FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
AND
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(See Section 10; rule 13)

TITLE OF THE INVENTION

"CURABLE POLYSILOXANE COMPOSITIONS AND PRESSURE SENSITIVE ADHESIVES MADE THEREFROM"

APPLICANT

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The following specification particularly describes
the invention and the manner in which
it is to be performed

What is claimed is:

1. A curable composition comprising:

at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties;

at least one hydroxyl-functional polyorganosiloxane resin; and

at least one photoactivatable composition that, upon exposure to radiation, generates at least one base selected from amidines, guanidines, phosphazenes, proazaphosphatranes, and combinations thereof.

2. The composition of claim 1, wherein the polydiorganosiloxane comprises polydimethylsiloxane.

3. The composition of claim 1, wherein the at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties comprises the following general formula:

$$(OH)_p\text{-}Si(R')_{3-p}\text{-}[G\text{-}Si(R')_2]_t\text{-}O\text{-}[(R')_2SiO]_q[Si(R')_2\text{-}G]_t\text{-}Si(R')_{3-p}\text{-}(OH)_p \quad (I)$$

wherein each p is independently an integer of 1, 2, or 3; each G is independently a divalent linking group; each R' is independently selected from alkyl, alkenyl, aryl, cycloalkyl, heteroalkyl, heteroaryl, heterocycloalkyl, and combinations thereof; q is an integer of 0 to 150,000; and each t is independently an integer of 0 or 1.

4. The composition of claim 3, wherein each G is independently selected from oxy, alkylene, arylene, heteroalkylene, heteroarylene, cycloalkylene, heterocycloalkylene, and combinations thereof; each R' is independently selected from alkyl, aryl, and combinations thereof; q is an integer of 20 to 150,000; and t is an integer of 0 or 1.

5. The composition of claim 1, wherein the at least one hydroxyl-functional polyorganosiloxane resin comprises an MQ resin.

6. The composition of claim 5, wherein the MQ resin comprises M units selected from $(CH_3)_3SiO_{1/2}$, $(CH_3)_2(Vi)SiO_{1/2}$, $(CH_3)_2ArSiO_{1/2}$, $(CH_3)Ar_2SiO_{1/2}$, and combinations thereof, where Vi is a vinyl group, and Ar is an aryl group.

7. The composition of claim 1, wherein the photoactivatable composition comprises at least one 1,3-diamine compound that is substituted on at least one nitrogen atom by at least one aralkyl

radical, wherein the at least one 1,3-diamine compound is selected from those that are represented by the formula:

$$N(R_7)(R_6)\text{-}CH(R_5)\text{-}N(R_4)\text{-}C(R_1)(R_2)(R_3) \qquad (VI)$$

wherein R_1 is selected from aromatic radicals, heteroaromatic radicals, and combinations thereof that absorb light in the wavelength range from 200 nm to 650 nm and that are unsubstituted or substituted one or more times by at least one monovalent group selected from C_1 -C_{18} alkyl, C_2 -C_{18} alkenyl, C_2 -C_{18} alkynyl, C_1 -C_{18} haloalkyl, -NO_2 , -NR_{10} R_{11} , -CN, -OR_{12} , -SR_{12} , -$C(O)R_{13}$, -$C(O)OR_{14}$, halogen, groups of the formula $N(R_7)(R_6)$-$CH(R_5)$-$N(R_4)$-$C(R_2)(R_3)$- where R_2-R_7 are as defined for Formula VI, and combinations thereof, and that upon said absorption bring about a photoelimination that generates an amidine or guanidine; R_2 and R_3 are each independently selected from hydrogen, C_1 -C_{18} alkyl, phenyl, substituted phenyl (that is, substituted one or more times by at least one monovalent group selected from C_1 -C_{18} alkyl, -CN, -OR_{12} , -SR_{12} , halogen, C_1 -C_{18} haloalkyl, and combinations thereof), and combinations thereof; R_5 is selected from C_1 -C_{18} alkyl, -NR_8 R_9 , and combinations thereof; R_4 , R_6 , R_7 , R_8 , R_9 , R_{10} and R_{11} are each independently selected from hydrogen, C_1 -C_{18} alkyl, and combinations thereof; or R_4 and R_6 together form a C_2 -C_{12} alkylene bridge that is unsubstituted or is substituted by one or more monovalent groups selected from C_1-C_4 alkyl radicals and combinations thereof; or R_5 and R_7 , independently of R_4 and R_6 , together form a C_2 -C_{12} alkylene bridge that is unsubstituted or is substituted by one or more monovalent groups selected from C_1-C_4 alkyl radicals and combinations thereof; or, if R_5 is -NR_8R_9 , then R_7 and R_9 together form a C_2 -C_{12} alkylene bridge that is unsubstituted or is substituted by one or more monovalent groups selected from C_1-C_4 alkyl radicals and combinations thereof; R_{12} and R_{13} are each independently selected from hydrogen, C_1 -C_{19} alkyl, and combinations thereof; and R_{14} is selected from C_1-C_{19} alkyl and combinations thereof.

