What is claimed is:

1. A moisture-curable composition comprising:

(a) a trialkylsilane-terminated sulfur-containing polymer, comprising a trialkylsilane-terminated polythioether comprising:

(A) a backbone comprising a structure having the Formula (1):

$$-R^1-[-S-(CH_2)_2-O-[-R^2-O-]_m-(CH_2)_2-S-R^1]_n- \quad (1)$$

wherein:

(i) each R^1 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-10} alkanecycloalkanediyl group, a heterocyclic group, a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group in which at least one $-CH_2-$ unit is substituted with a methyl group;

(ii) each R^2 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-14} alkanecycloalkanediyl group, a heterocyclic group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group;

(iii) each X is independently selected from –O–, –S–, and a $-NR^6-$ group, in which R^6 is selected from hydrogen and a methyl group;

(iv) m ranges from 0 to 50;

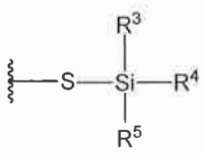
(v) n is an integer ranging from 1 to 60;

(vi) p is an integer ranging from 2 to 6;

(vii) q is an integer ranging from 1 to 5; and

(viii) r is an integer ranging from 2 to 10; and

(B) at least two groups, per molecule, of Formula (2):



(2)

wherein R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group; and

(b) a curing agent; and

(c) a blocked basic catalyst.

2. The composition of claim 1, wherein the trialkylsilane-terminated sulfur-containing polymer comprises a polysulfide.

3. The composition of claim 1, wherein the trialkylsilane-terminated polythioether comprises a trialkylsilane-terminated polythioether of Formula (3), a trialkylsilane-terminated polythioether adduct of Formula (3a), or a combination thereof:

$$R^6–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–R^6 \quad (3)$$

$$\{R^6–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (3a)$$

wherein:

each R^1 independently is selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

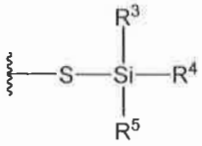
B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(-V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

each R^6 is independently a moiety comprising a terminal group of Formula (2),



(2)

wherein R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group.

4. The composition of claim 1, wherein the trialkylsilane-terminated polythioether comprises the reaction product of reactants comprising:

(a) a polythioether is selected from a thiol-terminated polythioether of Formula (8), a thiol-terminated polythioether of Formula (8a), and a combination thereof:

$$HS–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–SH \quad (8)$$

$$\{HS–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (8a)$$

wherein:

each R^1 is independently selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

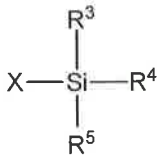
B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(–V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

(b) a halosilane of Formula (9):



(9)

wherein:

X is halogen; and

R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group.

5. The composition of claim 4, wherein z is 3 and the polyfunctionalizing agent is a trifunctionalizing agent.

6. The composition of claim 1, wherein the curing agent is selected from a polyepoxide, a compound having at least two terminal Michael acceptor groups, and a combination thereof.

7. The composition of claim 6, wherein the compound comprising at least two terminal Michael acceptor groups comprises divinyl sulfone.

8. The composition of claim 6, wherein the compound having at least two terminal Michael acceptor groups comprises a sulfur-containing adduct.

9. The composition of claim 8, wherein the sulfur-containing adduct is selected from a sulfur-containing adduct of Formula (11), a sulfur-containing adduct of Formula (11a), and a combination thereof:

$$R^7–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–R^7 \quad (11)$$

$$\{R^7–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (11a)$$

wherein:

each R^1 independently is selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(-V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

each R^7 is independently a moiety comprising a terminal Michael acceptor group.

10. The composition of claim 9, wherein each terminal Michael acceptor group is blocked with a trialkylsilane group.

11. The composition of claim 1, wherein the curing agent is characterized by an average functionality from 2 to 3.

12. The composition of claim 1, comprising a basic oxide.

13. The composition of claim 1, wherein the blocked base catalyst comprises a blocked amine catalyst.

14. The composition of claim 13, wherein the blocked amine catalyst is selected from a ketimine, an enamine, an oxazolidine, an aldimine, and an imidazolidine.

