CLAIMS

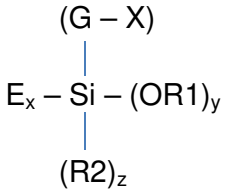
1. Modified diene elastomer comprising, within the main chain of the elastomer, a silicon atom substituted, on the one hand, by at least one alkoxy group, optionally partially or completely hydrolysed to give a hydroxyl group, and, on the other hand, by at least one other functional group comprising a nitrogen atom, the nitrogen atom being bonded to the silicon atom via a spacer group chosen from saturated linear divalent aliphatic hydrocarbon radicals having at least 5 carbon atoms, preferably at least 6, and at most 10 carbon atoms, preferably at most 9.

2. Modified diene elastomer according to any one of the preceding claims, characterized in that the spacer group is a saturated linear divalent C_6, C_7, C_8 or C_9, preferably C_6, aliphatic hydrocarbon radical.

3. Modified diene elastomer according to any one of the preceding claims, characterized in that the other functional group is a cyclic or non-cyclic, tertiary, protected or unprotected secondary or protected or unprotected primary amine, an isocyanate, an imine or a cyano.

4. Modified diene elastomer according to Claim 6, characterized in that the other functional group is a dialkylamino- tertiary amine, the alkyl radicals of which, independently of one another, are C_1-C_4 alkyl radicals, preferably methyl or ethyl.

5. Modified diene elastomer according to any one of the preceding claims, characterized in that it corresponds to the following general formula I:



Formula I

in which:

- E represents the diene elastomer chain;

- R1 represents a hydrogen atom or a C_1-C_{10}, indeed even C_1-C_8, alkyl radical, preferably a C_1-C_4 alkyl radical, more preferably methyl and ethyl;
- R2 represents a substituted or unsubstituted C_1-C_{10}, indeed even C_1-C_8, alkyl radical, preferably a C_1-C_4 alkyl radical, more preferably methyl and ethyl;
- G represents the spacer group chosen from saturated linear divalent C_6, C_7, C_8 or C_9, preferably C_6, aliphatic hydrocarbon radicals;
- X represents the functional group comprising a nitrogen atom, the nitrogen atom being bonded to the silicon atom via the spacer group G ;
- x has the value 1 or 2, y has the value 1 or 2 and z has the value 0 or 1, with the proviso that x + y + z = 3.

6. Modified diene elastomer according to Claim 5, characterized in that y has the value 1.

7. Modified diene elastomer according to Claim 6, characterized in that x = z = 1.

8. Modified diene elastomer according to Claim 6, characterized in that x = 2 and z = 0.

9. Process for the synthesis of a modified diene elastomer comprising, within the main chain of the elastomer, a silicon atom substituted, on the one hand, by at least one alkoxy group, optionally partially or completely hydrolysed to give a hydroxyl group, and, on the other hand, by at least one other functional group comprising a nitrogen atom bonded to the silicon atom via a spacer group, characterized in that it comprises:

   a) a stage of polymerization of at least one diene monomer,
   b) a stage of modification of the living diene elastomer obtained in the preceding stage by means of at least one functionalization agent corresponding to the following general formula:

$$Si(OR')_{3-z}(G\text{-}X)R_{2z}, \quad \text{Formula 2}$$

   in which:

- G is a spacer group chosen from saturated linear divalent aliphatic hydrocarbon radicals having at least 5 carbon atoms, preferably at least 6, and at most 10 carbon atoms, preferably at most 9;
- X represents a functional group comprising a nitrogen atom the nitrogen atom being bonded to the silicon atom via the spacer group G;
- R', independently of one another, represent a C_1-C_{10}, indeed even C_1-C_8, alkyl group, preferably a C_1-C_4 alkyl group, more preferably methyl and ethyl;
- R_2 represents a C_1-C_{10}, indeed even C_1-C_8, alkyl group, more preferably methyl and ethyl;
- z has the value 0 or 1.

10. Process according to Claim 9, characterized in that the functional group X is a cyclic or non-cyclic, tertiary, protected or unprotected secondary or protected or unprotected primary amine, an isocyanate, an imine, a cyano, preferably a dialkylamino- tertiary amine, the alkyl radicals of which, independently of one another, are C_1-C_4 alkyl radicals, preferably methyl or ethyl.

11. Process according to Claim 9 or 10, characterized in that the spacer group is a saturated linear divalent C_6, C_7, C_8 or C_9, preferably C_6, aliphatic hydrocarbon radical.

12. Process according to any one of Claims 9 to 11, characterized in that the polymerization stage is carried out by anionic polymerization in the presence of a polymerization initiator.

13. Process according to Claim 12, characterized in that the molar ratio of the functionalization agent to the metal of the polymerization initiator is greater than 0.5 and preferably greater than 0.65.

14. Process according to Claim 12, characterized in that the molar ratio of the functionalization agent to the metal of the polymerization initiator varies from 0.35 to 0.65, preferably from 0.40 to 0.60.

15. Rubber composition based on at least one reinforcing filler and an elastomer matrix comprising a modified diene elastomer as described in any one of Claims 1 to 8.

16. Tyre comprising a rubber composition according to Claim 15.

17. Compound corresponding to the following general formula:

$$Si(OR')_{3-z}(G\text{-}X)R_{2z}, \quad \text{Formula 2}$$

in which:

- G is a spacer group chosen from saturated linear divalent aliphatic hydrocarbon radicals having at least 5 carbon atoms, preferably at least 6, and at most 10 carbon atoms, preferably at most 9;
- X represents a tertiary amine or protected or unprotected secondary amine functional group, an isocyanate functional group, an imine functional group or a cyano functional group;
- R', independently of one another, represent a C_1-C_{10}, indeed even C_1-C_8, alkyl group, preferably a C_1-C_4 alkyl group, more preferably methyl and ethyl;
- R_2 represents a C_1-C_{10}, indeed even C_1-C_8, alkyl group, more preferably methyl and ethyl;
- z has the value 0 or 1.

18. Compound according to Claim 17, characterized in that the spacer group is a saturated linear divalent C_6, C_7, C_8 or C_9, preferably C_6, aliphatic hydrocarbon radical.

19. Compound according to Claim 17 or 18, characterized in that the functional group X is a tertiary or protected or unprotected secondary amine, preferably a dialkylamino- tertiary amine, the alkyl radicals of which, independently of one another, are C_1-C_4 alkyl radicals, preferably methyl or ethyl.