8. The composition of claim 1, wherein the photoactivatable composition comprises at least one compound that is an organoborate salt of a protonated amidine, guanidine, phosphazene, or proazaphosphatrane.

9. The composition of claim 1, wherein the photoactivatable composition comprises at least one compound selected from 8-benzyl-1,8-diazabicyclo[5.4.0]undecane, 8-benzyl-6-methyl-1,8-diazabicyclo[5.4.0]undecane, the tetraaryl borate salt of protonated 1,8-diazabicylo[5.4.0]undecene, and combinations thereof.

10. The composition of claim 1, wherein the photoactivatable composition further comprises at least one photosensitizer.

11. The composition of claim 1, wherein the composition is solventless.

12. A pressure sensitive adhesive comprising:

a cured curable composition, the curable composition comprising:

at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties;

at least one hydroxyl-functional polyorganosiloxane resin; and

at least one photoactivatable composition that, upon exposure to radiation, generates at least one base selected from amidines, guanidines, phosphazenes, proazaphosphatranes, and combinations thereof.

13. The pressure sensitive adhesive of claim 12, wherein the at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties comprises the following general formula:

$$(OH)_p\text{-}Si(R')_{3-p}\text{-}[G\text{-}Si(R')_2]_t\text{-}O\text{-}[(R')_2SiO]_q[Si(R')_2\text{–}G]_t\text{-}Si(R')_{3-p}\text{-}(OH)_p \quad (I)$$

wherein each p is independently an integer of 1, 2, or 3; each G is independently a divalent linking group; each R' is independently selected from alkyl, alkenyl, fluoroalkyl, aryl, fluoroaryl, cycloalkyl, fluorocycloalkyl, heteroalkyl, heterofluoroalkyl, heteroaryl, heterofluoroaryl, heterocycloalkyl, heterofluorocycloalkyl, and combinations thereof; q is an integer of 0 to 150,000; and each t is independently an integer of 0 or 1.

14. The pressure sensitive adhesive of claim 12, wherein the at least one hydroxyl-functional polyorganosiloxane resin comprises an MQ resin.

15. A method of preparing a coating comprising:

providing a curable composition, the curable composition comprising:

at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties;

at least one hydroxyl-functional polyorganosiloxane resin; and

at least one photoactivatable composition that, upon exposure to radiation, generates at least one base selected from amidines, guanidines, phosphazenes, proazaphosphatranes, and combinations thereof;

providing a substrate comprising at least a first major surface and a second major surface;

applying the curable composition to at least a portion of at least one major surface of the substrate; and

inducing the curable composition to cure to form a coating by exposing at least a portion of the curable composition to radiation.

16. The method of claim 15, wherein the radiation comprises ultraviolet radiation, visible radiation, or a combination thereof.

