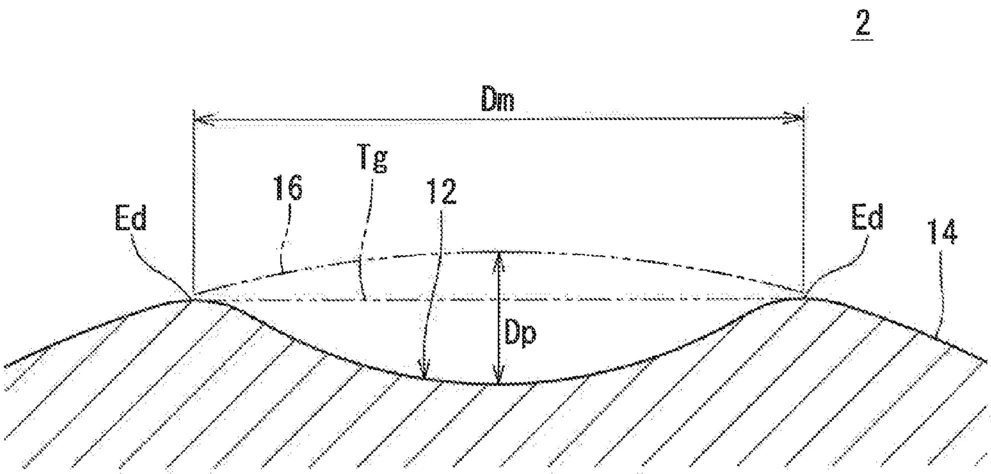

FIG. 4

GOLF BALL

[0001] This application claims priority on Patent Application No. 2014-133826 filed in JAPAN on Jun. 30, 2014. The entire contents of this Japanese Patent Application are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to golf balls. Specifically, the present invention relates to improvement of aerodynamic characteristics of golf balls.

[0004] 2. Description of the Related Art

[0005] Golf balls have a large number of dimples on the surfaces thereof. The dimples disturb the air flow around the golf ball during flight to cause turbulent flow separation. This phenomenon is referred to as "turbulization". Due to the turbulization, separation points of the air from the golf ball shift backwards leading to a reduction of drag. The turbulization promotes the displacement between the separation point on the upper side and the separation point on the lower side of the golf ball, which results from the backspin, thereby enhancing the lift force that acts upon the golf ball. Excellent dimples efficiently disturb the air flow. The excellent dimples produce a long flight distance.

[0006] A golf player can select the brand of a golf ball to be used by the golf player. In a golf tournament, the brand of a golf ball used by a golf player is often different from that of another golf player. In this respect, golf is a unique ball game.

[0007] Golf should be a sport in which golf players compete with each other on their skills. It is not preferable that scores of golf players greatly depend on the brands of golf balls. In this respect, the United States Golf Association (USGA) has established various rules about characteristics of golf balls. For example, rules about weight, diameter, initial speed, flight distance, and symmetry have been established.

[0008] Various golf balls have been proposed which can satisfy golf players while conforming to the rules.

[0009] JPH5-103846 discloses a golf ball which has dimples the diameters, the depths, and the number of which are made appropriate.

[0010] U.S. Pat. No. 5,782,703 (JPH10-43342) discloses a golf ball which has dimples the ratio of the diameter and the depth of each of which is made appropriate.

[0011] U.S. Pat. No. 5,782,702 (JPH10-43343) discloses a golf ball in which the ratio of the volumes of dimples relative to the volume of the ball is made appropriate.

[0012] JP2000-107338 discloses a golf ball having a diameter and a weight which are made appropriate.

[0013] Technological innovation in golf ball and golf club is remarkable. In recent tour tournaments, the average flight distance at tee shots has been increasing. The large flight distance makes a second shot easy. The large flight distance impairs the public interest in tournaments.

[0014] The USGA is scheduled to change the rules about flight distance. The head speeds of professional golf players who participate in tournaments are high. The USGA will strengthen regulations on a flight distance upon hitting at a high head speed.

[0015] Meanwhile, there are no regulations on a flight distance upon hitting at a low head speed. Amateur golf players desire longer flight distances. A golf ball is desired which achieves a long flight distance when being hit at a low head speed while conforming to the rules of the USGA.

[0016] For golf players, in addition to flight distance, feeling is also important. Golf players place importance on hit feeling and trajectory feeling. Golf players prefer soft hit feeling. Furthermore, golf players prefer high trajectories.

[0017] An object of the present invention is to provide a golf ball which satisfies a golf player having a low head speed.

SUMMARY OF THE INVENTION

[0018] A golf ball according to the present invention includes a core and a cover positioned outside the core. The golf ball has a large number of dimples on a surface thereof. The cover has a Shore D hardness of equal to or greater than 30 but equal to or less than 50. The golf ball has an amount of compressive deformation of equal to or greater than 3.0 mm but equal to or less than 5.0 mm, the amount of compressive deformation being measured under conditions of an initial load of 98 N and a final load of 1274 N. The golf ball meets the following mathematical formula (I):

$$0.80 \leq ((L1+L2)/2) \geq 0.95 \quad (I),$$

where: L1 represents a ratio (CL1/CD1) of a lift coefficient CL1 relative to a drag coefficient CD1, the lift coefficient CL1 and the drag coefficient CD1 being measured under conditions of a Reynolds number of 1.290×10^5 and a spin rate of 2820 rpm; and L2 represents a ratio (CL2/CD2) of a lift coefficient CL2 relative to a drag coefficient CD2, the lift coefficient CL2 and the drag coefficient CD2 being measured under conditions of a Reynolds number of 1.771×10^5 and a spin rate of 2940 rpm.

[0019] When the golf ball according to the present invention is hit by a golf player having a low head speed, a sufficient flight distance is achieved. The golf ball provides preferable feeling to the golf player having a low head speed.

[0020] Preferably, a total volume of the dimples is equal to or greater than 430 mm^3 but equal to or less than 580 mm^3.

[0021] Preferably, the cover has a thickness of equal to or greater than 0.3 mm but equal to or less than 1.8 mm.

[0022] Preferably, the ratio L1 is equal to or greater than 0.85 but equal to or less than 0.93. Preferably, the ratio L2 is equal to or greater than 0.76 but equal to or less than 0.92.

[0023] Preferably, a ratio of a sum of spherical surface areas of the dimples relative to a surface area of a phantom sphere of the golf ball is equal to or greater than 0.780 but equal to or less than 0.950.

[0024] Preferably, a total number of the dimples is equal to or greater than 250 but equal to or less than 450.

[0025] Preferably, each dimple has a diameter Dm of equal to or greater than 2.0 mm but equal to or less than 6.0 mm.

[0026] Preferably, each dimple has a depth of equal to or greater than 0.10 mm but equal to or less than 0.60 mm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. **1** is a cross-sectional view of a golf ball according to one embodiment of the present invention;

[0028] FIG. **2** is an enlarged front view of the golf ball in FIG. **1**;

[0029] FIG. **3** is a plan view of the golf ball in FIG. **2**; and

[0030] FIG. **4** is a partially enlarged cross-sectional view of the golf ball in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] The following will describe in detail the present invention, based on preferred embodiments with reference to the accompanying drawings.

[0032] FIG. **1** is a partially cutaway cross-sectional view of a golf ball **2** according to one embodiment of the present invention. The golf ball **2** includes a spherical core **4** and a cover **6** positioned outside the core **4**. The core **4** includes a spherical center **8** and a mid layer **10** positioned outside the center **8**. The golf ball **2** includes a paint layer and a mark layer on the external side of the cover **6** although these layers are not shown in the drawing. Furthermore, the golf ball **2** has a large number of dimples **12** on the surface thereof. Of the surface of the golf ball **2**, the part other than the dimples **12** is a land **14**. The golf ball **2** may include another layer between the center **8** and the mid layer **10**. The golf ball **2** may include another layer between the mid layer **10** and the cover **6**.

