CLAIMS

What is claimed is:

1. A method for preparing a coupled polymer, the method comprising the steps of:

(i) polymerizing monomer to form a reactive polymer;

(ii) reacting the reactive polymer with a polyisocyanate having a functionality of X to form an intermediate polymer product; and

(iii) reacting the intermediate polymer product with a polyol having a functionality of Y to form the coupled polymer product, where $X+Y \geq 5$.

2. The method of any of the preceding claims, where $X \geq 2$ and $Y \geq 2$.

3. The method of any of the preceding claims, where the polyisocyanate is a diisocyanate or triisocyanate.

4. The method of any of the preceding claims, where the polyisocyanate is a diisocyanato hydrocarbyl and the polyol is a triol or a polyol having four or more hydroxyl groups.

5. The method of any of the preceding claims, where the polyisocyanate is a triisocyanato hydrocarbyl and the polyol is a diol, triol, or polyol having four or more hydroxyl groups.

6. The method of any of the preceding claims, where the polyisocyanate is a diisocyanato hydrocarbyl selected from the group consisting of diisocyanatoalkyls, diisocyanatocycloalkyls, diisocyantoaryls, diisocyanatoalkenyls, and diisocyanatoalkynyls.

7. The method of any of the preceding claims, where the polyisocyanate is selected from the group consisting of methylene diphenyl diisocyanate, toluene diisocyanate,

hexamethylene diisocyanate, isophonrone diisocyanate, and 4,4'-methylenebis(cyclohexyl isocyanate).

8. The method of any of the preceding claims, where polyol is a diol selected from the group consisting of alkyldiols, cycloalkyldiols, aryldiols, alkenyldiols, and akynyldiols.

9. The method of any of the preceding claims, where polyol is a triol selected from the group consisting of alkyltriols, cycloalkyltriols, aryltriols, alkenyltriols, and alkynyltriols.

10. The method of any of the preceding claims, where the where the polyol is glycerol.

11. The method of any of the preceding claims, where the said step of polymerizing monomer includes polymerizing conjugated diene monomer and monomer copolymerizable therewith.

12. The method of any of the preceding claims, where said step of polymerizing takes place using anionic polymerization techniques.

13. The method of claim 7, where said step of polymerizing takes place using an organolithium initiator.

14. The method of claim 13, where said step of polymerizing takes place using a coordination catalyst system.

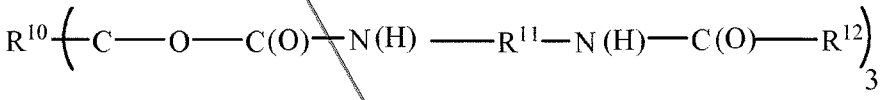
15. A method for preparing a coupled polymer, the method comprising the steps of:

(i) polymerizing conjugated diene monomer, and optionally monomer copolymerizable therewith, to form polymer having a reactive chain end;

(ii) reacting the reactive chain end of the polymer with a polyisocyanate having a functionality of X to form an intermediate polymer product; and

(iii) reacting the intermediate polymer product with a polyol having a functionality of Y to form the coupled polymer product, where $X+Y \geq 5$.

16. A coupled polymer defined by the formula:



where R^{10} is a multivalent organic group deriving from the triol, R^{11} is a divalent organic group deriving from the diisocyanate, and each R^{12} is a polymer chain.

17. The coupled polymer of claim 16, where R^{12} is a polydiene having a cis-1,4-linkage content that is greater than 60%.

18. The coupled polymer of claim 18, where R^{12} is a polydiene or polydiene copolymer having a cis-1,4-linkage content of from about 10% to 60%.

19. A tire component prepared from the coupled polymer of any of the preceding claims.

CLAIMS

1. A method for preparing a coupled polymer, the method comprising the steps of:

   (i) polymerizing monomer to form a reactive polymer within a polymerization mixture;

   (ii) reacting the reactive polymer with a polyisocyanate having a functionality of X to form an intermediate polymer product by adding a polyisocyanate having a functionality of X into the polymerization mixture; and

   (iii) reacting the intermediate polymer product with a polyol having a functionality of Y to form the coupled polymer product by adding a polyol having a functionality of Y into the polymerization mixture including the intermediate polymer, where $X+Y \geq 5$.

2. The method of any of the preceding claims, where $X \geq 2$ and $Y \geq 2$.

3. The method of any of the preceding claims, where the polyisocyanate is a diisocyanate or triisocyanate.

4. The method of any of the preceding claims, where the polyisocyanate is a diisocyanato hydrocarbyl and the polyol is a triol or a polyol having four or more hydroxyl groups.

5. The method of any of the preceding claims, where the polyisocyanate is a diisocyanato hydrocarbyl selected from the group consisting of diisocyanatoalkyls, diisocyanatocycloalkyls, diisocyantoaryls, diisocyanatoalkenyls, and diisocyanatoalkynyls.

6. The method of any of the preceding claims, where the polyisocyanate is selected from the group consisting of methylene diphenyl diisocyanate, toluene diisocyanate, hexamethylene diisocyanate, isophonrone diisocyanate, and 4,4'-methylenebis(cyclohexyl isocyanate).

7. The method of any of the preceding claims, where polyol is a diol selected from the group consisting of alkyldiols, cycloalkyldiols, aryldiols, alkenyldiols, and akynyldiols.

8. The method of any of the preceding claims, where polyol is a triol selected from the group consisting of alkyltriols, cycloalkyltriols, aryltriols, alkenyltriols, and alkynyltriols.

9. The method of any of the preceding claims, where the polyol is glycerol.

10. The method of any of the preceding claims, where said step of polymerizing monomer includes polymerizing conjugated diene monomer and monomer copolymerizable therewith.

11. The method of claim 1, where said step of polymerizing takes place using an organolithium initiator.

12. The method of claim 13, where the organolithium initiator includes a lithium cation and the molar ratio of isocyanate functionality of the polyisocyanate added in step (ii) to the moles of the lithium cation is from 10:1 to 1:1.

13. The method of claim 1, where said step of polymerizing takes place using a coordination catalyst system.

14. The method of any of the preceding claims, where said reactive polymer has a reactive chain end.

15. A coupled polymer defined by the formula:

$$R^{10}\text{-(-C-O-C(O)-N(H)-}R^{11}\text{-N(H)-C-(O)-}R^{12})_3$$

where R^{10} is a multivalent organic group deriving from the triol, R^{11} is a divalent organic group deriving from the diisocyanate, and each R^{12} is a polymer chain.

16. A tire component prepared from the coupled polymer of any of the preceding claims.