CLAIMS

1. An initiator compound obtained by reacting a multivinylaminosilane of the following Formula 1 with an organo-alkali metal compound, preferably selected from methyllithium, ethyllithium, n-butyllithium, s-butyllithium, t-octyllithium, isopropyllithium, phenyllithium, cyclohexyllithium, 2-butyllithium, 4-phenylbutyllithium, t-butyldimethylsilyloxypropyllithium, dialkylaminopropyllithium, N-morpholinopropyllithium, sodium biphenylide, sodium naphthalenide and potassium naphthalenide:

$$(A)—B_n \qquad \text{(Formula 1)}$$

wherein

A is an organic group having at least two amino groups;

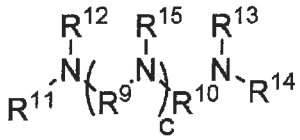
each B is independently selected from a group $-Si(R^1)(R^2)(R^3)$, wherein R^1, R^2 and R^3 are each independently selected from vinyl, butadienyl, methyl, ethyl, propyl, butyl, hexyl, octyl and benzyl, with the proviso that at least one of R^1, R^2 and R^3 is selected from vinyl and butadienyl, wherein each group B is a substituent of an amino group of group A;

at least two of the amino groups of group A are each substituted with at least one group B;

n is an integer of at least 2, preferably an integer selected from 2 to 6; and

all amino groups in group A are tertiary amino groups.

2. The initiator compound according to claim 1, wherein the multivinylaminosilane is a compound selected from the following Formulas 1-1 to 1-5:



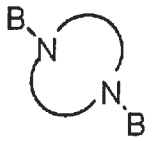
(Formula 1-1)

wherein

each of R^{11}, R^{12}, R^{13}, R^{14} and R^{15} is independently selected from group B, C_1-C_{18} alkyl, C_6-C_{18} aryl, optionally C_1-C_4 alkyl-substituted C_3-C_{12} heteroaryl, C_7-C_{18} aralkyl, $(R^4)_a$-O-$(R^5)_b$, wherein each of R^4 and R^5 is independently selected from C_1-C_6 alkyl and C_6-C_{18} aryl and a and b are each integers independently selected from 0 to 4, and $-Si(R^6)(R^7)(R^8)$, wherein each of R^6, R^7 and R^8 is independently selected from methyl, ethyl, propyl, butyl, hexyl, octyl and benzyl;

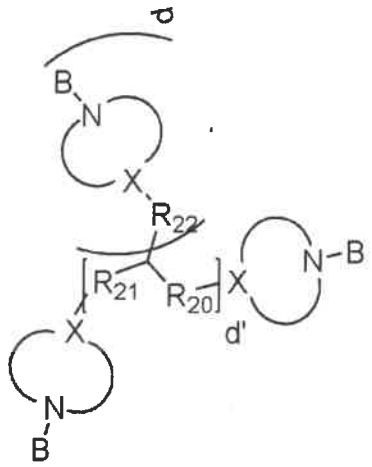
each of R^9 and R^{10} is independently selected from divalent ethyl, propyl, butyl, phenyl and $-(CH_2)_{a'}$-C_6H_5-$(CH_2)_{b'}$-, wherein each of a' and b' is an integer independently selected from 0 and1; and

c is an integer selected from 0, 1, 2 and 3;



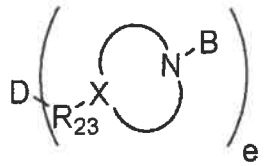
(Formula 1-2)

wherein the group -N<>N- is a 5- to 18-membered heterocyclic group which may be saturated or unsaturated and which may be substituted on any carbon atom of the ring with a C_1-C_6 alkyl group, wherein heteroatomic groups other than the two N atoms expressly shown in Formula 1-2 are selected from –N=, >NR^{16}, wherein R^{16} is selected from group B, C_1-C_6 alkyl, phenyl and benzyl, -O-, -S- and >$SiR^{17}R^{18}$, wherein each of R^{17} and R^{18} is independently selected from C_1-C_6 alkyl, phenyl and benzyl;



