CLAIMS

1. A copolymer of a conjugated diene compound and a non-conjugated olefin, wherein the content of 1,2 adduct units (including 3,4 adduct units) of a unit derived from the conjugated diene compound is 5 % or less.

2. The copolymer according to claim 1, wherein the unit derived from the conjugated diene compound has a cis-1,4 bond content of more than 50 mol%.

3. The copolymer according to claim 1, wherein the content of a unit derived from the non-conjugated olefin is greater than 0 mol% and not more than 50 mol%.

4. The copolymer according to claim 1, wherein the copolymer has a polystyrene-equivalent average-weight molecular weight of 10,000 to 10,000,000.

5. The copolymer according to claim 1, wherein the copolymer has a molecular weight distribution (Mw/Mn) of 10 or less.

6. The copolymer according to claim 1, wherein the non-conjugated olefin is an acyclic olefin.

7. The copolymer according to claim 6, wherein the non-conjugated olefin has 2 to 10 carbon atoms.

8. The copolymer according to claim 7, wherein the non-conjugated olefin is at least one selected from the group consisting of ethylene, propylene, and 1-butene.

9. The copolymer according to claim 8, wherein the non-conjugated olefin is ethylene.

10. The copolymer according to claim 1, wherein the conjugated diene compound is at least one selected from the group consisting of 1,3-butadiene and isoprene.

11. A rubber composition comprising the copolymer according to claim 1.

12. The rubber composition according to claim 11 further comprising a conjugated diene-based polymer.

13. The rubber composition according to claim 11 or 12 further comprising carbon black, wherein the carbon black has a nitrogen adsorption specific surface area (N_2SA) of 20 m^2/g to 100 m^2/g.

14. The rubber composition according to claim 13, wherein the content of the carbon black is 10 parts by mass to 70 parts by mass per 100 parts by mass of the rubber component.

15. The rubber composition according to claim 12, wherein the conjugated diene-based polymer is natural rubber.

16. The rubber composition according to claim 15, wherein the content of the natural rubber per 100 parts by mass of the rubber component is at least 10 parts by mass.

17. The rubber composition according to claim 12, wherein a mass ratio of the copolymer of a conjugated diene compound and a non-conjugated olefin to the conjugated diene-based polymer is 10/90 to 90/10.

18. The rubber composition according to claim 11 further comprising a crosslinking agent by 0.1 parts by mass to 20 parts by mass per 100 parts by mass of the rubber component.

19. A rubber composition for tire side use using the rubber composition according to claim 11 for tire sidewall members.

20. A crosslinked rubber composition obtained by crosslinking the rubber composition according to claim 11.

21. A tire manufactured by using the rubber composition according to claim 11 or the crosslinked rubber composition according to claim 20.

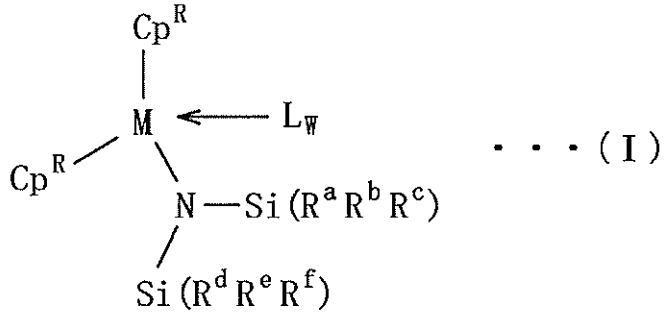
22. A tire using the rubber composition according to claim 11 or the crosslinked rubber composition according to claim 20 for sidewall members thereof.