15. A moisture-curable composition comprising:

(a) a trialkylsilane-terminated sulfur-containing polymer, comprising a trialkylsilane-terminated polythioether comprising:

(A) a backbone comprising a structure having the Formula (1):

$$-R^1-[-S-(CH_2)_2-O-[-R^2-O-]_m-(CH_2)_2-S-R^1]_n- \quad (1)$$

wherein:

(i) each R^1 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-10}

alkanecycloalkanediyl group, a heterocyclic group, a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group in which at least one $-CH_2-$ unit is substituted with a methyl group;

(ii) each R^2 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-14} alkanecycloalkanediyl group, a heterocyclic group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group;

(iii) each X is independently selected from –O–, –S–, and a $-NR^6-$ group, in which R^6 is selected from hydrogen and a methyl group;

(iv) m ranges from 0 to 50;

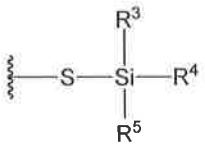
(v) n is an integer ranging from 1 to 60;

(vi) p is an integer ranging from 2 to 6;

(vii) q is an integer ranging from 1 to 5; and

(viii) r is an integer ranging from 2 to 10; and

(B) at least two groups, per molecule, of Formula (2):



(2)

wherein R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group; and

(b) divinyl sulfone; and

(c) a moisture-activated amine catalyst.

16. An aperture sealed with the composition of any one of claims 1 and 15.

17. A method of sealing an aperture comprising:

(a) applying the composition of any one of claims 1 or 15 to at least one surface defining an aperture;

(b) assembling the surfaces defining the aperture; and

(c) curing the sealant to provide a sealed aperture.

18. The composition of claim 1, wherein the polythioether is characterized by an average functionality from 2.1 to 2.8.

19. The composition of claim 1, wherein,

R^1 is $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ wherein X is O;

each R^2 is a C_{2-10} n-alkanediyl group; and

m ranges from 1 to 4.

20. The composition of claim 1, formulated as a sealant.

21. A surface sealed with the composition of claim 20.

What is claimed is:

1. A moisture-curable composition comprising:

(a) a trialkylsilane-terminated sulfur-containing polymer;

(b) a curing agent; and

(c) a blocked basic catalyst.

2. The composition of claim 1, wherein the sulfur-containing polymer is selected from a polythioether, a polysulfide, and a combination thereof.

3. The composition of claim 1, wherein the trialkylsilane-terminated sulfur-containing polymer comprises a trialkylsilane-terminated polythioether.

4. The composition of claim 3, wherein the trialkylsilane-terminated polythioether comprises:

(a) a backbone comprising a structure having the Formula (1):

$$-R^1-[-S-(CH_2)_2-O-[-R^2-O-]_m-(CH_2)_2-S-R^1]_n- \quad (1)$$

wherein:

(i) each R^1 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-10} alkanecycloalkanediyl group, a heterocyclic group, a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group in which at least one $-CH_2-$ unit is substituted with a methyl group;

(ii) each R^2 is independently selected from a C_{2-10} n-alkanediyl group, a C_{3-6} branched alkanediyl group, a C_{6-8} cycloalkanediyl group, a C_{6-14} alkanecycloalkanediyl group, a heterocyclic group, and a $-[(-CH_2-)_p-X-]_q-(CH_2)_r-$ group;

(iii) each X is independently selected from –O–, –S–, and a $-NR^6-$ group, in which R^6 is selected from hydrogen and a methyl group;

(iv) m ranges from 0 to 50;

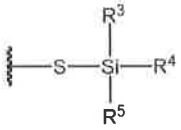
(v) n is an integer ranging from 1 to 60;

(vi) p is an integer ranging from 2 to 6;

(vii) q is an integer ranging from 1 to 5; and

(viii) r is an integer ranging from 2 to 10; and

(b) at least two groups, per molecule, of Formula (2):



(2)

wherein R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group.

5. The composition of claim 3, wherein the trialkylsilane-terminated sulfur-containing polymer is selected from a trialkylsilane-terminated polythioether of Formula (3), a trialkylsilane-terminated polythioether adduct of Formula (3a), and a combination thereof:

$$R^6–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–R^6 \quad (3)$$

$$\{R^6–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (3a)$$

wherein:

each R^1 independently is selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(-V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

each R^6 is independently a moiety comprising a terminal group of Formula (2), wherein R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group.