17. The method of claim 15, further comprising drying the curable composition and/or the cured composition.

18. An article comprising:

a substrate comprising at least a first major surface and a second major surface; and

a pressure sensitive adhesive coated on at least a portion of at least one major surface of the substrate, the pressure sensitive adhesive comprising:

a cured curable composition, the curable composition comprising:

at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties;

at least one hydroxyl-functional polyorganosiloxane resin; and

at least one photoactivatable composition that, upon exposure to radiation, generates at least one base selected from amidines, guanidines, phosphazenes, proazaphosphatranes, and combinations thereof.

19. The article of claim 18, wherein the substrate comprises a film, a release liner, a tape backing, a metal foil, a plates, or the outer surface of an article.

20. The article of claim 18, wherein the at least one polydiorganosiloxane, comprising at least two hydroxysilyl moieties comprises the following general formula:

$$(OH)_p\text{-}Si(R')_{3-p}\text{-}[G\text{-}Si(R')_2]_t\text{-}O\text{-}[(R')_2SiO]_q[Si(R')_2\text{-}G]_t\text{-}Si(R')_{3-p}\text{-}(OH)_p \quad (I)$$

wherein each p is independently an integer of 1, 2, or 3; each G is independently a divalent linking group; each R' is independently selected from alkyl, alkenyl, fluoroalkyl, aryl, fluoroaryl,

cycloalkyl, fluorocycloalkyl, heteroalkyl, heterofluoroalkyl, heteroaryl, heterofluoroaryl, heterocycloalkyl, heterofluorocycloalkyl, and combinations thereof; q is an integer of 0 to 150,000; and each t is independently an integer of 0 or 1.

21. The article of claim 18, wherein the at least one hydroxyl-functional polyorganosiloxane resin comprises an MQ resin.

22. The article of claim 18, wherein the photoactivatable composition comprises at least one compound that is an organoborate salt of a protonated amidine, guanidine, phosphazene, or proazaphosphatrane.

23. The article of claim 18, wherein the photoactivatable composition comprises at least one compound selected from 5-benzyl-1,5-diazabicyclo[4.3.0]nonane, 5-(anthracen-9-yl-methyl)-1,5-diaza[4.3.0]nonane, 5-(2′-nitrobenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(4′-cyanobenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(3′-cyanobenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(anthraquinon-2-yl-methyl)-1,5-diaza[4.3.0]nonane, 5-(2′-chlorobenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(4′-methylbenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(2′,4′,6′-trimethylbenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(4′-ethenylbenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(3′-trimethylbenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(2′,3′-dichlorobenzyl)-1,5-diazabicyclo[4.3.0]nonane, 5-(naphth-2-yl-methyl-1,5-diazabicyclo[4.3.0]nonane, 1,4-bis(1,5-diazabicyclo[4.3.0]nonanylmethyl)benzene, 8-benzyl-1,8-diazabicyclo[5.4.0]undecane, 8-benzyl-6-methyl-1,8-diazabicyclo[5.4.0]undecane, 9-benzyl-1,9-diazabicyclo[6.4.0]dodecane, 10-benzyl-8-methyl-1,10-diazabicyclo[7.4.0]tridecane, 11-benzyl-1,11-diazabicyclo[8.4.0]tetradecane, 8-(2′-chlorobenzyl)-1,8-diazabicyclo[5.4.0]undecane, 8-(2′,6′-dichlorobenzyl)-1,8-diazabicyclo[5.4.0]undecane, 4-(diazabicyclo[4.3.0]nonanylmethyl)-1,1′-biphenyl, 4,4′-bis(diazabicyclo[4.3.0]nonanylmethyl)-11′-biphenyl, 5-benzyl-2-methyl-1,5-diazabicyclo[4.3.0]nonane, 5-benzyl-7-methyl-1,5,7-triazabicyclo[4.4.0]decane, the tetraaryl borate salt of protonated 1,8-diazabicylo[5.4.0]undecene, and combinations thereof.

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