[0033] The golf ball **2** preferably has a diameter of equal to or greater than 40 mm but equal to or less than 45 mm. From the standpoint of conformity to the rules established by the United States Golf Association (USGA), the diameter is particularly preferably equal to or greater than 42.67 mm. In light of suppression of air resistance, the diameter is more preferably equal to or less than 44 mm and particularly preferably equal to or less than 42.80 mm. The golf ball **2** preferably has a weight of equal to or greater than 40 g but equal to or less than 50 g. In light of attainment of great inertia, the weight is more preferably equal to or greater than 44 g and particularly preferably equal to or greater than 45.00 g. From the standpoint of conformity to the rules established by the USGA, the weight is particularly preferably equal to or less than 45.93 g.

[0034] The center **8** is obtained by crosslinking a rubber composition. Examples of preferable base rubbers for use in the rubber composition include polybutadienes, polyisoprenes, styrene-butadiene copolymers, ethylene-propylene-diene copolymers, and natural rubbers. In light of resilience performance, polybutadienes are preferred. When a polybutadiene and another rubber are used in combination, it is preferred if the polybutadiene is a principal component. Specifically, the proportion of the polybutadiene to the entire base rubber is preferably equal to or greater than 50% by weight and particularly preferably equal to or greater than 80% by weight. A polybutadiene in which the proportion of cis-1,4 bonds is equal to or greater than 80% is particularly preferred.

[0035] The rubber composition of the center **8** preferably includes a co-crosslinking agent. Preferable co-crosslinking agents in light of resilience performance are monovalent or bivalent metal salts of an α,β-unsaturated carboxylic acid having 2 to 8 carbon atoms. Examples of preferable co-crosslinking agents include zinc acrylate, magnesium acrylate, zinc methacrylate, and magnesium methacrylate. In light of resilience performance, zinc acrylate and zinc methacrylate are particularly preferred.

[0036] The rubber composition may include a metal oxide and an α,β-unsaturated carboxylic acid having 2 to 8 carbon atoms. They both react with each other in the rubber composition to obtain a salt. The salt serves as a co-crosslinking agent. Examples of preferable α,β-unsaturated carboxylic acids include acrylic acid and methacrylic acid. Examples of preferable metal oxides include zinc oxide and magnesium oxide.

[0037] In light of resilience performance of the golf ball **2**, the amount of the co-crosslinking agent per 100 parts by weight of the base rubber is preferably equal to or greater than 10 parts by weight and particularly preferably equal to or greater than 15 parts by weight. In light of soft feel at impact, the amount is preferably equal to or less than 50 parts by weight and particularly preferably equal to or less than 45 parts by weight.

[0038] Preferably, the rubber composition of the center **8** includes an organic peroxide together with the co-crosslinking agent. The organic peroxide serves as a crosslinking initiator. The organic peroxide contributes to the resilience performance of the golf ball **2**. Examples of suitable organic peroxides include dicumyl peroxide, 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, and di-t-butyl peroxide. An organic peroxide with particularly high versatility is dicumyl peroxide.

[0039] In light of resilience performance of the golf ball **2**, the amount of the organic peroxide per 100 parts by weight of the base rubber is preferably equal to or greater than 0.1 parts by weight, more preferably equal to or greater than 0.3 parts by weight, and particularly preferably equal to or greater than 0.5 parts by weight. In light of soft feel at impact, the amount is preferably equal to or less than 3.0 parts by weight, more preferably equal to or less than 2.8 parts by weight, and particularly preferably equal to or less than 2.5 parts by weight.

[0040] Preferably, the rubber composition of the center **8** includes an organic sulfur compound. Examples of preferable organic sulfur compounds include monosubstitutions such as diphenyl disulfide, bis(4-chlorophenyl)disulfide, bis(3-chlorophenyl)disulfide, bis(4-bromophenyl)disulfide, bis(3-bromophenyl)disulfide, bis(4-fluorophenyl)disulfide, bis(4-iodophenyl)disulfide, and bis(4-cyanophenyl)disulfide; disubstitutions such as bis(2,5-dichlorophenyl)disulfide, bis(3,5-dichlorophenyl)disulfide, bis(2,6-dichlorophenyl)disulfide, bis(2,5-dibromophenyl)disulfide, bis(3,5-dibromophenyl)disulfide, bis(2-chloro-5-bromophenyl)disulfide, and bis(2-cyano-5-bromophenyl)disulfide; trisubstitutions such as bis(2,4,6-trichlorophenyl)disulfide and bis(2-cyano-4-chloro-6-bromophenyl)disulfide; tetrasubstitutions such as bis(2,3,5,6-tetrachlorophenyl)disulfide; and pentasubstitutions such as bis(2,3,4,5,6-pentachlorophenyl)disulfide and bis(2,3,4,5,6-pentabromophenyl)disulfide. The organic sulfur compound contributes to resilience performance. Particularly preferable organic sulfur compounds are diphenyl disulfide and bis(pentabromophenyl)disulfide.

[0041] In light of resilience performance of the golf ball **2**, the amount of the organic sulfur compound per 100 parts by weight of the base rubber is preferably equal to or greater than 0.1 parts by weight and particularly preferably equal to or greater than 0.2 parts by weight. In light of soft feel at impact, the amount is preferably equal to or less than 1.5 parts by weight, more preferably equal to or less than 1.0 parts by weight, and particularly preferably equal to or less than 0.8 parts by weight.

[0042] For the purpose of adjusting specific gravity and the like, a filler may be included in the center **8**. Examples of suitable fillers include zinc oxide, barium sulfate, calcium carbonate, and magnesium carbonate. Powder of a metal with a high specific gravity may be included as a filler. Specific examples of metals with a high specific gravity include tungsten and molybdenum. The amount of the filler is determined as appropriate so that the intended specific gravity of the center **8** is accomplished. A particularly preferable filler is zinc oxide. Zinc oxide serves not only as a specific gravity adjuster but also as a crosslinking activator. According to need, various additives such as sulfur, an anti-aging agent, a coloring agent, a plasticizer, a dispersant, and the like are included in the rubber composition of the center **8** in an adequate amount. Crosslinked rubber powder or synthetic resin powder may also be included in the center **8**.

[0043] The center **8** preferably has a surface hardness H1 of equal to or greater than 35 but equal to or less than 60. The center **8** having a surface hardness H1 of equal to or greater than 35 can achieve excellent resilience performance. In this respect, the surface hardness H1 is more preferably equal to or greater than 40 and particularly preferably equal to or greater than 45. The center **8** having a surface hardness H1 of equal to or less than 60 can achieve excellent feel at impact. In this respect, the surface hardness H1 is more preferably equal to or less than 55 and particularly preferably equal to or less than 50. The surface hardness H1 is measured by pressing a Shore D type hardness scale against the surface of the center **8** from which the mid layer **10** and the cover **6** have been removed. For the measurement, an automated rubber hardness measurement machine (trade name "P1", manufactured by Kobunshi Keiki Co., Ltd.), to which this hardness scale is mounted, is used.

[0044] In light of feel at impact, the center **8** has an amount of compressive deformation DF1 of preferably equal to or greater than 3.5 mm, more preferably equal to or greater than 4.0 mm, and particularly preferably equal to or greater than 4.5 mm. In light of resilience performance, the amount of compressive deformation DF1 is preferably equal to or less than 6.5 mm, more preferably equal to or less than 6.0 mm, and particularly preferably equal to or less than 5.5 mm,

[0045] For measurement of the amount of compressive deformation, a YAMADA type compression tester is used. In the tester, a sphere (the center **8**, the core **4**, the golf ball **2**, etc.) which is an object to be measured is placed on a hard plate made of metal. Next, a cylinder made of metal gradually descends toward the sphere. The sphere, squeezed between the bottom face of the cylinder and the hard plate, becomes deformed. A migration distance of the cylinder, starting from the state in which an initial load of 98 N is applied to the sphere up to the state in which a final load of 1274 N is applied thereto, is measured. A moving speed of the cylinder until the initial load is applied is 0.83 mm/s, A moving speed of the cylinder after the initial speed is applied until the final load is applied is 1.67 mm/s. The atmospheric temperature at the measurement is 23° C. Prior to the measurement, the sphere is kept in a thermostat bath at 23° C. for 24 hours or longer.