6. The composition of claim 3, wherein the trialkylsilane-terminated polythioether comprises the reaction product of reactants comprising:

(a) a polythioether is selected from a thiol-terminated polythioether of Formula (8), a thiol-terminated polythioether of Formula (8a), and a combination thereof:

$$HS–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–SH \quad (8)$$

$$\{HS–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (8a)$$

wherein:

each R^1 is independently selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

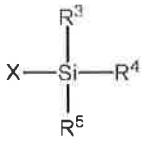
B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(-V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

(b) a halosilane of Formula (9):



(9)

wherein:

X is halogen; and

R^3, R^4, and R^5 are each independently selected from a C_{1-6} n-alkyl group, a C_{3-6} branched alkyl group, a substituted C_{1-6} n-alkyl group, and a phenyl group.

7. The composition of claim 6, wherein z is 3 and the polyfunctionalizing agent is a trifunctionalizing agent.

8. The composition of claim 1, wherein the curing agent is selected from a polyepoxide, a compound having at least two terminal Michael acceptor groups, and a combination thereof.

9. The composition of claim 8, wherein the curing agent comprises a compound comprising at least two terminal Michael acceptor groups, wherein the compound comprises divinyl sulfone.

10. The composition of claim 8, wherein the curing agent comprises a compound comprising at least two terminal Michael acceptor groups, wherein the compound having at least two terminal Michael acceptor groups comprises a sulfur-containing adduct.

11. The composition of claim 10, wherein the sulfur-containing adduct is selected from a sulfur-containing adduct of Formula (11), a sulfur-containing adduct of Formula (11a), and a combination thereof:

$$R^7–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–R^7 \quad (11)$$

$$\{R^7–S–R^1–[–S–(CH_2)_p–O–(R^2–O)_m–(CH_2)_2–S–R^1–]_n–S–V'–\}_zB \quad (11a)$$

wherein:

each R^1 independently is selected from C_{2-6} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-10} alkanecycloalkanediyl, C_{5-8} heterocycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$; wherein:

s is an integer from 2 to 6;

q is an integer from 1 to 5;

r is an integer from 2 to 10;

each R^3 is independently selected from hydrogen and methyl; and

each X is independently selected from –O–, –S–, and –NHR–, wherein R is selected from hydrogen and methyl;

each R^2 is independently selected from C_{1-10} alkanediyl, C_{6-8} cycloalkanediyl, C_{6-14} alkanecycloalkanediyl, and $–[(–CHR^3–)_s–X–]_q–(–CHR^3–)_r–$, wherein s, q, r, R^3, and X are as defined above;

m is an integer from 0 to 50;

n is an integer from 1 to 60;

p is an integer from 2 to 6;

B represents a core of a z-valent, alkenyl-terminated polyfunctionalizing agent $B(–V)_z$ wherein:

z is an integer from 3 to 6; and

each –V is a group comprising a terminal alkenyl group; and

each –V'– is derived from the reaction of –V with a thiol; and

each R^7 is independently a moiety comprising a terminal Michael acceptor group.

12. The composition of claim 11, wherein each terminal Michael acceptor group is blocked with a trialkylsilane group.

13. The composition of claim 1, wherein the average functionality of the curing agent is from 2 to 3.

14. The composition of claim 1, comprising a basic oxide.

15. The composition of claim 1, wherein the blocked base catalyst comprises a blocked amine catalyst.

16. The composition of claim 15, wherein the blocked amine catalyst is a ketimine, an enamine, an oxazolidine, an aldimine, an imidazolidine, or a combination thereof.

17. A moisture-curable composition comprising:

(a) a trialkylsilane-terminated sulfur-containing polymer;

(b) a Michael acceptor curing agent; and

(c) a basic catalyst.

18. An aperture sealed with the composition of any one of claims 1 and 17.

19. A method of sealing an aperture comprising:

(a) applying the composition of any one of claims 1 and 17 to at least one surface defining an aperture;

(b) assembling the surfaces defining the aperture; and

(c) curing the sealant to provide a sealed aperture.