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inches behind the point in the downswing where the club was vertical. The height of the tee and the toe-heel position of the club relative to the tee were adjusted in order that the center of the impact mark was about  $\frac{3}{4}$  of an inch above the sole and was centered toe to heel across the face. Three samples of each ball were tested. Each ball was hit three times.

Other methods may also be used to determine the scuff resistance, such as the methods described in the commonly assigned copending application titled "Golf Ball Wear Indicator", U.S. application Ser. No. 12/691,282, filed Jan. 21, 2010, in the name of Brad Tutmark.

After the above described scuff resistance testing, each golf ball cover was visually observed and rated according to the following scale: a golf ball cover was rated "1" when little or no damage was visible, only groove markings or dents; a golf ball cover was rated "2" when small cuts and/or ripples in the cover were apparent; a golf ball cover was rated "3" when moderate amounts of cover material were lifted from the ball's surface, but the cover material was still attached to the ball; and finally a golf ball cover was rated "4" when cover material was removed or barely attached to the golf ball.

Shore D hardness values of the core and cover layer were measured on the spherical surface of the layer to be measured by using a Shore D hardness tester.

As shown in Table 5, golf ball examples 1 and 2 made from compositions including a cross-linked thermoplastic polyurethane elastomer having cross-links located in the hard segments, where the cross-links are the reaction product of unsaturated bonds located in the hard segments as catalyzed by a free radical initiator and a proper ratio of the organic isocyanate to the long chain polyol, provides superior scuff resistance.

Additional golf balls are made in accordance with the method and comprising the compositions of Examples 1 and 2, with the exception that the index is 1.20 in one golf ball, 1.30 in another, and 1.40 in a third. The golf balls then are subjected to the scuffing test, and provide a scuff resistance rating of 1.5, 1.5, and 1.

While various embodiments of the invention have been described, the description is intended to be exemplary, rather than limiting and it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible that are within the scope of the invention. Accordingly, the invention is not to be restricted except in light of the attached claims and their equivalents. Also, various modifications and changes may be made within the scope of the attached claims. For example, different golf ball precursors, perhaps those having a different number of layers or a different core composition, also fall within the scope of the claims.

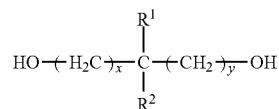
We claim:

1. A method of making a golf ball, comprising the steps of: forming a golf ball precursor, the precursor having at least one golf ball layer but not an outer cover layer and forming an outer cover layer substantially surrounding the golf ball precursor,

wherein the outer cover layer comprises a composition of an over-indexed, crosslinked thermoplastic polyurethane elastomer including crosslinks formed from allyl groups and the thermoplastic polyurethane elastomer is a reaction product formed from reacting a mixture of a diisocyanate and:

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(a) an unsaturated diol of the formula



in which  $\text{R}^1$  is a substituted or unsubstituted alkyl group, substituted or unsubstituted aryl group, or substituted or unsubstituted alkyl-aryl group, which may optionally include an ether or ester group or an unsaturated bond in any group, or is H;  $\text{R}^2$  is a substituted or unsubstituted alkyl group, substituted or unsubstituted aryl group, or substituted or unsubstituted alkyl-aryl group, which may optionally include an ether or ester group, and  $\text{R}^2$  includes an allyl group; and x and y are integers independently having any value from 1 to 10;

(b) a chain extender having at least two reaction sites with isocyanates and having a molecular weight of less than about 450;

(c) a long chain polyol having a molecular weight of between about 500 and about 4,000; and

(d) a sufficient amount of free radical initiator so as to be capable of generating free radicals that induce crosslinking structures in the hard segments by free radical initiation,

wherein the mixture has a stoichiometric excess of isocyanate moieties of at least about 1 mol percent;

wherein forming the outer cover layer further comprises applying the composition over the golf ball precursor and then moisture curing the composition; and

wherein the outer cover layer has a flexural modulus between 400 psi and 900 psi.

2. The method of making the golf ball according to claim 1, wherein the organic isocyanate moieties to the hydroxyl moieties are in a molar ratio of from about 1.06:1.00 to about 1.18:1.00.

3. The method of making the golf ball according to claim 2, wherein the molar ratio is from about 1.10:1.00 to about 1.15:1.00.

4. The method of making the golf ball according to claim 1, wherein the free radical initiator is present in the mixture in a weight ratio of free radical initiator to unsaturated diols of from about 0.1:100 to about 100:100.

5. The method of making the golf ball according to claim 4, wherein a weight ratio of the crosslinked thermoplastic polyurethane elastomer to the unsaturated diols is about 100:10.

6. The method of making the golf ball according to claim 1, wherein the unsaturated diol is trimethylolpropane monoallyl ether.

7. The method of making the golf ball according to claim 1, wherein the free radical initiator generates free radicals through at least one of thermal cleavage and UV radiation cleavage.

8. The method of making the golf ball according to claim 1, wherein the free radical initiator is selected from the group consisting of peroxides.

9. The method of making the golf ball according to claim 1, wherein the step of forming a golf ball precursor further comprises the steps of:

forming an inner core layer comprising a highly neutralized acid polymer;

forming an outer core layer substantially surrounding the inner core layer; and