

IN THE EUROPEAN PATENT OFFICE
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

APPLICANT: ZYDEX INC.
INTERNATIONAL APPLICATION NO.: PCT/US2019/068920
INTERNATIONAL FILING DATE: 30 DECEMBER 2019
TITLE: SOIL STABILIZING COMPOSITIONS

Authorized Officer: Johannes Buter

European Patent Office
NL-2280 HV Rijswijk

RESPONSE TO THE FIRST
WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

Dear Officer Buter:

This communication is in response to the Written Opinion, dated 19 November 2020, from the International Preliminary Examining Authority (IPEA). Applicants have submitted herewith amendments under Article 34, as described more fully below, to correct certain defects in the claims and to more particularly distinguish the claimed invention from the cited references. In addition and as also described more fully below, Applicants have provided remarks explaining the patentability of the claimed invention to overcome the defects noted in the Written Opinion. Applicants respectfully request reconsideration in light of these amendments and remarks and issuance of a favorable International Preliminary Report on Patentability.

Independent claim 1 and 14 has been amended to include the subject matter of previously presented dependent claims 2 and 12. As such, no new matter has been introduced to independent claim 1.

A “marked-up” copy of the claims has been provided to easily identify the claim amendments. A clean copy of the amended claims is also provided with this response.

For the reasons provided below, Applicants respectfully submit that all claims are patentable over the cited references.

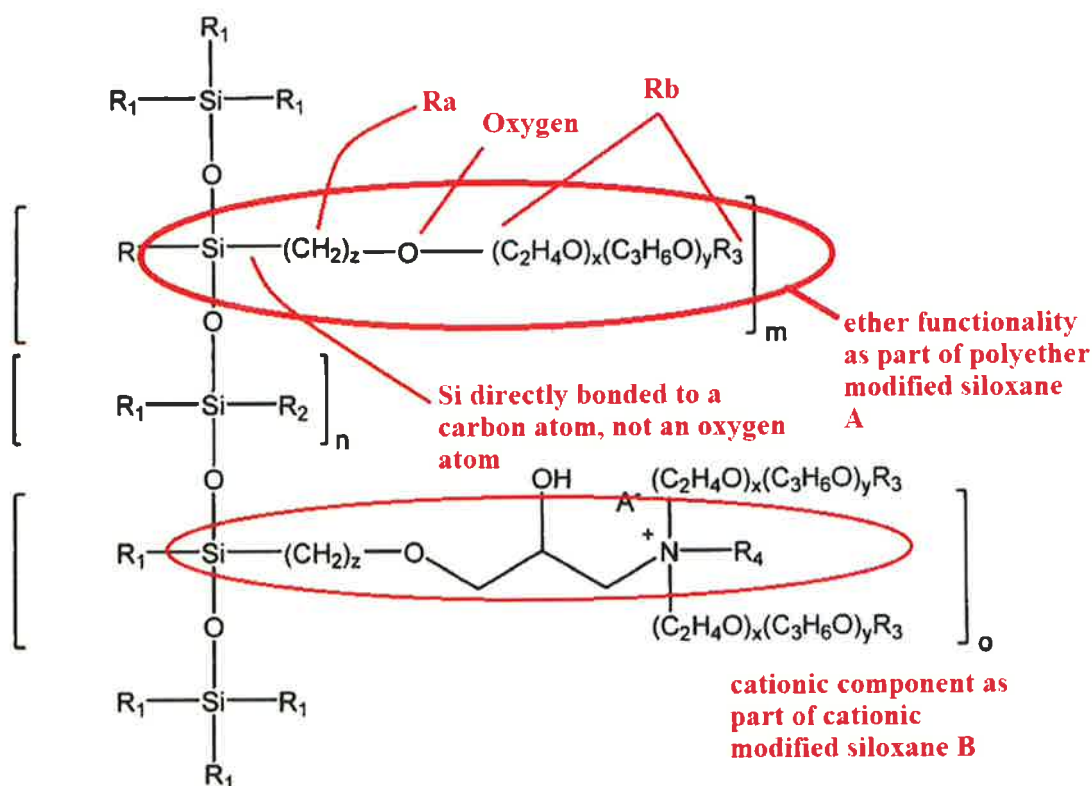
REMARKS

The Written Opinion finds that all claims (i.e., claims 1-35) lack novelty and inventive step in view of EP 3360917A (“D1”). Applicants respectfully disagree.