[0046] The center **8** preferably has a diameter of equal to or greater than 35.0 mm but equal to or less than 40.0 mm. The center **8** preferably has a weight of equal to or greater than 30 g but equal to or less than 41 g. The temperature for crosslinking the center **8** is equal to or higher than 140° C. but equal to or lower than 180° C. The time period for crosslinking the center **8** is equal to or longer than 10 minutes but equal to or shorter than 60 minutes. The center **8** may include two or more layers. The center **8** may have a rib on the surface thereof. The center **8** may be hollow.

[0047] The mid layer **10** is formed from a thermoplastic resin composition. Examples of the base polymer of the resin composition include ionomer resins, thermoplastic polyester elastomers, thermoplastic polyamide elastomers, thermoplastic polyurethane elastomers, thermoplastic polyolefin elastomers, and thermoplastic polystyrene elastomers. Ionomer resins are particularly preferred. Ionomer resins are highly elastic. As described later, the cover **6** of the golf ball **2** is thin. When the golf ball **2** is hit, the mid layer **10** significantly deforms due to the thinness of the cover **6**. Therefore, the mid layer **10** greatly influences resilience performance. The golf ball **2** which includes the mid layer **10** including an ionomer resin has excellent resilience performance.

[0048] An ionomer resin and another resin may be used in combination. In this case, in light of resilience performance, the ionomer resin is included as the principal component of the base polymer. The proportion of the ionomer resin to the entire base polymer is preferably equal to or greater than 50% by weight, more preferably equal to or greater than 70% by weight, and particularly preferably equal to or greater than 85% by weight.

[0049] Examples of preferable ionomer resins include binary copolymers formed with an α-olefin and an α,β-unsaturated carboxylic acid having 3 to 8 carbon atoms. A preferable binary copolymer includes 80% by weight or more but 90% by weight or less of an α-olefin, and 10% by weight or more but 20% by weight or less of an α,β-unsaturated carboxylic acid. The binary copolymer has excellent resilience performance. Examples of other preferable ionomer resins include ternary copolymers formed with: an α-olefin; an α,β-unsaturated carboxylic acid having 3 to 8 carbon atoms; and an α,β-unsaturated carboxylate ester having 2 to 22 carbon atoms. A preferable ternary copolymer includes 70% by weight or more but 85% by weight or less of an α-olefin, 5% by weight or more but 30% by weight or less of an α,β-unsaturated carboxylic acid, and 1% by weight or more but 25% by weight or less of an α,β-unsaturated carboxylate ester. The ternary copolymer has excellent resilience performance. For the binary copolymer and the ternary copolymer, preferable α-olefins are ethylene and propylene, while preferable α,β-unsaturated carboxylic acids are acrylic acid and methacrylic acid. A particularly preferable ionomer resin is a copolymer formed with ethylene and acrylic acid. Another particularly preferable ionomer resin is a copolymer formed with ethylene and methacrylic acid.

[0050] In the binary copolymer and the ternary copolymer, some of the carboxyl groups are neutralized with metal ions. Examples of metal ions for use in neutralization include sodium ion, potassium ion, lithium ion, zinc ion, calcium ion, magnesium ion, aluminum ion, and neodymium ion. The neutralization may be carried out with two or more types of metal ions. Particularly suitable metal ions in light of resilience performance and durability of the golf ball **2** are sodium ion, zinc ion, lithium ion, and magnesium ion.

[0051] Specific examples of ionomer resins include trade names "Himilan 1555", "Himilan 1557", "Himilan 1605", "Himilan 1706", "Himilan 1707", "Himilan 1856", "Himilan 1855", "Himilan AM7311", "Himilan AM7315", "Himilan AM7317", "Himilan AM7329", and "Himilan AM7337", manufactured by Du Pont-MITSUI POLYCHEMICALS Co., Ltd.; trade names "Surlyn 6120", "Surlyn 6910", "Surlyn 7930", "Surlyn 7940", "Surlyn 8140", "Surlyn 8150", "Surlyn 8940", "Surlyn 8945", "Surlyn 9120", "Surlyn 9150", "Surlyn 9910", "Surlyn 9945", "Surlyn AD8546", "HPF1000", and "HPF2000", manufactured by E.I. du Pont de Nemours and Company; and trade names "IOTEK 7010", "IOTEK 7030", "IOTEK 7510", "IOTEK 7520", "IOTEK 8000", and "IOTEK 8030", manufactured by ExxonMobil Chemical Corporation. Two or more ionomer resins may be used in combination.

[0052] For the purpose of adjusting specific gravity and the like, a filler may be included in the resin composition of the mid layer **10**. Examples of suitable fillers include zinc oxide, barium sulfate, calcium carbonate, and magnesium carbonate. Powder of a metal with a high specific gravity may be included as a filler. Specific examples of metals with a high specific gravity include tungsten and molybdenum. The amount of the filler is determined as appropriate so that the intended specific gravity of the mid layer **10** is accomplished. A coloring agent, crosslinked rubber powder, or synthetic resin powder may also be included in the mid layer **10**.

[0053] The mid layer **10** has a thickness of preferably equal to or greater than 0.5 mm and more preferably equal to or greater than 1.0 mm. The thickness is preferably equal to or less than 2.0 mm and more preferably equal to or less than 1.8 mm.

[0054] The mid layer **10** has a hardness H2 of preferably equal to or greater than 55, more preferably equal to or greater than 60, and particularly preferably equal to or greater than 63. The hardness H2 is preferably equal to or less than 75, more preferably equal to or less than 72, and particularly preferably equal to or less than 70.

[0055] In the present invention, the hardness H2 of the mid layer **10** and a hardness H3 of the cover **6** are measured according to the standards of "ASTM-D 2240-68". For the measurement, an automated rubber hardness measurement machine (trade name "P1", manufactured by Kobunshi Keiki Co., Ltd.), to which a Shore D type hardness scale is mounted, is used. For the measurement, a sheet that is formed by hot press, is formed from the same material as that of the mid layer **10** (or the cover **6**), and has a thickness of about 2 mm is used. Prior to the measurement, a sheet is kept at 23° C. for two weeks. At the measurement, three sheets are stacked.

[0056] The core **4** (i.e., the center **8** and the mid layer **10**) preferably has a diameter of equal to or greater than 41.0 mm but equal to or less than 42.0 mm. The core **4** preferably has a weight of equal to or greater than 42.0 g but equal to or less than 44.0 g. The core **4** preferably has an amount of compressive deformation DF2 of equal to or greater than 3.0 mm but equal to or less than 5.0 mm.

[0057] The cover **6** is formed from a resin composition. Examples of the base resin of the resin composition include polyurethanes, polyamide elastomers, styrene block-containing thermoplastic elastomers, polyester elastomers, polyolefin elastomers, and ionomer resins.

[0058] A preferable base polymer is a polyurethane. The resin composition may include a thermoplastic polyurethane, or may include a thermosetting polyurethane. In light of productivity, the thermoplastic polyurethane is preferable. The thermoplastic polyurethane includes a polyurethane component as a hard segment, and a polyester component or a polyether component as a soft segment. The thermoplastic polyurethane is flexible. The cover **6** in which the polyurethane is used has excellent scuff resistance. When a thermoplastic polyurethane and another resin are used in combination for the cover **6**, the proportion of the thermoplastic polyurethane to the entire base resin is preferably equal to or greater than 50% by weight, more preferably equal to or greater than 60% by weight, and particularly preferably equal to or greater than 70% by weight.