CLAIMS

1. A copolymer of a conjugated diene compound and a non-conjugated olefin,

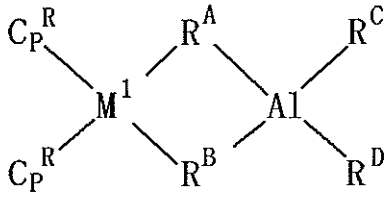
wherein the content of 1,2 adduct units (including 3,4 adduct units) in a unit derived from the conjugated diene compound is 5 % or less,

wherein the copolymer of the conjugated diene compound and the non-conjugated olefin is obtained by polymerization under the existence of a polymerization catalyst composition including at least one complex selected from the group consisting of: a metallocene complex represented by the following general formula (I); and metallocene-based composite catalyst represented by the following formula (XV):



... (I)

(where M represents a lanthanoid element, scandium, or yttrium; Cp^R each independently represents an unsubstituted or substituted indenyl; R^a to R^f each independently represent a hydrogen atom or an alkyl group having 1 to 3 carbon atoms; at least one of R^a to R^f is a hydrogen atom; L represents a neutral Lewis base; and w represents an integer of 0 to 3);



(XV)

(where M^1 represents a lanthanoid element, scandium, or yttrium; Cp^R each independently represents an unsubstituted or substituted indenyl; R^A and R^B each independently represent a hydrocarbon group having 1 to 20 carbon atoms, R^A and R^B being μ-coordinated with M^1 and Al; and R^C and R^D each independently represent a hydrocarbon group having 1 to 20 carbon atoms or a hydrogen atom).

2. The copolymer according to claim 1, wherein the unit derived from the conjugated diene compound has a cis-1,4 bond content of more than 50 mol%.

3. The copolymer according to claim 1, wherein the content of a unit derived from the non-conjugated olefin is greater than 0 mol% and not more than 50 mol%.

4. The copolymer according to claim 1, wherein the copolymer has a polystyrene-equivalent average-weight molecular weight of 10,000 to 10,000,000.

5. The copolymer according to claim 1, wherein the copolymer has a molecular weight distribution (Mw/Mn) of 10 or less.

6. The copolymer according to claim 1, wherein the non-conjugated olefin is an acyclic olefin.

7. The copolymer according to claim 6, wherein the non-conjugated olefin has 2 to 10 carbon atoms.

8. The copolymer according to claim 7, wherein the non-conjugated olefin is at least one selected from the group consisting of ethylene, propylene, and 1-butene.

9. The copolymer according to claim 8, wherein the non-conjugated olefin is ethylene.

10. The copolymer according to claim 1, wherein the conjugated diene compound is at least one selected from the group consisting of 1,3-butadiene and isoprene.

11. A rubber composition comprising the copolymer according to claim 1.

12. The rubber composition according to claim 11 further comprising a conjugated diene-based polymer.

13. The rubber composition according to claim 11 or 12 further comprising carbon black, wherein the carbon black has a nitrogen adsorption specific surface area (N_2SA) of 20 m^2/g to 100 m^2/g.

14. The rubber composition according to claim 13, wherein the content of the carbon black is 10 parts by mass to 70 parts by mass per 100 parts by mass of the rubber component.

15. The rubber composition according to claim 12, wherein the conjugated diene-based polymer is natural rubber.

16. The rubber composition according to claim 15, wherein the content of the natural rubber per 100 parts by mass of the rubber component is at least 10 parts by mass.

17. The rubber composition according to claim 12, wherein a mass ratio of the copolymer of a conjugated diene compound and a non-conjugated olefin to the conjugated diene-based polymer is 10/90 to 90/10.

18. The rubber composition according to claim 11 further comprising a crosslinking agent by 0.1 parts by mass to 20 parts by mass per 100 parts by mass of the rubber component.

19. A rubber composition for tire side use using the rubber composition according to claim 11 for tire sidewall members.

20. A crosslinked rubber composition obtained by crosslinking the rubber composition according to claim 11.

21. A tire manufactured by using the rubber composition according to claim 11 or the crosslinked rubber composition according to claim 20.

22. A tire using the rubber composition according to claim 11 or the crosslinked rubber composition according to claim 20 for sidewall members thereof.