As part of the Written Opinion's arguments for maintaining the rejections based upon D1, the Written Opinion contends that polyether modified siloxane A of D1 contains hydroxy groups and reads on the claimed water soluble non-ionic organosilane (e.g., a transesterified alkoxy silane and/or amino-functional silane). The Written Opinion also argues that the claimed transesterified alkoxy silanes are product-by-process limitations, such that the term "transesterified" is not limiting. Based on this line of reasoning, the Written Opinion argues that the polyether modified siloxane A of D1 falls under the definition of an alkoxy silane. Applicants respectfully disagree with the Written Opinion's proposition that the claimed "transesterified alkoxy silanes" feature is a product-by-process limitation, in which the Written Opinion is effectively reading the "transesterified" limitation out of this feature.

With regard to the "transesterified alkoxy silane" issue, Applicants note that the specification specifically describes a "transesterified alkoxy silane" as a compound that generally includes a Si-O-R-OH group. In this regard, a the claimed "transesterified alkoxy silane" includes an alkoxy group including a hydroxyl group, which is hydrophilic, that is directly bonded to a silicon atom. In this regard, the term "transesterified" does not render this claimed feature as a product-by-process limitation. To the contrary, the term "transesterified" helps describe at least one aspect of the structure of such silanes.

Additionally, Applicants note that D1 does not teach or suggest a "transesterified alkoxy silane" as described in the present specification and claimed. For instance, the claimed "transesterified alkoxy silane" has at least one hydroxyl-containing alkoxy groups (e.g., Si-O-R-OH) directly bonded to a silicon atom. To the contrary, the polyether modified siloxane A of D1 has the following general ether functionality: Si-R_a-O-R_b-OH. In this regard, the silicon atom is not bonded to the oxygen atom but a carbon atom as part of R_a. Below is an annotated copy of formula 1 from D1 to help illustrate that the polyether modified siloxane A is structurally different from the claimed "transesterified alkoxy silane"



As noted above, D1 does not teach or suggest the claimed “transesterified alkoxy silane” aspect of the currently claimed invention. For instance the ether functionality of D1 does not include an oxygen atom directly bonded to a silicon atom.

The Written Opinion also argues that the cationic modified siloxane B of D1 reads on the claimed ionic organosilicon compound. The Written Opinion also specifically notes that amino functionality may be included in the cationic modified siloxane B of D1. In this regard, it appears that the Written Opinion has mistakenly associated the claimed amino-functional silanes with the ionic organosilicon compounds instead of the claimed water soluble non-ionic organosilane.

Applicants note that D1 appears to only teach amino-functionality associated with the cationic modified siloxane B. Accordingly, D1 does not teach or suggest a non-ionic amino-functional silane as claimed.

Accordingly, Applicants submit that all claims as currently presented are patentable over the prior art of record.

CONCLUSION

All of the points raised by the ISA and Written Opinion have now been addressed by the remarks provided above. Accordingly, Applicants respectfully request that a favorable International Preliminary Report on Patentability indicate the same.

Respectfully Submitted,



John E. Johnson, III
Attorney for Applicant
Burr & Forman LLP
Bank of America Plaza
101 South Tryon Street, Suite 2610
Charlotte, NC 28280
Tel (704) 347-6479
Fax (704) 347-4467

Docket No.: 068023-00008

CLEAN CLAIMS

THAT WHICH IS CLAIMED:

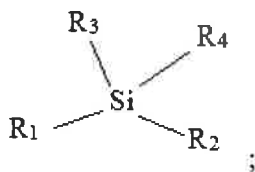
1. A composition for soil stabilization, comprising:

(a) at least one ionic organosilicon compound; and

(b) at least one water soluble non-ionic organosilane, wherein the at least one water soluble non-ionic organosilane comprises a transesterified alkoxy silane, an amino-functional silane, or a combination thereof;

wherein the composition comprises a liquid.