[0059] The thermoplastic polyurethane has a urethane bond within the molecule. The urethane bond can be formed by reacting a polyol with a polyisocyanate. The polyol, as a material for the urethane bond, has a plurality of hydroxyl groups. Low-molecular-weight polyols and high-molecular-weight polyols can be used.

[0060] Examples of low-molecular-weight polyols include diols, triols, tetraols, and hexaols. Specific examples of diols include ethylene glycol, diethylene glycol, triethylene glycol, 1,2-propanediol, 1,3-propanediol, 2-methyl-1,3-propanediol, dipropylene glycol, 1,2-butanediol, 1,3-butanediol, 1,4-butanediol, 2,3-butanediol, 2,3-dimethyl-2,3-butanediol, neopentyl glycol, pentanediol, hexanediol, heptanediol, octanediol, and 1,6-cyclohexanedimethylol. Aniline-based diols or bisphenol A-based diols may be used. Specific examples of triols include glycerin, trimethylol propane, and hexanetriol. Specific examples of tetraols include pentaerythritol and sorbitol.

[0061] Examples of high-molecular-weight polyols include polyether polyols such as polyoxyethylene glycol (PEG), polyoxypropylene glycol (PPG), and polytetramethylene ether glycol (PTMG); condensed polyester polyols such as polyethylene adipate (PEA), polybutylene adipate (PBA), and polyhexamethylene adipate (PHMA); lactone polyester polyols such as poly-ϵ-caprolactone (PCL); polycarbonate polyols such as polyhexamethylene carbonate; and acrylic polyols. Two or more polyols may be used in combination. In light of feel at impact of the golf ball **2**, the high-molecular-weight polyol has a number average molecular weight of preferably equal to or greater than 400 and more preferably equal to or greater than 1000. The number average molecular weight is preferably equal to or less than 10000.

[0062] Examples of polyisocyanates, as a material for the urethane bond, include aromatic diisocyanates, alicyclic diisocyanates, and aliphatic diisocyanates. Two or more types of diisocyanates may be used in combination,

[0063] Examples of aromatic diisocyanates include 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 4,4'-diphenylmethane diisocyanate (MDI), 1,5-naphthylene diisocyanate (NDI), 3,3'-bitolylene-4,4'-diisocyanate (TODI), xylylene diisocyanate (XDI), tetramethylxylylene diisocyanate (TMXDI), and paraphenylene diisocyanate (PPDI). One example of aliphatic diisocyanates is hexamethylene diisocyanate (HDI). Examples of alicyclic diisocyanates include 4,4'-dicyclohexylmethane diisocyanate ($H_{12}MDI$), 1,3-bis (isocyanatemethyl)cyclohexane (H_6XDI) isophorone diisocyanate (IPDI), and trans-1,4-cyclohexane diisocyanate (CHDI). 4,4'-dicyclohexylmethane diisocyanate is preferable.

[0064] Specific examples of the thermoplastic polyurethane include trade names "Elastollan XNY80A", "Elastollan XNY82A", "Elastollan XNY85A", "Elastollan XNY90A", "Elastollan XNY97A", "Elastollan XNY585", and "Elastollan XKP016N", manufactured by BASF Japan Ltd.; and trade names "RESAMINE P4585LS" and "RESAMINE PS62490", manufactured by Dainichiseika Color & Chemicals Mfg. Co., Ltd.

[0065] According to need, a coloring agent such as titanium dioxide, a filler such as barium sulfate, a dispersant, an antioxidant, an ultraviolet absorber, a light stabilizer, a fluorescent material, a fluorescent brightener, and the like are included in the resin composition of the cover **6** in an adequate amount.

[0066] The cover **6** preferably has a hardness H3 of equal to or greater than 30 but equal to or less than 50. The golf ball **2** having a hardness H3 of equal to or greater than 30 has excellent resilience performance. When the golf ball **2** is hit by an amateur golf player, a long flight distance is achieved. In this respect, the hardness H3 is more preferably equal to or greater than 31 and particularly preferably equal to or greater than 32. The golf ball **2** having a hardness H3 of equal to or less than 50 has excellent spin performance. The spin achieves a high trajectory of the golf ball **2**. When the golf ball **2** is hit by an amateur golf player, excellent trajectory feeling is obtained. In this respect, the hardness H3 is more preferably equal to or less than 45 and particularly preferably equal to or less than 40.

[0067] The cover **6** preferably has a thickness of equal to or greater than 0.3 mm but equal to or less than 1.8 mm. The golf ball **2** in which the thickness of the cover **6** is equal to or greater than 0.3 mm has excellent spin performance. The spin achieves a high trajectory of the golf ball **2**. When the golf ball **2** is hit by an amateur golf player, excellent trajectory feeling is obtained. In this respect, the thickness is more preferably equal to or greater than 0.4 mm and particularly preferably equal to or greater than 0.5 mm. The golf ball **2** in which the thickness is equal to or less than 1.8 mm has excellent resilience performance. When the golf ball **2** is hit by an amateur golf player, a long flight distance is achieved. Furthermore, the golf ball **2** in which the thickness of the cover **6** is equal to or less than 1.8 mm is excellent in hit feeling. In these respects, the thickness is more preferably equal to or less than 1.0 mm and particularly preferably equal to or less than 0.8 mm.

[0068] The golf ball **2** may include a reinforcing layer between the mid layer **10** and the cover **6**. The reinforcing layer firmly adheres to the mid layer **10** and also to the cover **6**. The reinforcing layer suppresses separation of the mid layer **10** from the cover **6**. The reinforcing layer is formed from a resin composition. Examples of a preferable base polymer of the reinforcing layer include two-component curing type epoxy resins and two-component curing type urethane resins.

[0069] The golf ball **2** has an amount of compressive deformation DF3 of equal to or greater than 3.0 mm but equal to or less than 5.0 mm. The golf ball **2** having an amount of compressive deformation DF3 of equal to or greater than 3.0 mm does not have excessive resilience performance. The golf ball **2** can conform to the rules about flight distance established by the USGA. Furthermore, with the golf ball **2** having an amount of compressive deformation DF3 of equal to or greater than 3.0 mm, soft hit feeling is obtained. In these respects, the amount of compressive deformation DF3 is more preferably equal to or greater than 3.5 mm and particularly preferably equal to or greater than 3.8 mm. The golf ball **2** having an amount of compressive deformation DF3 of equal to or less than 5.0 mm has excellent resilience performance. In this respect, the amount of compressive deformation DF3 is more preferably equal to or less than 4.7 mm and particularly preferably equal to or less than 4.5 mm.

[0070] As shown in FIGS. **2** and **3**, the contour of each dimple **12** is circular. The golf ball **2** has dimples A each having a diameter of 4.6 mm; dimples B each having a diameter of 4.4 mm; dimples C each having a diameter of 4.2 mm; dimples D each having a diameter of 4.0 mm; dimples E each having a diameter of 3.9 mm; and dimples F each having a diameter of 2.6 mm. The number of types of the dimples **12** is six. The golf ball **2** may have non-circular dimples instead of the circular dimples **12** or together with circular dimples **12**.

[0071] The number of the dimples A is 42; the number of the dimples B is 72; the number of the dimples C is 66; the number of the dimples D is 126; the number of the dimples E is 12; and the number of the dimples F is 12. The total number of the dimples **12** is 330.

[0072] FIG. **4** shows a cross section along a plane passing through the center of the dimple **12** and the center of the golf ball **2**. In FIG. **4**, the top-to-bottom direction is the depth direction of the dimple **12**. In FIG. **4**, a chain double-dashed line indicates a phantom sphere **16**. The surface of the phantom sphere **16** is the surface of the golf ball **2** when it is postulated that no dimple **12** exists. The dimple **12** is recessed from the surface of the phantom sphere **16**. The land **14** coincides with the surface of the phantom sphere **16**. In the present embodiment, the cross-sectional shape of each dimple **12** is substantially a circular arc.