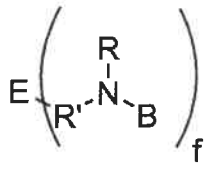
(Formula 1-3)

wherein each of R^{20}, R^{21} and R^{22} is independently selected from a single bond and a divalent C_1-C_{10} alkyl group, d is an integer selected from 0, 1 and 2, d' is an integer selected from 0 and 1, wherein d is 0 when d' is 0, each group –N<>X- is independently selected from a 5- to 10-membered heterocyclic group which may be saturated or unsaturated and which may be substituted on any carbon atom of the ring with a C_1-C_6 alkyl group, wherein each X is independently selected from -N-, -C= and –CH-, and heteroatomic groups other than the two groups N and X expressly shown in Formula 1-3 are selected from –N=, >NR^{16}, wherein R^{16} is selected from C_1-C_6 alkyl, group B, phenyl and benzyl, -O-, -S- and >$SiR^{17}R^{18}$, wherein each of R^{17} and R^{18} is independently selected from C_1-C_6 alkyl, phenyl and benzyl;



(Formula 1-4)

wherein D is a 5- to 10-membered carbocyclic or heterocyclic group which may be saturated or unsaturated and which may be substituted on any carbon atom of the ring with a C_1-C_6 alkyl group, wherein heteroatomic groups are selected from –N=, >NR^{16}, wherein R^{16} is selected from C_1-C_6 alkyl, group B, phenyl and benzyl, -O-, -S- and >$SiR^{17}R^{18}$, wherein each of R^{17} and R^{18} is independently selected from C_1-C_6 alkyl and phenyl, each group –N<>X- is independently selected from a 5- to 10-membered heterocyclic group which may be saturated or unsaturated and which may be substituted on any carbon atom of the ring with a C_1-C_6 alkyl group, wherein each X is independently selected from -N-, -C= and –CH-, R^{23} is selected from a single bond and a divalent C_1-C_{10} alkyl group, and e is an integer selected from 2, 3 and 4;

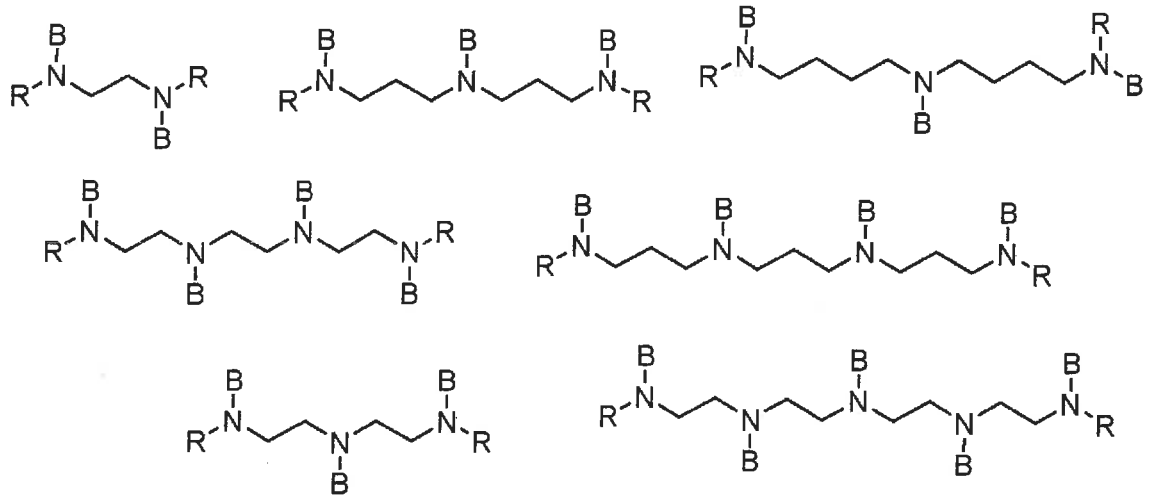


(Formula 1-5)