2. The composition of claim 1, wherein the transesterified alkoxy silane comprises a structure according to the formula:



wherein

R₁ comprises a substituted or non-substituted hydrocarbon radical;

R₂ comprises a first hydroxy-containing alkoxy radical;

R₃ comprises an alkoxy radical or a second hydroxy-containing alkoxy radical; and

R₄ comprises an alkoxy radical or a third hydroxy-containing alkoxy radical.

3. The composition of claim 2, wherein the first hydroxy-containing alkoxy radical, the second hydroxy-containing alkoxy radical, and the third hydroxy-containing alkoxy radical are the same.

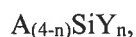
4. The composition of claim 2, wherein the first hydroxy-containing alkoxy radical is different than at least the second hydroxy-containing alkoxy radical.
5. The composition of claims 2-4, wherein R_1 comprises an alkyl radical.
6. The composition of claim 5, wherein the alkyl radical comprises a linear alkyl radical, a branched alkyl radical, or a cycloalkyl radical including from one to thirty carbon atoms.
7. The composition of claims 2-4, wherein R_1 comprises a substituted hydrocarbon radical having one or more of a halide atom, a nitrogen atom, or an oxygen atom.
8. The composition of claims 2-7, wherein at least the first hydroxy-containing alkoxy radical comprises $-\text{[OCH}_2\text{CH}_2\text{]}_a\text{OH}$ where 'a' has a value of 1 through 10, $-\text{[OC}_3\text{H}_6\text{]}_b\text{OH}$ where 'b' has a value of one through ten, or $[\text{C}_3\text{H}_7\text{O}_3]$.
9. The composition of claim 2-7, wherein the transesterified alkoxy silane comprises the first hydroxy-containing alkoxy radical and the second hydroxy-containing alkoxy radical, and wherein the first hydroxy-containing alkoxy radical and the second hydroxy-containing alkoxy radical each independently comprise $-(\text{OCH}_2\text{CH}_2)_a\text{OH}$ where 'a' has a value of 1 through 10, $-\text{[OC}_3\text{H}_6\text{]}_b\text{OH}$ where 'b' has a value of 1 through 10, or $[\text{C}_3\text{H}_7\text{O}_3]$.
10. The composition of claim 1, wherein the at least one water soluble non-ionic organosilane comprises an inherently or naturally water soluble organosilane.

11. The composition of claims 1-10, wherein the at least one water soluble non-ionic organosilane comprises a solubility in water of at least about 2.5 grams per Liter of water at a temperature of 20°C, such as at least about any of the following: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 g/L and/or at most about 150, 140, 130, 120, 110, 100, 90, 80, 70, and 60 g/L.

12. The composition of claims 10-11, wherein the at least one water soluble non-ionic organosilane comprises a bis-aminofunctional silane.

13. The composition of claims 1-12, wherein the amino-functional silane comprises N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, N-aminoethylaminomethylphenyltrimethoxysilane, N-(2-aminoethyl)-3-aminopropyltris(2-ethylhexoxy)-silane, 3-aminopropyltrimethoxysilane, trimethoxysilyl-propyldiethylenetriamine, bis(2-hydroxyethyl)-3-aminopropyltrimethoxysilane, 2-methacryloxyethyl dimethyl-[3-trimethoxysilylpropyl] ammonium chloride, or any combination thereof.

14. The composition of claims 1-13, wherein the at least one water soluble non-ionic organosilane comprises a structure according to the following formula:



wherein, 'A' comprises a monovalent organic radical, 'Y' comprises a hydroxyl groups or a hydrolyzable radical, and n is 1, 2, or 3.

15. The composition of claim 14, wherein 'A' comprises an alkyl or aryl radical.

16. The composition of claims 14-15, wherein 'Y' comprises acetoxyl radicals, alkoxy radicals with 1 to 6 carbon atoms.

17. The composition of claims 1-16, wherein the composition comprises at least one water soluble non-ionic organosilane comprising a transesterified alkoxy silane and at least one inherently or naturally water soluble non-ionic organosilane.