[0073] In FIG. **4**, a double ended arrow Dm indicates the diameter of the dimple **12**. The diameter Dm is the distance between two tangent points Ed appearing on a tangent line Tg that is drawn tangent to the far opposite ends of the dimple **12**. Each tangent point Ed is also the edge of the dimple **12**. The edge Ed defines the contour of the dimple **12**. In FIG. **4**, a double ended arrow Dp indicates the depth of the dimple **12**. The depth Dp is the distance between the deepest part of the dimple **12** and the phantom sphere **16**.

[0074] The diameter Dm of each dimple **12** is preferably equal to or greater than 2.0 mm but equal to or less than 6.0 mm. The dimple **12** having a diameter Dm of equal to or greater than 2.0 mm contributes to turbulization. In this respect, the diameter Dm is more preferably equal to or greater than 2.5 mm and particularly preferably equal to or greater than 2.8 mm. The dimple **12** having a diameter Dm of equal to or less than 6.0 mm does not impair a fundamental feature of the golf ball **2** that the golf ball **2** is substantially a sphere. In this respect, the diameter Dm is more preferably equal to or less than 5.5 mm and particularly preferably equal to or less than 5.0 mm.

[0075] In light of suppression of rising of the golf ball **2** during flight, the depth Dp of each dimple **12** is preferably equal to or greater than 0.10 mm, more preferably equal to or greater than 0.13 mm, and particularly preferably equal to or greater than 0.15 mm. In light of suppression of dropping of the golf ball **2** during flight, the depth Dp is preferably equal to or less than 0.60 mm, more preferably equal to or less than 0.55 mm, and particularly preferably equal to or less than 0.50 mm.

[0076] The spherical surface area s of each dimple **12** is the area of a zone surrounded by the contour line of the dimple **12**, of the surface of the phantom sphere **16** of the golf ball **2**. In the golf ball **2** shown in FIGS. **2** and **3**, the spherical surface area s of each dimple A is 16.61 mm^2; the spherical surface area s of each dimple B is 15.20 mm^2; the spherical surface area s of each dimple C is 13.85 mm^2; the spherical surface area s of each dimple D is 12.56 mm^2; the spherical surface area s of each dimple E is 11.94 mm^2; and the spherical surface area s of each dimple F is 5.31 mm^2.

[0077] The ratio of the sum of the spherical surface areas s of all the dimples **12** to the surface area of the phantom sphere **16** is referred to as an occupation ratio. In light of turbulization, the occupation ratio is preferably equal to or greater than 0.780, more preferably equal to or greater than 0.800, and particularly preferably equal to or greater than 0.840. The occupation ratio is preferably equal to or less than 0.950. In the golf ball **2** shown in FIGS. **2** and **3**, the sum of the spherical surface areas s is 4495.3 mm^2. The surface area of the phantom sphere **16** of the golf ball **2** is 5728.0 mm^2, and thus the occupation ratio is 0.785.

[0078] From the standpoint that a sufficient occupation ratio is achieved, the total number of the dimples **12** is preferably equal to or greater than 250, more preferably equal to or greater than 280, and particularly preferably equal to or greater than 300. From the standpoint that each dimple **12** can contribute to turbulization, the total number of the dimples **12** is preferably equal to or less than 450, more preferably equal to or less than 400, and particularly preferably equal to or less than 380.

[0079] In the present invention, the "volume of the dimple" means the volume of a portion surrounded by the phantom sphere **16** and the surface of the dimple **12**. The total volume of the dimples **12** of the golf ball **2** is preferably equal to or less than 580 mm^3. With the golf ball **2** in which the total volume is equal to or less than 580 mm^3, a high trajectory is achieved. When the golf ball **2** is hit by an amateur golf player, excellent trajectory feeling is obtained. In this respect, the total volume is more preferably equal to or less than 560 mm^3 and particularly preferably equal to or less than 550 mm^3. In light of suppression of rising of the golf ball **2** during flight, the total volume is preferably equal to or greater than 430 mm^3.

[0080] The golf ball **2** meets the following mathematical formula (I):

$$0.80 \leq ((L1+L2)/2) \leq 0.95 \quad (I),$$

where: L1 represents the ratio (CL1/CD1) of a lift coefficient CL1 relative to a drag coefficient CD1, the lift coefficient CL1 and the drag coefficient CD1 being measured under conditions of a Reynolds number of 1.290×10^5 and a spin rate of 2820 rpm; and L2 represents the ratio (CL2/CD2) of a lift coefficient CL2 relative to a drag coefficient CD2, the lift coefficient CL2 and the drag coefficient CD2 being measured under conditions of a Reynolds number of 1.771×10^5 and a spin rate of 2940 rpm. The lift coefficients and the drag coefficients are measured according to the Indoor Test Range (ITR) determined by the USGA.

[0081] A Reynolds number is a dimensionless number used in the field of fluid mechanics. A Reynolds number (Re) can be calculated by the following mathematical formula:

$$Re=\rho vL/\mu,$$

where, ρ represents the density of a fluid, v represents a speed of an object, L represents a characteristic length, and μ represents a viscosity coefficient of the fluid.

[0082] As described above, the Reynolds number at the measurements of the lift coefficient CL1 and the drag coefficient CD1 is 1.290×10^5. Regarding the golf ball **2** which flies in the air, this Reynolds number corresponds to a ball speed when the golf ball **2** is launched with a driver at a head speed of 35 m/s. The spin rate at the measurements of the lift coefficient CL1 and the drag coefficient CD1 is 2820 rpm. This spin rate is an average value of a golf player having a head speed of 35 m/s. For measurement of the ratio L1, a golf player having a head speed of 35 m/s is assumed.

[0083] As described above, the Reynolds number at the measurements of the lift coefficient CL2 and the drag coefficient CD2 is 1.771×10^5. Regarding the golf ball **2** which flies in the air, this Reynolds number corresponds to a ball speed when the golf ball **2** is launched with a driver at a head speed of 45 m/s. The spin rate at the measurements of the lift coefficient CL2 and the drag coefficient CD2 is 2940 rpm. This spin rate is an average value of a golf player having a head speed of 45 m/s. For measurement of the ratio L2, a golf player having a head speed of 45 m/s is assumed.

[0084] Many amateur golf players have a head speed of equal to or greater than 35 m/s but equal to or less than 45 m/s. In the above mathematical formula (I), the ratio L1 corresponding to a head speed of 35 m/s and the ratio L2 corresponding to a head speed of 45 m/s are averaged. The golf ball **2** in which an average value ((L1+L2)/2) is equal to or greater than 0.80 but equal to or less than 0.95 is suitable for many amateur golf players.

[0085] When the golf ball **2** in which the average value ((L1+L2)/2) is equal to or greater than 0.80 is hit by an amateur golf player, a high trajectory is achieved. Although the golf ball **2** conforms to the rules of the USGA about flight distance, the golf player feels satisfied with the trajectory. The golf ball **2** is excellent in trajectory feeling. In this respect, the average value ((L1+L2)/2) is more preferably equal to or greater than 0.84 and particularly preferably equal to or greater than 0.88.

[0086] The golf ball **2** in which the average value ((L1+L2)/2) is equal to or less than 0.95 is less likely to rise during flight. In this respect, the average value ((L1+L2)/2) is more preferably equal to or less than 0.93 and particularly preferably equal to or less than 0.92.

[0087] The average value ((L1+L2)/2) can be achieved in the above range by making the specifications of the dimples **12** appropriate. Specifically, the ratio L1 and the ratio L2 can be made appropriate to achieve the average value ((L1+L2)/2) in the above range, by means such as:

[0088] (1) making the depth of each dimple **12** appropriate;

[0089] (2) making the area of each dimple **12** appropriate;

[0090] (3) making the volume of each dimple **12** appropriate;

[0091] (4) making the number of the dimples **12** appropriate;

[0092] (5) making the occupation ratio of the dimples **12** appropriate; and the like.