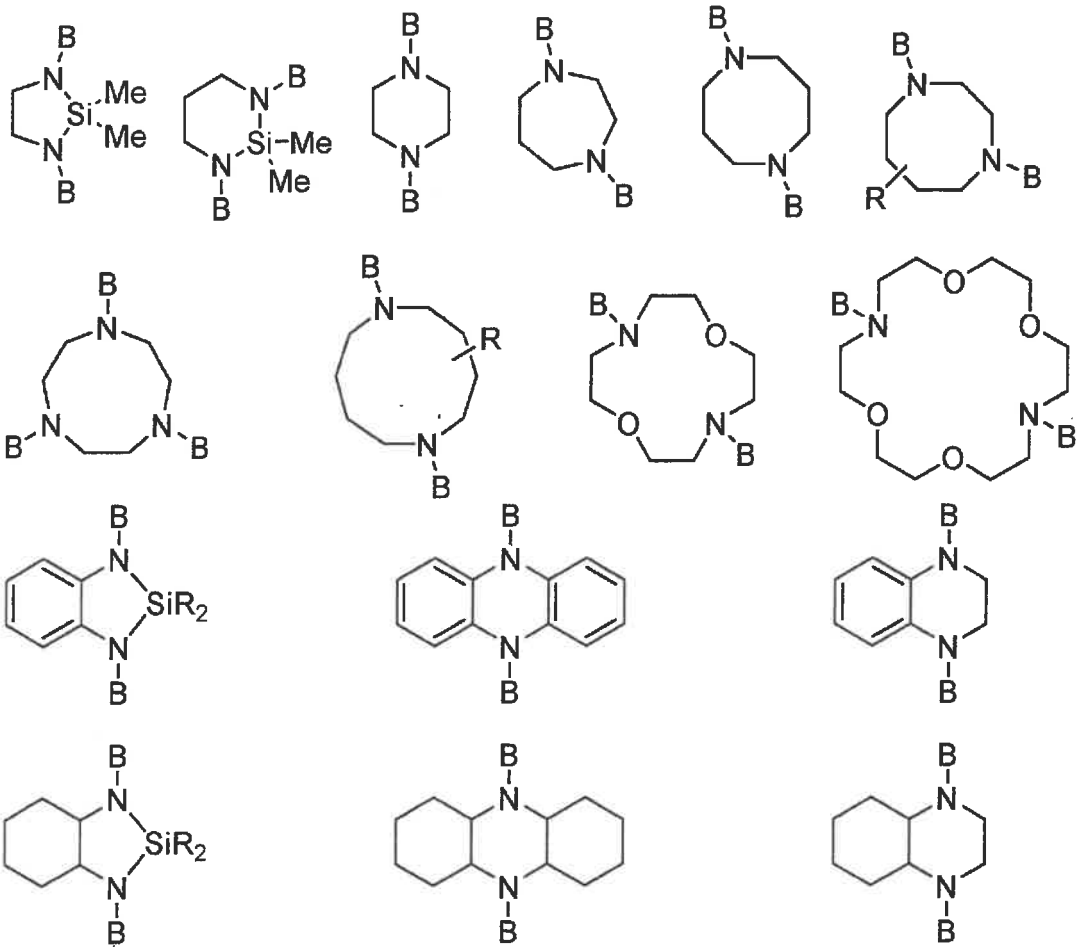
wherein E is a 6- to 10-membered cycloaliphatic or aromatic group, each R' is independently selected from a single bond and C_1-C_2 alkyl, each R is independently selected from B, C_1-C_4 alkyl and benzyl, and f is an integer selected from 2 and 3.

3. The initiator compound according to claim 2, wherein in Formula 1-1 each of R^{11}, R^{12}, R^{13}, R^{14} and R^{15} is independently selected from group B and methyl; each of R^9 and R^{10} is divalent ethyl; and c is an integer selected from 0, 1, 2 and 3.

