**CLAIMS**

1. A modified conjugated diene-based polymer comprising: a repeating unit derived from a conjugated diene-based monomer; and a functional group derived from a modifier, and

satisfying the following conditions of (i) to (vii):

(i) a molecular weight distribution curve by gel permeation chromatography is unimodal;

(ii) molecular weight distribution is 2.0 or more;

(iii) a weight average molecular weight is 100,000 g/mol to 2,000,000 g/mol;

(vi) a modification ratio is 70% or more;

(v) a mooney stress relaxation ratio measured at 100°C is 0.7 to 3.0;

(vi) a mooney large relaxation area (MLRA) measured at 100°C and represented by the following Mathematical Formula 1 is 1500 MU-s or less; and

(vii) nitrogen atom content is 100 ppm or more based on a weight of the polymer:

[Mathematical Formula 1]

$$A = \frac{k}{(a+1)}\left[t_f^{(a+1)} - t_o^{(a+1)}\right]$$

in Mathematical Formula 1,

A is a mooney large relaxation area (MLRA),

k is a mooney intercept after 1 second from stopping

operation of a rotor of a mooney viscometer,

a is a gradient value of mooney torque change,

$t_o$ is an initiation point of mooney relaxation, and

$t_f$ is a finishing point of mooney relaxation,

wherein the modification ratio is calculated according to Mathematical Formula 2 below using a chromatogram obtained from the gel permeation chromatography:

[Mathematical Formula 2]

$$modification\ ratio\ (\%) = \frac{peak\ area\ of\ modified\ copolymer\ unit}{peak\ area\ of\ unmodified\ copolymer\ unit + peak\ are\ of\ modified\ copolymer\ unit} \times 100$$

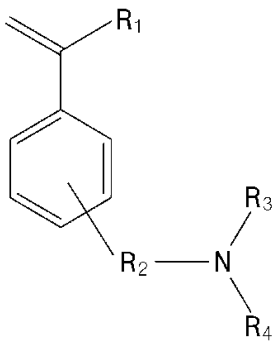
in Mathematical Formula 2,

the peak area of the unmodified polymer unit is a first peak area of the chromatogram on a first solution transported to a detector, and

the peak area of the modified polymer unit is a second peak area of the chromatogram on a second solution transported to the detector.

2. The modified conjugated diene-based polymer of claim 1, further comprising a repeating unit derived from a compound represented by the following formula 1:

[Formula 1]




in Formula 1,

$R_1$ is a hydrogen atom, or an alkyl group of 1 to 20 carbon atoms,

$R_2$ is a single bond or a substituted with a substituent or unsubstituted alkylene group of 1 to 20 carbon atoms,

$R_3$ and $R_4$ are each independently a substituted with a substituent or unsubstituted alkyl group of 1 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms or an aryl group of 6 to 30 carbon atoms, and

the substituent is one or more selected from the group consisting of an alkyl group of 1 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms and an aryl group of 6 to 20 carbon atoms.

3. The modified conjugated diene-based polymer of claim 2, wherein, in Formula 1,

$R_1$ is a hydrogen atom, or an alkyl group of 1 to 10 carbon atoms,

$R_2$ is a single bond or an unsubstituted alkylene group of 1 to 10 carbon atoms,

$R_3$ and $R_4$ are each independently an unsubstituted alkyl group of 1 to 10 carbon atoms, a cycloalkyl group of 3 to 10 carbon atoms or an aryl group of 6 to 12 carbon atoms.

4. The modified conjugated diene-based polymer of claim 1, wherein the modifier is an alkoxysilane-based compound.

5. The modified conjugated diene-based polymer of claim 1, wherein

a repeating unit derived from an aromatic vinyl-based monomer is further comprised, and

the aromatic vinyl-based monomer is one or more selected from the group consisting of styrene, α-methylstyrene, 3-methylstyrene, 4-methylstyrene, 4-propylstyrene, 1-vinylnaphthalene, 4-cyclohexylstyrene, 4-(p-methylphenyl)styrene, 1-vinyl-5-hexylnaphthalene, 3-(2-pyrrolidino ethyl)styrene, 4-(2-pyrrolidino ethyl)styrene and 3-(2-pyrrolidino-1-methyl ethyl)-α-methylstyrene.