[0093] The ratio L1 is preferably equal to or greater than 0.85 but equal to or less than 0.93. When the golf ball **2** having a ratio L1 of equal to or greater than 0.85 is hit with a driver at a head speed of 35 m/s, a high trajectory is achieved. Although the golf ball **2** conforms to the rules of the USGA about flight distance, the golf player feels satisfied with the trajectory. The golf ball **2** is excellent in trajectory feeling. In this respect, the ratio L1 is more preferably equal to or greater than 0.87 and particularly preferably equal to or greater than 0.88. The golf ball **2** having a ratio L1 of equal to or less than 0.93 is less likely to rise during flight. In this respect, the ratio L1 is particularly preferably equal to or less than 0.92.

[0094] The ratio L2 is preferably equal to or greater than 0.76 but equal to or less than 0.92. When the golf ball **2** having a ratio L2 of equal to or greater than 0.76 is hit with a driver at a head speed of 45 m/s, a high trajectory is achieved. Although the golf ball **2** conforms to the rules of the USGA about flight distance, the golf player feels satisfied with the trajectory. The golf ball **2** is excellent in trajectory feeling. In this respect, the ratio L2 is more preferably equal to or greater than 0.80 and particularly preferably equal to or greater than 0.86. The golf ball **2** having a ratio L2 of equal to or less than 0.92 is less likely to rise during flight. In this respect, the ratio L2 is particularly preferably equal to or less than 0.91.

EXAMPLES

Example 1

[0095] A rubber composition was obtained by kneading 100 parts by weight of a high-cis polybutadiene (trade name "BR-730", manufactured by JSR Corporation), 22.5 parts by weight of zinc diacrylate, 5 parts by weight of zinc oxide, an appropriate amount of barium sulfate, 0.5 parts by weight of diphenyl disulfide, and 0.6 parts by weight of dicumyl peroxide. This rubber composition was placed into a mold including upper and lower mold halves each having a hemispherical cavity, and heated at 170° C. for 18 minutes to obtain a center with a diameter of 38.5 mm.

[0096] A resin composition was obtained by kneading 50 parts by weight of an ionomer resin (trade name "Himilan 1605", manufactured by Du Pont-MITSUI POLYCHEMICALS Co., Ltd.), 50 parts by weight of another ionomer resin ("Himilan AM7329", manufactured by Du Pont-MITSUI POLYCHEMICALS Co., Ltd.), and 4 parts by weight of titanium dioxide with a twin-screw kneading extruder. The center was covered with the resin composition by injection molding to form a mid layer with a thickness of 1.6 mm.

[0097] A paint composition (trade name "POLIN 750LE", manufactured by SHINTO PAINT CO., LTD.) including a two-component curing type epoxy resin as a base polymer was prepared. The base material liquid of this paint composition includes 30 parts by weight of a bisphenol A type solid epoxy resin and 70 parts by weight of a solvent. The curing agent liquid of this paint composition includes 40 parts by weight of a modified polyamide amine, 55 parts by weight of a solvent, and 5 parts by weight of titanium dioxide. The weight ratio of the base material liquid to the curing agent liquid is 1/1. This paint composition was applied to the surface of the mid layer with a spray gun, and kept at 23° C. for 6 hours to obtain a reinforcing layer with a thickness of 10 μm.

[0098] A resin composition was obtained by kneading 100 parts by weight of a thermoplastic polyurethane elastomer (trade name "Elastollan XNY85A", manufactured by BASF Japan Ltd.) and 4 parts by weight of titanium dioxide with a twin-screw kneading extruder. Half shells were formed from this resin composition by compression molding. The sphere consisting of the center, the mid layer, and the reinforcing layer was covered with two of these half shells. The half shells and the sphere were placed into a final mold that includes upper and lower mold halves each having a hemispherical cavity and having a large number of pimples on its cavity face, and a cover was obtained by compression molding. The thickness of the cover was 0.5 mm. Dimples having a shape that is the inverted shape of the pimples were formed on the cover. A clear paint including a two-component curing type polyurethane as a base material was applied to this cover to obtain a golf ball of Example 1 with a diameter of about 42.7 mm and a weight of about 45.6 g. The golf ball has dimple specifications D3 shown in Table 1 below.

Examples 2 to 11 and Comparative Examples 1 to 9

[0099] Golf balls of Examples 2 to 11 and Comparative Examples 1 to 9 were obtained in the same manner as Example 1, except the specifications of the center, the mid layer, the cover, and the dimples were as shown in Tables 5 to 8 below. The composition of the center is shown in detail in Table 1 below. The compositions of the mid layer and the cover are shown in detail in Table 2 below. The specifications of the dimples are shown in detail in Tables 3 and 4 below.

[0100] [Flight Test]

[0101] A driver with a head made of a titanium alloy (trade name "XXIO", manufactured by DUNLOP SPORTS CO. LTD., shaft hardness: R, loft angle: 11°) was attached to a swing machine manufactured by Golf Laboratories, Inc. A golf ball was hit under a condition of a head speed of 40 m/sec, and a ball speed, a launch angle, a spin rate, highest point coordinates (x,y), and a carry were measured. The coordinate x is the horizontal distance from the launch point to the highest point. The coordinate y is the vertical distance from the launch point to the highest point. The carry is the distance from the launch point to the landing point. The results are shown in Tables 9 to 12 below.

[0102] [Sensuous Evaluation]

[0103] Ten testers hit golf balls with drivers and evaluated trajectory feeling and hit feeling. The evaluation was categorized on the basis of the following criteria. The results are shown in Tables 9 to 12 below.

[0104] Trajectory feeling: the number of testers who feel that a flight distance is long.

[0105] A: 8 or more

[0106] B: 5 to 7

[0107] C: 2 to 4

[0108] D: 1 or less

[0109] Hit feeling: the number of tester who feel soft.

[0110] A: 8 or more

[0111] B: 5 to 7

[0112] C: 2 to 4

[0113] D: 1 or less

TABLE 1

Composition of Center (parts by weight)

	T1	T2	T3	T4	T5
BR730	100	100	100	100	100
Zinc diacrylate	18.5	20.0	22.5	26.5	27.5
Zinc oxide	5	5	5	5	5
Barium sulfate	*	*	*	*	*
Diphenyl disulfide	0.5	0.5	0.5	0.5	0.5
Dicumyl peroxide	0.5	0.5	0.6	0.7	0.7

*: Appropriate amount

TABLE 2

Compositions of Mid Layer and Cover

(parts by weight)

	M1	C1	C2	C3	C4	C5
Himilan #1605	50					
Himilan AM7329	50					50
Himilan AM7337						24
Rabalon T3221C						26
Barium sulfate						17
Elastollan XNY82A		100				

TABLE 2-continued

Compositions of Mid Layer and Cover

	M1	C1	C2	C3	C4	C5
					(parts by weight)	
Elastollan XNY85A			100			
Elastollan XNY90A				100		
Elastollan XNY97A					100	
Titanium dioxide	4	4	4	4	4	6
Hardness (Shore D)	65	29	32	38	47	52

TABLE 3

Specifications of Dimples

	Type	Number of dimples	Diameter (mm)	Depth (mm)	Volume (mm^3)
D1	A	42	4.6	0.224	1.865
	B	72	4.4	0.214	1.626
	C	66	4.2	0.183	1.272
	D	126	4.0	0.164	1.030
	E	12	3.9	0.149	0.892
	F	12	2.6	0.100	0.265
D2	A	42	4.6	0.244	2.032
	B	72	4.4	0.234	1.778
	C	66	4.2	0.203	1.411
	D	126	4.0	0.184	1.156
	E	12	3.9	0.169	1.011
	F	12	2.6	0.120	0.318
D3	A	42	4.6	0.264	2.198
	B	72	4.4	0.254	1.931
	C	66	4.2	0.223	1.550
	D	126	4.0	0.204	1.282
	E	12	3.9	0.189	1.131
	F	12	2.6	0.140	0.371
D4	A	42	4.6	0.274	2.282
	B	72	4.4	0.264	2.007
	C	66	4.2	0.233	1.619
	D	126	4.0	0.214	1.345
	E	12	3.9	0.199	1.191
	F	12	2.6	0.150	0.398