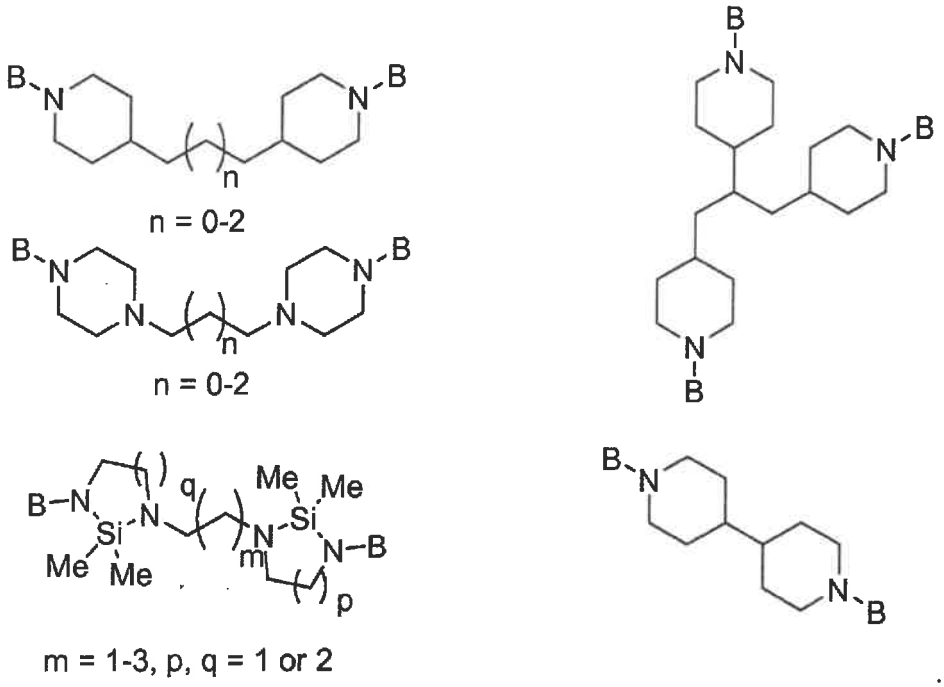
4. The initiator compound according to claim 2, wherein the multivinylaminosilane is selected from



wherein each R is independently selected from B, C_1-C_6 alkyl and benzyl;