18. The composition of claims 1-17, wherein the composition is an aqueous solution or aqueous dispersion.

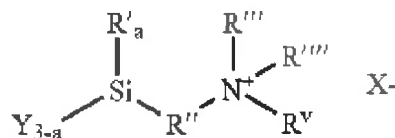
19. The compositions of claims 1-18, wherein the composition comprises less than 10% by weight, such less than 5% by weight, or less than 1% by weight of an organic solvent.

20. The composition of claims 1-19, wherein the composition is devoid of an organic solvent.

21. The composition of claims 1-20, wherein the composition comprises a weight ratio between the at least one water soluble non-ionic organosilane and the at least one ionic organosilicon compound comprising from about 98:2 to about 2:98; such as at most about any of the following: 95:5, 90:10, 85:15, 80:20, 75:25, 70:30, 65:45, 60:40, 55:45, 50:50, 45:55, and 40:60 and/or at least about any of the following: 2:98, 5:95, 10:90, 15:85, 20:80, 25:75, 30:70, 35:65, 40:60, 45:55, 50:50, 55:45, and 60:40.

22. The composition of claims 1-21, wherein the at least one ionic organosilicon compound comprises a cationic organosilicon compound.

23. The composition of claim 22, wherein the cationic organosilicon compound comprises a structure according to the formula:



wherein

Y is an alkoxy radical with 1 to 6 carbon atoms; 'a' has a value of zero; R'' is propylene; R''' is methyl or ethyl; R''' and R^v are identical or different alkyl groups containing from one to twenty-two carbon atoms, wherein at least one of R''' and R''' is larger than eight carbon atoms; and X is a halide, acetate, or tosylate.

24. The composition of claims 22-23, wherein the cationic organosilicon compound comprises 3-(trimethoxysilyl)propyldimethyloctadecyl ammonium chloride, 3-(trimethoxysilyl)propylmethyldidecyl ammonium chloride, or 3-(trimethoxysilyl)propyldimethylhexadecyl ammonium chloride.

25. The composition of claims 1-24, wherein the sum of the at least one ionic organosilicon compound and the at least one water soluble non-ionic organosilane comprises from about 5% to about 100% dissolved and/or suspended solids by weight.

26. The composition of claims 1-24, wherein the sum of the at least one ionic organosilicon compound and the at least one water soluble non-ionic organosilane comprises from about 0.1% to about 10% dissolved and/or suspended solids by weight.

27. The composition of claims 1-26, wherein the composition further comprises at least one surfactant.

28. The composition of claim 27, wherein the at least one surfactant comprises an anionic surfactant, cationic surfactant, zwitterionic surfactant, non-ionic surfactant or any combination thereof.

29. The composition of claim 1-28, further comprising a soil.

30. The composition of claim 29, wherein the soil comprises gravel, sand, silt, clay, or any combination thereof.

31. The composition of claims 29-30, wherein the composition comprises a maximum dry density (MDD) of at least about 1.5 gm/cc, such as from about 1.5 gm/cc to about 3 gm/cc.

32. A composition, comprising:

(a) at least one transesterified alkoxy silane; and

(b) soil.

33. The composition of claims 32, wherein the soil comprises gravel, sand, silt, clay, or any combination thereof.

34. The composition of claims 32-33, wherein the composition comprises a maximum dry density (MDD) of at least about 1.5 gm/cc, such as from about 1.5 gm/cc to about 3 gm/cc.

MARKED-UP CLAIMS

THAT WHICH IS CLAIMED:

1. A composition for soil stabilization, comprising:

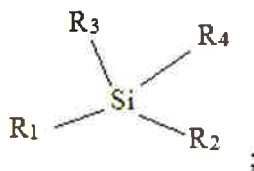
(a) at least one ionic organosilicon compound; and

(b) at least one water soluble non-ionic organosilane, wherein the at least one water soluble non-ionic organosilane comprises a transesterified alkoxy silane, an amino-functional silane, or a combination thereof;

wherein the composition comprises a liquid.

