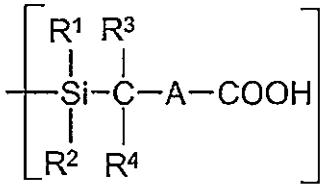
Claims

1. End group-functionalized polymers, characterized in that the polymers have, at the end of the polymer chain, a silane-containing carboxyl group of the formula (I)



(I)

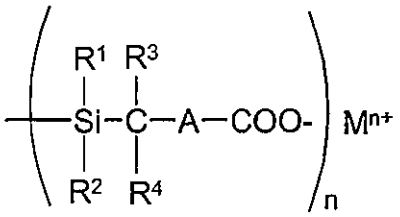
where

R^1, R^2 are the same or different and are each an H, alkyl, alkoxy, cycloalkyl, cycloalkoxy, aryl, aryloxy, alkaryl, alkaryloxy, aralkyl or aralkoxy radical which may contain one or more heteroatoms, preferably O, N, S or Si,

R^3, R^4 are the same or different and are each an H, alkyl, cycloalkyl, aryl, alkaryl or aralkyl radical which may contain one or more heteroatoms, preferably O, N, S or Si,

A is a divalent organic radical which, as well as C and H, may contain one or more heteroatoms, preferably O, N, S or Si.

2. End group-functionalized polymers according to Claim 1, characterized in that the end groups of the polymers are present as carboxylates of the formula (II)



(II)

where

R^1, R^2 are the same or different and are each an H, alkyl, alkoxy, cycloalkyl, cycloalkoxy, aryl, aryloxy, alkaryl, alkaryloxy, aralkyl or aralkoxy radical which may contain one or more heteroatoms, preferably O, N, S or Si,

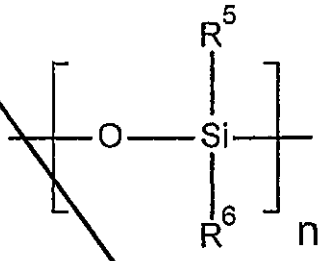
R^3, R^4 are the same or different and are each an H, alkyl, cycloalkyl, aryl, alkaryl or aralkyl radical which may contain one or more heteroatoms, preferably O, N, S or Si,

A is a divalent organic radical which, as well as C and H, may contain one or more heteroatoms, preferably O, N, S or Si,

n is an integer from 1 to 4,

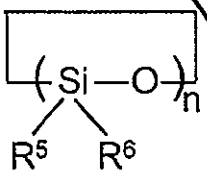
M is a metal or semimetal of valency 1 to 4, preferably Li, Na, K, Mg, Ca, Zn, Fe, Co, Ni, Al, Nd, Ti, Sn, Si, Zr, V, Mo or W.

3. End group-functionalized polymers according to Claim 1 or 2, additionally containing one or more divalent structural elements of the formula (V)



(V),

preferably derived from cyclosiloxanes, more preferably from cyclosiloxanes of the formula (IV)



(IV)

n = 3-6

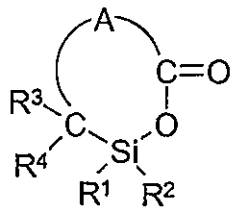
where R^5, R^6 in formula (IV) are the same or different and are each an H, alkyl, cycloalkyl, aryl, alkaryl or aralkyl radical which may contain one or more heteroatoms, preferably O, N, S or Si, and most preferably hexamethylcyclotrisiloxane, octamethylcyclotetrasiloxane, decamethylcyclopentasiloxane or dodecamethylcyclohexasiloxane.

4. End group-functionalized polymers according to any of Claims 1 to 3, characterized in that the polymers are diene polymers, preferably polybutadiene or polyisoprene, or diene copolymers obtainable by copolymerization of dienes with

vinylaromatic monomers, preferably butadiene-isoprene copolymer, butadiene-styrene copolymer, isoprene-styrene copolymer or butadiene-isoprene-styrene terpolymer.

5. End group-functionalized polymers according to any of Claims 1 to 4, characterized in that the polymer is obtainable by reaction of reactive ends of the polymer chain with one or more functionalizing reagents in the form of silalactones.

6. End group-functionalized polymers according to any of Claims 1 to 5, characterized in that the silalactones are compounds of the formula (III)



(III)

where

R^1, R^2 are the same or different and are each an H, alkyl, alkoxy, cycloalkyl, cycloalkoxy, aryl, aryloxy, alkaryl, alkaryloxy, aralkyl or aralkoxy radical which may contain one or more heteroatoms, preferably O, N, S or Si,

R^3, R^4 are the same or different and are each an H, alkyl, cycloalkyl, aryl, alkaryl or aralkyl radical which may contain one or more heteroatoms, preferably O, N, S or Si,

A is a divalent organic radical which, as well as C and H, may contain one or more heteroatoms, preferably O, N, S or Si.

7. End group-functionalized polymers according to any of Claims 1 to 6, characterized in that the polymers have mean molar masses (number-average, M_n) of 10 000 to 2 000 000 g/mol, preferably of 100 000 to 1 000 000 g/mol.

8. End group-functionalized polymers according to any of Claims 1 to 7, characterized in that the polymers have glass transition temperatures of -110°C to +20°C, preferably -110°C to 0°C.