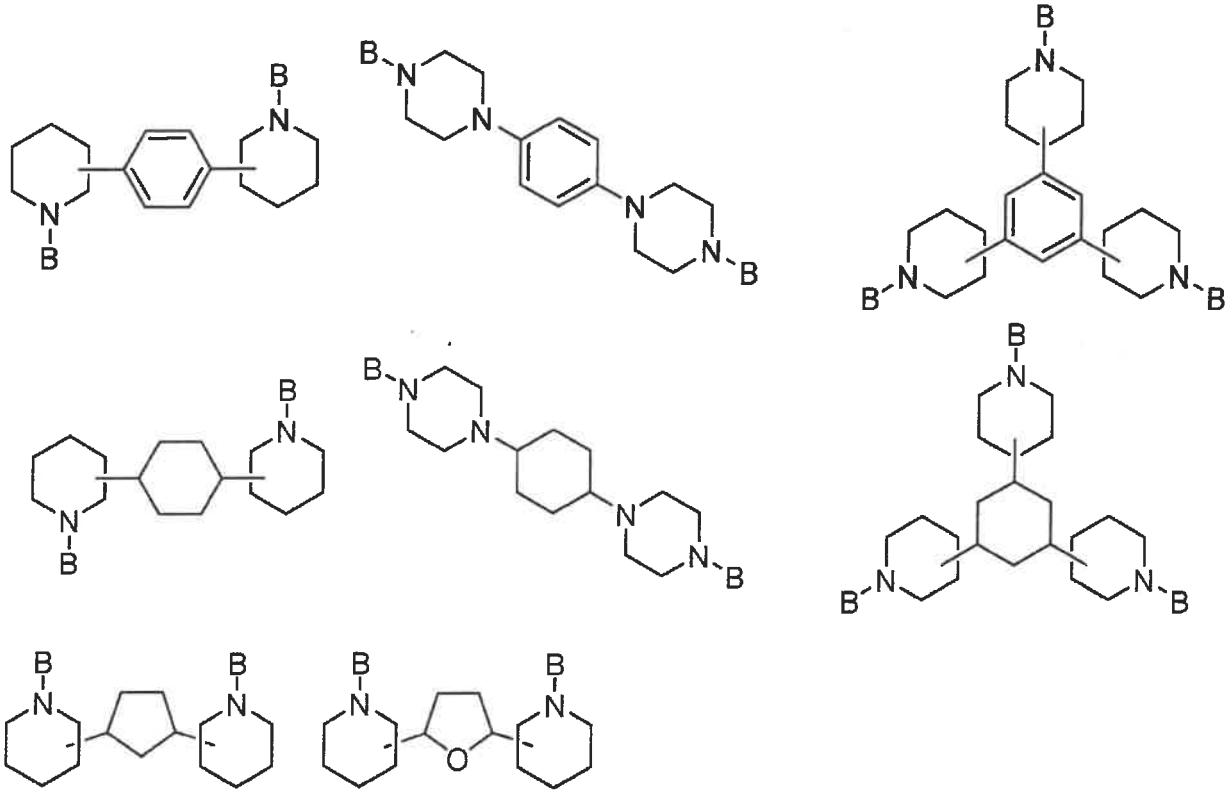


wherein R is a C_1-C_6 alkyl group; and

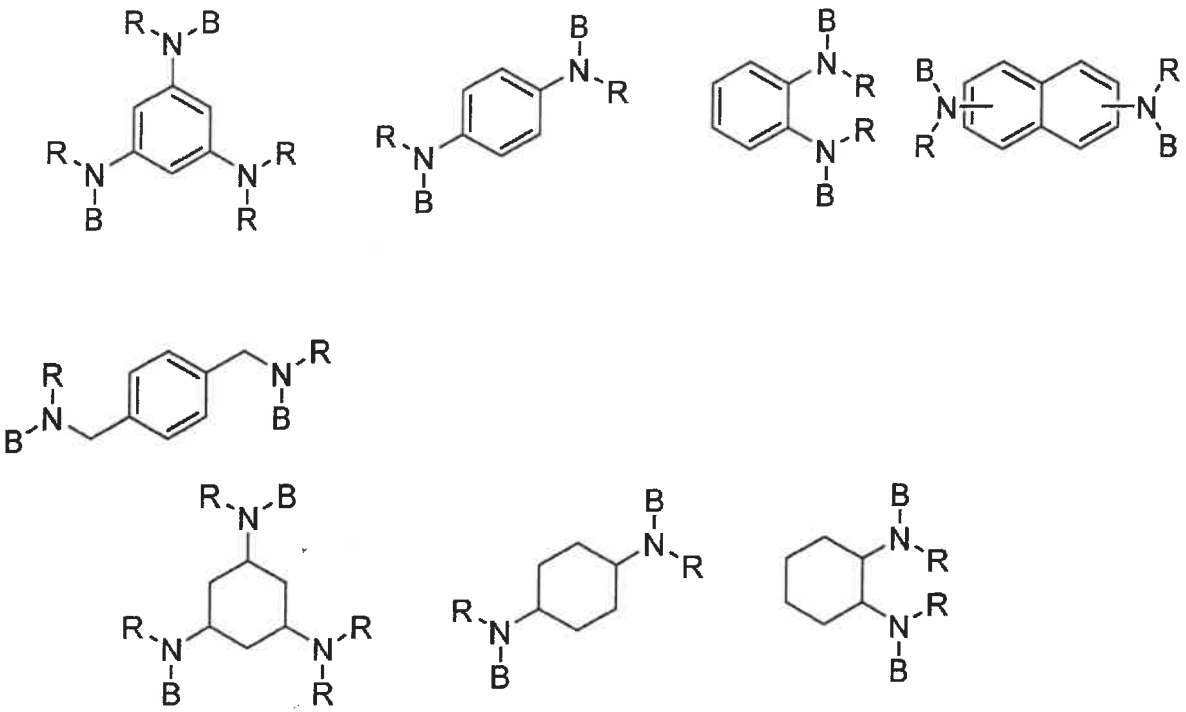


5. The initiator compound according to claim 2, wherein in Formula 1-4 D is selected from cyclopentyl, cyclohexyl, phenyl and tetrahydrofuranyl; each group –N<>X- is selected from