~~2. The composition of claim 1, wherein the at least one water soluble non-ionic organosilane comprises a transesterified alkoxy silane.~~

~~32.~~ The composition of ~~claims 1-2~~claim 1, wherein the transesterified alkoxy silane comprises a structure according to the formula:



wherein

R₁ comprises a substituted or non-substituted hydrocarbon radical;

R₂ comprises a first hydroxy-containing alkoxy radical;

R₃ comprises an alkoxy radical or a second hydroxy-containing alkoxy radical; and

R₄ comprises an alkoxy radical or a third hydroxy-containing alkoxy radical.

~~43~~. The composition of claim ~~32~~, wherein the first hydroxy-containing alkoxy radical, the second hydroxy-containing alkoxy radical, and the third hydroxy-containing alkoxy radical are the same.

~~54~~. The composition of claim ~~32~~, wherein the first hydroxy-containing alkoxy radical is different than at least the second hydroxy-containing alkoxy radical.

~~65~~. The composition of claims ~~3-52-4~~, wherein R_1 comprises an alkyl radical.

~~76~~. The composition of claim ~~65~~, wherein the alkyl radical comprises a linear alkyl radical, a branched alkyl radical, or a cycloalkyl radical including from one to thirty carbon atoms.

~~87~~. The composition of claims ~~3-52-4~~, wherein R_1 comprises a substituted hydrocarbon radical having one or more of a halide atom, a nitrogen atom, or an oxygen atom.

~~98~~. The composition of claims ~~3-82-7~~, wherein at least the first hydroxy-containing alkoxy radical comprises $-\text{[OCH}_2\text{CH}_2\text{]}_a\text{OH}$ where 'a' has a value of 1 through 10, $-\text{[OC}_3\text{H}_6\text{]}_b\text{OH}$ where 'b' has a value of one through ten, or $[\text{C}_3\text{H}_7\text{O}_3]$.

~~109~~. The composition of claim ~~3-82-7~~, wherein the transesterified alkoxy silane comprises the first hydroxy-containing alkoxy radical and the second hydroxy-containing alkoxy radical, and wherein the first hydroxy-containing alkoxy radical and the second hydroxy-containing alkoxy radical each independently comprise $-(\text{OCH}_2\text{CH}_2)_a\text{OH}$ where 'a' has a value of 1 through 10, $-\text{[OC}_3\text{H}_6\text{]}_b\text{OH}$ where 'b' has a value of 1 through 10, or $[\text{C}_3\text{H}_7\text{O}_3]$.

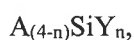
~~11~~10. The composition of claim 1, wherein the at least one water soluble non-ionic organosilane comprises an inherently or naturally water soluble organosilane.

~~12~~11. The composition of claims 1-~~11~~10, wherein the at least one water soluble non-ionic organosilane comprises a solubility in water of at least about 2.5 grams per Liter of water at a temperature of 20°C, such as at least about any of the following: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 g/L and/or at most about 150, 140, 130, 120, 110, 100, 90, 80, 70, and 60 g/L.

~~13~~12. The composition of claims ~~11-12~~10-11, wherein the at least one water soluble non-ionic organosilane comprises ~~an amino-functional silane or~~ a bis-aminofunctional silane.

~~14~~13. The composition of ~~claim 13~~claims 1-12, wherein the amino-functional silane comprises N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, N-aminoethylaminomethylphenyltrimethoxysilane, N-(2-aminoethyl)-3-aminopropyltris(2-ethylhexoxy)-silane, 3-aminopropyltrimethoxysilane, trimethoxysilyl-propyldiethylenetriamine, bis(2-hydroxyethyl)-3-aminopropyltrimethoxysilane, 2-methacryloxyethyltrimethyl-[3-trimethoxysilylpropyl] ammonium chloride, or any combination thereof.

~~15~~14. The composition of claims ~~11-12~~1-13, wherein the at least one water soluble non-ionic organosilane comprises a structure according to the following formula:



wherein, 'A' comprises a monovalent organic radical, 'Y' comprises a hydroxyl groups or a hydrolyzable radical, and n is 1, 2, or 3.

~~16~~15. The composition of claim ~~15~~14, wherein 'A' comprises an alkyl or aryl radical.