6. A method for preparing the modified conjugated diene-based polymer described in claim 1, the method comprising:

polymerizing a conjugated diene-based monomer, or a conjugated diene-based monomer and an aromatic vinyl-based monomer in a hydrocarbon solvent to prepare an active polymer (S1); and

reacting or coupling the active polymer prepared in step

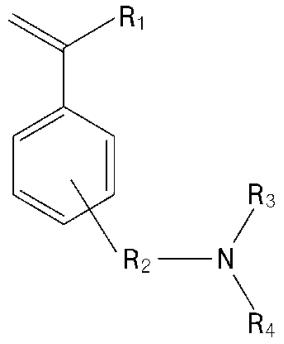
(S1) with a modifier (S2),

wherein the polymerization of step (S1) is performed by initiating the polymerization in the presence of a first polymerization initiator, and performing polymerization reaction by injecting a second polymerization initiator in at least one installment at a point where a polymerization conversion ratio is 50% to 95%,

the first and second polymerization initiators are oligomers having an anionic active terminal, prepared by reacting an organometallic compound, a conjugated diene-based monomer and a compound represented by the following Formula 1, and

step (S1) is continuously performed in at least two polymerization reactors, where a polymerization conversion ratio in the first reactor among the polymerization reactors is 10% to 50%:

[Formula 1]




in Formula 1,

$R_1$ is a hydrogen atom, or an alkyl group of 1 to 20 carbon atoms,

$R_2$ is a single bond or a substituted with a substituent or unsubstituted alkylene group of 1 to 20 carbon atoms,

$R_3$ and $R_4$ are each independently a substituted with a substituent or unsubstituted alkyl group of 1 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms or an aryl group of 6 to 30 carbon atoms, and

the substituent is one or more selected from the group consisting of an alkyl group of 1 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms and an aryl group of 6 to 20 carbon atoms.

7. The method for preparing the modified conjugated diene-based polymer according to claim 6, wherein the oligomer has a weight average molecular weight of 100 g/mol to 30,000 g/mol.

8. The method for preparing the modified conjugated diene-based polymer of claim 6, wherein step (S1) uses the polymerization initiator in 0.01 mmol to 10 mmol based on total 100 g of the monomer, and the polymerization initiator comprises the first and second polymerization initiators.

9. The method for preparing the modified conjugated diene-based polymer of claim 6, wherein the second polymerization initiator is used in 0.01 mol to 10 mol based on 1 mol of the first polymerization initiator.

10. The method for preparing the modified conjugated diene-based polymer of claim 6, wherein the injection in installments comprises first continuous injection in installments of a portion among the total amount of the second polymerization initiator at a point where a polymerization conversion ratio is 50% to less than 80%, and second continuous injection in installments of the remaining amount among the total amount at a point where a polymerization conversion ratio is 80% to 95%, and the first continuous injection in installments and the second continuous injection in installments are injections of the second polymerization initiator in a constant rate from the initiation to the end of the injection.

11. The method for preparing the modified conjugated diene-based polymer of claim 6, wherein the polymerization in step (S1) is performed by further comprising a polar additive.

12. The method for preparing the modified conjugated diene-based polymer of claim 6, wherein the modifier is an alkoxysilane-based compound.

13. A rubber composition comprising the modified conjugated diene-based polymer described in claim 1, and a filler.

14. The rubber composition of claim 13, wherein the rubber composition comprises 0.1 parts by weight to 200 parts by weight of the filler based on 100 parts by weight of the modified conjugated diene-based polymer.

15. The rubber composition of claim 13, further comprising a vulcanizing agent.