piperidinyl and piperazinyl; R^{23} is a single bond; and e is an integer selected from 2 and 3; preferably selected from

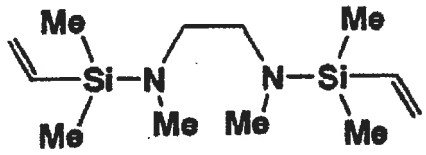


6. The initiator compound according to claim 2, wherein in Formula 1-5 E is selected from cyclohexyl and phenyl; R' is a single bond; R is selected from B, C_1-C_4 alkyl and phenyl; and f is an integer selected from 2 and 3; preferably selected from



wherein each R is independently selected from B, C_1-C_4 alkyl and phenyl.

7. A multivinylaminosilane of Formula 1 as defined in any one of claims 1 to 6, with the proviso that the multivinylaminosilane is not N,N'-bis(ethenyldimethylsilyl)-N,N'-dimethyl-1,2-ethanediamine:



8. A process for preparing the multivinylaminosilane of Formula 1 as defined in claim 1, said process comprising reacting an amine with a silane of the following Formula 2 in the presence of a base:

$$X\text{-}Si(R^1)(R^2)(R^3) \qquad \text{(Formula 2)}$$

wherein

X is selected from Cl, Br, I, trifluoromethanesulfonate (OTf) and tosylate (OTos);

R^1, R^2 and R^3 are each independently selected from vinyl, butadienyl, methyl, ethyl, propyl, butyl, hexyl, octyl and benzyl, with the proviso that at least one of R^1, R^2 and R^3 is selected from vinyl and butadienyl; and

the amine is a compound having at least two groups independently selected from a primary amino group and a secondary amino group.

9. Use of the multivinylaminosilane of Formula 1 as defined in any one of claims 1 to 6 as a branching agent for introducing branching in an elastomeric polymer.

10. A process for preparing a branched elastomeric polymer, said process comprising:

polymerizing at least one conjugated diene and a multivinylaminosilane of Formula 1 as defined in any one of claims 1 to 6 in the presence of an initiator compound,

polymerizing at least one conjugated diene in the presence of an initiator compound according to claim 1, or

reacting a living polymer, obtainable by anionically polymerizing at least one conjugated diene, with a multivinylaminosilane of Formula 1 as defined in any one of claims 1 to 6.

11. A branched elastomeric polymer obtainable by a process as defined in claim 10.

12. A non-vulcanized polymer composition comprising the branched elastomeric polymer as defined in claim 11 and one or more further components selected from (i) components which are added to or formed as a result of the polymerization process used for making said polymer, (ii) components which remain after solvent removal from the polymerization process, and (iii) components which are added to the polymer after completion of the polymer manufacturing process.

13. The non-vulcanized polymer composition according to claim 12 which comprises one or more fillers.

14. The non-vulcanized polymer composition according to claim 12 or 13, which comprises one or more vulcanizing agents.

15. A vulcanized polymer composition which is obtained by vulcanizing the non-vulcanized polymer composition as defined in claim 14.

16. A process for preparing a vulcanized polymer composition, said process comprising vulcanizing the non-vulcanized polymer composition as defined in claim 14.

17. An article comprising at least one component formed from the vulcanized polymer composition as defined in claim 15, which article is preferably selected from a tire, a tire tread, a tire side wall, a tire carcass, a belt, a gasket, a seal, a hose, a vibration damper, a footwear component, a golf ball and a hose.