~~17~~16. The composition of claims ~~15-16~~14-15, wherein 'Y' comprises acetoxy radicals, alkoxy radicals with 1 to 6 carbon atoms.

~~18~~17. The composition of claims 1-~~17~~16, wherein the composition comprises at least one water soluble non-ionic organosilane comprising a transesterified alkoxy silane and at least one inherently or naturally water soluble non-ionic organosilane.

~~19~~18. The composition of claims 1-~~18~~17, wherein the composition is an aqueous solution or aqueous dispersion.

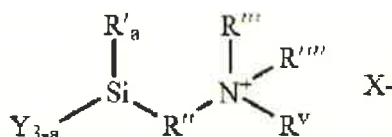
~~20~~19. The compositions of claims 1-~~19~~18, wherein the composition comprises less than 10% by weight, such less than 5% by weight, or less than 1% by weight of an organic solvent.

~~21~~20. The composition of claims 1-~~20~~19, wherein the composition is devoid of an organic solvent.

~~22~~21. The composition of claims 1-~~21~~20, wherein the composition comprises a weight ratio between the at least one water soluble non-ionic organosilane and the at least one ionic organosilicon compound comprising from about 98:2 to about 2:98; such as at most about any of the following: 95:5, 90:10, 85:15, 80:20, 75:25, 70:30, 65:45, 60:40, 55:45, 50:50, 45:55, and 40:60 and/or at least about any of the following: 2:98, 5:95, 10:90, 15:85, 20:80, 25:75, 30:70, 35:65, 40:60, 45:55, 50:50, 55:45, and 60:40.

2322. The composition of claims 1-2221, wherein the at least one ionic organosilicon compound comprises a cationic organosilicon compound.

2423. The composition of claim 2322, wherein the cationic organosilicon compound comprises a structure according to the formula:



wherein

Y is an alkoxy radical with 1 to 6 carbon atoms; 'a' has a value of zero; R'' is propylene; R''' is methyl or ethyl; R'''' and R^v are identical or different alkyl groups containing from one to twenty-two carbon atoms, wherein at least one of R''' and R'''' is larger than eight carbon atoms; and X is a halide, acetate, or tosylate.

2524. The composition of claims 26-2822-23, wherein the cationic organosilicon compound comprises 3-(trimethoxysilyl)propyldimethyloctadecyl ammonium chloride, 3-(trimethoxysilyl)propylmethyldidecyl ammonium chloride, or 3-(trimethoxysilyl)propyldimethylhexadecyl ammonium chloride.

2625. The composition of claims 1-2524, wherein the sum of the at least one ionic organosilicon compound and the at least one water soluble non-ionic organosilane comprises from about 5% to about 100% dissolved and/or suspended solids by weight.

2726. The composition of claims 1-2524, wherein the sum of the at least one ionic organosilicon compound and the at least one water soluble non-ionic organosilane comprises from about 0.1% to about 10% dissolved and/or suspended solids by weight.

~~2827~~. The composition of claims 1-~~2726~~, wherein the composition further comprises at least one surfactant.

~~2928~~. The composition of claim ~~2827~~, wherein the at least one surfactant comprises an anionic surfactant, cationic surfactant, zwitterionic surfactant, non-ionic surfactant or any combination thereof.

~~3029~~. The composition of claim 1-~~2928~~, further comprising a soil.

~~3130~~. The composition of claim ~~3029~~, wherein the soil comprises gravel, sand, silt, clay, or any combination thereof.

~~3231~~. The composition of claims ~~30-3129-30~~, wherein the composition comprises a maximum dry density (MDD) of at least about 1.5 gm/cc, such as from about 1.5 gm/cc to about 3 gm/cc.

~~3332~~. A composition, comprising:

(a) at least one transesterified alkoxy silane; and

(b) soil.

~~3433~~. The composition of claims ~~3332~~, wherein the soil comprises gravel, sand, silt, clay, or any combination thereof.

~~35~~34. The composition of claims ~~33-34~~32-33, wherein the composition comprises a maximum dry density (MDD) of at least about 1.5 gm/cc, such as from about 1.5 gm/cc to about 3 gm/cc.