9. Use of silalactones for preparation of end group-functionalized polymers according to any of Claims 1 to 8.

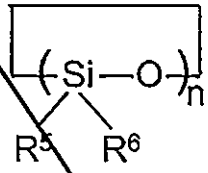
10. Process for preparing end group-functionalized polymers according to any of Claims 1 to 8, characterized in that one or more silalactones are added to polymers having reactive ends of the polymer chain.

11. Process according to Claim 10, characterized in that the silalactones are added after completion of the polymerization.

12. Process according to Claim 10 or 11, characterized in that an excess or a stoichiometric amount or a deficiency of silalactones is used, based on the amount of polymer.

13. Process according to any of Claims 10 to 12, characterized in that the amount of silalactones is from 0.005 to 2% by weight, preferably from 0.01 to 1% by weight, based on the amount of polymer.

14. Process according to any of Claims 10 to 13, characterized in that the polymerization is followed and the addition of the silalactones is preceded by the use of cyclosiloxanes of the formula (IV)



(IV)

n = 3-6

where R^5, R^6 in formula (IV) are the same or different and are each an H, alkyl, cycloalkyl, aryl, alkaryl or aralkyl radical which may contain one or more heteroatoms, preferably O, N, S or Si, preferably hexamethylcyclotrisiloxane, octamethylcyclotetrasiloxane, decamethylcyclopentasiloxane or dodecamethylcyclohexasiloxane.

15. Process according to Claim 14, characterized in that the amount of cyclosiloxanes of the formula (IV) is within a range from 0.002 to 4% by weight, preferably within a range from 0.005 to 2% by weight, based on the amount of polymer.

16. Process according to Claim 14 or 15, characterized in that the ratio of silalactone to cyclosiloxane is from 20:1 to 1:1, preferably from 10:1 to 1:1, more preferably from 3:1 to 1:1.

17. Use of end group-functionalized polymers according to any of the preceding claims for production of vulcanizable rubber compositions.

18. Vulcanizable rubber compositions comprising

a) end group-functionalized polymers according to any of Claims 1 – 8 and

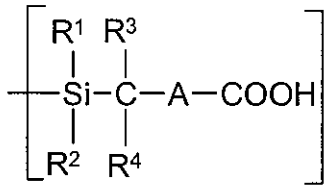
b) ageing stabilizers, oils, fillers, rubbers and/or further rubber auxiliaries.

19. Use of the vulcanizable rubber compositions according to Claim 18 for production of mouldings, especially cable sheaths, hoses, drive belts, conveyor belts, roll covers, shoe soles, gasket rings, damping elements or tyres, especially tyre treads.

20. Mouldings, especially tyres, obtainable according to Claim 19.

Claims

1. End group-functionalized polymers, characterized in that the polymers have, at the end of the polymer chain, a silane-containing carboxyl group of the formula (I)



(I)

where

R^1, R^2 are the same or different and are each an H, alkyl, alkoxy, cycloalkyl, cycloalkoxy, aryl, aryloxy, alkaryl, alkaryloxy, aralkyl or aralkoxy radical which may contain one or more heteroatoms, preferably O, N, S or Si,

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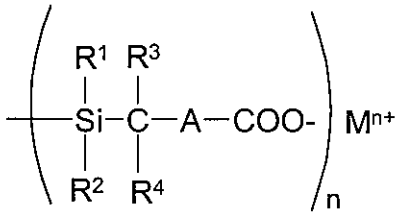
wherein the polymers are diene polymers, preferably polybutadiene or polyisoprene, or diene copolymers obtainable by copolymerization of dienes with vinylaromatic monomers, preferably butadiene-isoprene copolymer, butadiene-styrene copolymer, isoprene-styrene copolymer or butadiene-isoprene-styrene terpolymer.

2. End group-functionalized polymers according to Claim 1, characterized in that the end groups of the polymers are present as carboxylates of the formula (II)



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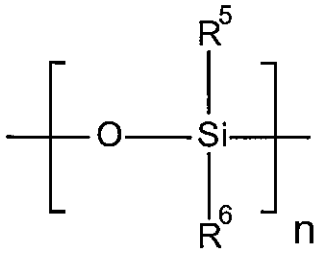

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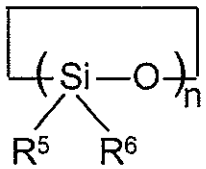

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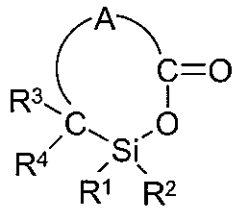

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9. Process for preparing end group-functionalized polymers according to any of Claims 1 to 7, characterized in that one or more silalactones are added to polymers having reactive ends of the polymer chain.

10. Process according to Claim 9, characterized in that the silalactones are added after completion of the polymerization.

11. Process according to Claim 9 or 10, characterized in that an excess or a stoichiometric amount or a deficiency of silalactones is used, based on the amount of polymer.

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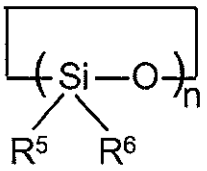

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    b) ageing stabilizers, oils, fillers, rubbers and/or further rubber auxiliaries.

18. Use of the vulcanizable rubber compositions according to Claim 17 for production of mouldings, especially cable sheaths, hoses, drive belts, conveyor belts, roll covers, shoe soles, gasket rings, damping elements or tyres, especially tyre treads.

19. Mouldings, especially tyres, obtainable according to Claim 18.