TABLE 4

Specifications of Dimples

	Type	Number of dimples	Diameter (mm)	Depth (mm)	Volume (mm^3)
D5	A	42	4.6	0.284	2.365
	B	72	4.4	0.274	2.083
	C	66	4.2	0.243	1.689
	D	126	4.0	0.224	1.408
	E	12	3.9	0.209	1.251
	F	12	2.6	0.160	0.425
D6	A	42	4.6	0.294	2.449
	B	72	4.4	0.284	2.160
	C	66	4.2	0.253	1.759
	D	126	4.0	0.234	1.471
	E	12	3.9	0.219	1.311
	F	12	2.6	0.170	0.451
D7	A	42	4.6	0.334	2.783
	B	72	4.4	0.324	2.466
	C	66	4.2	0.293	2.038
	D	126	4.0	0.274	1.724

TABLE 4-continued

Specifications of Dimples

Type	Number of dimples	Diameter (mm)	Depth (mm)	Volume (mm^3)
E	12	3.9	0.259	1.551
F	12	2.6	0.210	0.559

TABLE 5

Specifications of Golf Ball

		Comp. Ex. 3	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Center	Composition	T3	T3	T3	T3	T3
	Diameter	38.50	38.50	38.50	38.50	38.50
	H1 (D)	46	46	46	46	46
	DF1 (mm)	5.05	5.05	5.05	5.05	5.05
	Weight (g)	35.0	35.0	35.0	35.0	35.0
Mid layer	Composition	M1	M1	M1	M1	M1
	Thickness (mm)	1.60	1.60	1.60	1.60	1.60
	H2 (D)	65	65	65	65	65
	Diameter	41.70	41.70	41.70	41.70	41.70
Core	DF2 (mm)	4.30	4.30	4.30	4.30	4.30
	Weight (g)	43.4	43.4	43.4	43.4	43.4
Cover	Composition	C2	C2	C2	C2	C2
	Thickness (mm)	0.50	0.50	0.50	0.50	0.50
	H3 (D)	32	32	32	32	32
Ball	Diameter	42.70	42.70	42.70	42.70	42.70
	DF3 (mm)	4.10	4.10	4.10	4.10	4.10
	Weight (g)	45.6	45.6	45.6	45.6	45.6
Dimple	Specifications	D1	D2	D3	D4	D5
	Total volume (mm^3)	423	468	513	536	558
	CD1	0.311	0.287	0.274	0.238	0.233
	CL1	0.301	0.266	0.252	0.211	0.198
	L1	0.968	0.928	0.918	0.887	0.852
	CD2	0.255	0.243	0.229	0.225	0.224
	CL2	0.241	0.221	0.196	0.180	0.171
	L2	0.945	0.912	0.860	0.801	0.761
	(L1 + L2)/2	0.956	0.920	0.889	0.844	0.806

TABLE 6

Specifications of Golf Ball

		Comp. Ex. 4	Comp. Ex. 5	Comp. Ex. 6	Ex. 5	Ex. 6
Center	Composition	T3	T3	T1	T2	T4
	Diameter	38.50	38.50	38.50	38.50	38.50
	H1 (D)	46	46	38	42	51
	DF1 (mm)	5.05	5.05	6.05	5.75	4.05
	Weight (g)	35.0	35.0	35.0	35.0	35.0
Mid layer	Composition	M1	M1	M1	M1	M1
	Thickness (mm)	1.60	1.60	1.60	1.60	1.60
	H2 (D)	65	65	65	65	65
	Diameter	41.70	41.70	41.70	41.70	41.70
Core	DF2 (mm)	4.30	4.30	5.30	5.00	3.30
	Weight (g)	43.4	43.4	43.4	43.4	43.4
Cover	Composition	C2	C2	C2	C2	C2
	Thickness (mm)	0.50	0.50	0.50	0.50	0.50
	H3 (D)	32	32	32	32	32
Ball	Diameter	42.70	42.70	42.70	42.70	42.70
	DF3 (mm)	4.10	4.10	5.10	4.80	3.10
	Weight (g)	45.6	45.6	45.6	45.6	45.6

TABLE 6-continued

Specifications of Golf Ball

		Comp. Ex. 4	Comp. Ex. 5	Comp. Ex. 6	Ex. 5	Ex. 6
Dimple	Specifications	D6	D7	D3	D3	D3
	Total volume (mm^3)	581	672	513	513	513
	CD1	0.235	0.238	0.274	0.274	0.274
	CL1	0.197	0.169	0.252	0.252	0.252
	L1	0.839	0.709	0.918	0.918	0.918
	CD2	0.228	0.235	0.229	0.229	0.229
	CL2	0.170	0.155	0.196	0.196	0.196
	L2	0.745	0.661	0.860	0.860	0.860
	(L1 + L2)/2	0.792	0.685	0.889	0.889	0.889

TABLE 7

Specifications of Golf Ball

		Comp. Ex. 7	Comp. Ex. 8	Ex. 7	Ex. 8	Comp. Ex. 9
Center	Composition	T5	T3	T3	T3	T3
	Diameter	38.50	38.50	38.50	38.50	38.50
	H1 (D)	54	46	46	46	46
	DF1 (mm)	3.85	5.05	5.05	5.05	5.05
	Weight (g)	35.0	35.0	35.0	35.0	35.0
Mid layer	Composition	M1	M1	M1	M1	M1
	Thickness (mm)	1.60	1.60	1.60	1.60	1.60
	H2 (D)	65	65	65	65	65
	Diameter	41.70	41.70	41.70	41.70	41.70
Core	DF2 (mm)	3.10	4.30	4.30	4.30	4.30
	Weight (g)	43.4	43.4	43.4	43.4	43.4
Cover	Composition	C2	C1	C3	C4	C5
	Thickness (mm)	0.50	0.50	0.50	0.50	0.50
	H3 (D)	32	29	38	47	53
Ball	Diameter	42.70	42.70	42.70	42.70	42.70
	DF3 (mm)	2.85	4.15	4.05	4.00	3.95
	Weight (g)	45.6	45.6	45.6	45.6	45.6
Dimple	Specifications	D3	D3	D3	D3	D3
	Total volume (mm^3)	513	513	513	513	513
	CD1	0.274	0.274	0.274	0.274	0.274
	CL1	0.252	0.252	0.252	0.252	0.252
	L1	0.918	0.918	0.918	0.918	0.918
	CD2	0.229	0.229	0.229	0.229	0.229
	CL2	0.196	0.196	0.196	0.196	0.196
	L2	0.860	0.860	0.860	0.860	0.860
	(L1 + L2)/2	0.889	0.889	0.889	0.889	0.889

TABLE 8

Specifications of Golf Ball

		Ex. 9	Ex. 10	Ex. 11	Comp. Ex. 1	Comp. Ex. 2
Center	Composition	T3	T3	T3	T4	T4
	Diameter	37.50	36.50	35.50	38.50	38.50
	H1 (D)	46	46	46	51	51
	DF1 (mm)	5.05	5.05	5.05	4.05	4.05
	Weight (g)	32.3	29.8	27.4	35.0	35.0
Mid layer	Composition	M1	M1	M1	M1	M1
	Thickness (mm)	1.60	1.60	1.60	1.60	1.60
	H2 (D)	65	65	65	65	65
	Diameter	40.70	39.70	38.70	41.70	41.70
Core	DF2 (mm)	4.30	4.30	4.30	3.30	3.30
	Weight (g)	40.3	37.4	34.6	43.4	43.4

TABLE 8-continued

Specifications of Golf Ball

		Ex. 9	Ex. 10	Ex. 11	Comp. Ex. 1	Comp. Ex. 2
Cover	Composition	C4	C4	C4	C3	C3
	Thickness (mm)	1.00	1.50	2.00	0.50	0.50
	H3 (D)	47	47	47	38	38
Ball	Diameter	42.70	42.70	42.70	42.70	42.70
	DF3 (mm)	4.05	4.10	4.15	3.05	3.05
	Weight (g)	45.6	45.6	45.6	45.6	45.6
Dimple	Specifications	D3	D3	D3	D6	D7
	Total volume (mm^3)	513	513	513	581	672
	CD1	0.274	0.274	0.274	0.235	0.238
	CL1	0.252	0.252	0.252	0.197	0.169
	L1	0.918	0.918	0.918	0.839	0.709
	CD2	0.229	0.229	0.229	0.228	0.235
	CL2	0.196	0.196	0.196	0.170	0.155
	L2	0.860	0.860	0.860	0.745	0.661
	(L1 + L2)/2	0.889	0.889	0.889	0.792	0.685

TABLE 9

Results of Evaluation

	Comp. Ex. 3	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Cover thickness (mm)	0.50	0.50	0.50	0.50	0.50
Hardness H3 (D)	32	32	32	32	32
Deformation DF3 (mm)	4.10	4.10	4.10	4.10	4.10
Total volume (mm^3)	423	468	513	536	558
L1	0.968	0.928	0.918	0.887	0.852
L2	0.945	0.912	0.860	0.801	0.761
(L1 + L2)/2	16.473	16.456	16.430	16.400	16.381
Flight test					
Ball speed (m/s)	56.80	56.80	56.80	56.80	56.80
Launch angle (deg)	12.5	12.5	12.5	12.5	12.5
Spin (rpm)	2850	2850	2850	2850	2850
Highest point (x)	102	107	111	109	111
Highest point (y)	24	23	22	21	19
Carry (m)	162	166	168	176	177
Feeling					
Trajectory feeling	C	B	A	A	B
Hit feeling	A	A	A	A	A

TABLE 10

Results of Evaluation

	Comp. Ex. 4	Comp. Ex. 5	Comp. Ex. 6	Ex. 5	Ex. 6
Cover thickness (mm)	0.50	0.50	0.50	0.50	0.50
Hardness H3 (D)	32	32	32	32	32

TABLE 10-continued

Results of Evaluation

	Comp. Ex. 4	Comp. Ex. 5	Comp. Ex. 6	Ex. 5	Ex. 6
Deformation DF3 (mm)	4.10	4.10	5.10	4.80	3.10
Total volume (mm^3)	581	672	513	513	513
L1	0.839	0.709	0.918	0.918	0.918
L2	0.745	0.661	0.860	0.860	0.860
(L1 + L2)/2	16.372	16.330	16.430	16.430	16.430
Flight test					
Ball speed (m/s)	56.80	56.80	55.70	56.30	57.45
Launch angle (deg)	12.5	12.5	12.8	12.7	12.4
Spin (rpm)	2850	2850	2700	2750	2900
Highest point (x)	113	107	107	107	111
Highest point (y)	18	17	21	22	23
Carry (m)	179	173	164	166	170
Feeling					
Trajectory feeling	C	D	A	A	A
Hit feeling	A	A	C	B	B

TABLE 11

Results of Evaluation

	Comp. Ex. 7	Comp. Ex. 8	Ex. 7	Ex. 8	Comp. Ex. 9
Cover thickness (mm)	0.50	0.50	0.50	0.50	0.50
Hardness H3 (D)	32	29	38	47	53
Deformation DF3 (mm)	2.85	4.15	4.05	4.00	3.95
Total volume (mm^3)	513	513	513	513	513
L1	0.918	0.918	0.918	0.918	0.918
L2	0.860	0.860	0.860	0.860	0.860
(L1 + L2)/2	16.430	14.930	19.430	23.930	26.930
Flight test					
Ball speed (m/s)	57.55	56.75	56.85	56.90	56.95
Launch angle (deg)	12.3	12.3	13.1	13.4	13.5
Spin (rpm)	2950	2950	2550	2400	2350
Highest point (x)	111	108	109	112	114
Highest point (y)	23	22	22	22	22
Carry (m)	170	165	171	175	178
Feeling					
Trajectory feeling	A	C	A	A	A
Hit feeling	D	A	A	A	A

TABLE 12

Results of Evaluation

	Ex. 9	Ex. 10	Ex. 11	Comp. Ex. 1	Comp. Ex. 2
Cover thickness (mm)	1.00	1.50	2.00	0.50	0.50
Hardness H3 (D)	47	47	47	38	38
Deformation DF3 (mm)	4.05	4.10	4.15	3.05	3.05
Total volume (mm^3)	513	513	513	581	672
L1	0.918	0.918	0.918	0.839	0.709
L2	0.860	0.860	0.860	0.745	0.661
(L1 + L2)/2	23.930	23.930	23.930	19.372	19.330
Flight test					
Ball speed (m/s)	56.85	56.80	56.75	57.50	57.50
Launch angle (deg)	13.0	12.8	12.7	13.0	13.0
Spin (rpm)	2600	2700	2750	2600	2600
Highest point (x)	111	110	108	115	108
Highest point (y)	22	22	22	19	18
Carry (m)	169	168	166	183	176
Feeling					
Trajectory feeling	A	A	B	A	D
Hit feeling	A	A	B	C	C

[0114] As shown in Tables 9 to 12, the golf ball of each Example is excellent in various performance characteristics. From the results of evaluation, advantages of the present invention are clear.

[0115] The golf ball according to the present invention is suitable for, for example, playing golf on golf courses and practicing at driving ranges. The above descriptions are merely illustrative examples, and various modifications can be made without departing from the principles of the present invention.

What is claimed is:

1. A golf ball comprising a core and a cover positioned outside the core, wherein
   - the golf ball has a large number of dimples on a surface thereof,
   - the cover has a Shore D hardness of equal to or greater than 30 but equal to or less than 50,
   - the golf ball has an amount of compressive deformation of equal to or greater than 3.0 mm but equal to or less than 5.0 mm, the amount of compressive deformation being measured under conditions of an initial load of 98 N and a final load of 1274 N, and
   - the golf ball meets the following mathematical formula (I):

$$0.80 \leq ((L1+L2)/2) \leq 0.95 \quad (I),$$

where: L1 represents a ratio (CL1/CD1) of a lift coefficient CL1 relative to a drag coefficient CD1, the lift coefficient CL1 and the drag coefficient CD1 being measured under conditions of a Reynolds number of 1.290×10^5 and a spin rate of 2820 rpm; and L2 represents a ratio (CL2/CD2) of a lift coefficient CL2 relative to a drag coefficient CD2, the lift coefficient CL2 and the drag coefficient CD2 being measured under conditions of a Reynolds number of 1.771×10^5 and a spin rate of 2940 rpm.

2. The golf ball according to claim **1**, wherein a total volume of the dimples is equal to or greater than 430 mm^3 but equal to or less than 580 mm^3.

3. The golf ball according to claim **1**, wherein the cover has a thickness of equal to or greater than 0.3 mm but equal to or less than 1.8 mm.

4. The golf ball according to claim **1**, wherein the ratio L1 is equal to or greater than 0.85 but equal to or less than 0.93.

5. The golf ball according to claim **1**, wherein the ratio L2 is equal to or greater than 0.76 but equal to or less than 0.92.

6. The golf ball according to claim **1**, wherein a ratio of a sum of spherical surface areas of the dimples relative to a surface area of a phantom sphere of the golf ball is equal to or greater than 0.780 but equal to or less than 0.950.

7. The golf ball according to claim **1**, wherein a total number of the dimples is equal to or greater than 250 but equal to or less than 450.

8. The golf ball according to claim **1**, wherein each dimple has a diameter Dm of equal to or greater than 2.0 mm but equal to or less than 6.0 mm.

9. The golf ball according to claim **1**, wherein each dimple has a depth of equal to or greater than 0.10 mm but equal to or less than 0.60 mm.

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