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WE CLAIM:

1. A coated article comprising a hybrid sol-gel coating, said coating comprising:

a siloxane matrix having void spaces therein; and

an organic polymer filler phase present as discrete and separate phase inclusions that are interspersed within, and throughout, the void spaces in the siloxane matrix, wherein the organic polymer comprises at least one of the following:

an amorphous thermoplastic having a glass transition temperature of 200 °C or greater;

a crystalline thermoplastic having a melt point of 200°C or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200°C or greater.

2. The coated article of claim 1, wherein said coating further comprises an inorganic filler.

3. The coated article of claim 2, wherein the inorganic filler is silicon carbide.

4. The coated article of claim 1, wherein the organic polymer is selected from the group consisting of: polyphenylene sulfide (PPS); polyethersulones (PES), polyether ether ketone (PEEK); polyphenylsulfone (PPSU); polyethersulfone (PESU); polyamide-imides (PAI); polyetherimides (PEI), and combinations of the foregoing.

5. The coated article of claim 1, wherein the organic polymer comprises polyphenylene sulfide (PPS).

6. The coated article of claim 1, wherein the organic polymer comprises 2 wt.% to 50 wt.% of the composition on a total dry weight basis.

7. The coated article of claim 1, wherein the siloxane matrix is formed from an organoalkoxysilane of the formula:

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$R_xSi(OR')_{4-x}$

wherein: R is one or more moieties chosen independently from linear, branched, or cyclic alkyl and aryl;

R' is methyl, ethyl, propyl or alkyl; and

x is at least 0 and less than 4.

8. The coated article of claim 7, wherein R is C_6 aryl or C_1-C_6 linear or branched alkyl.

9. The coated article of claim 1, wherein the siloxane matrix is formed from an organoalkoxysilane selected from the group consisting of: methyltrimethoxysilane, methyltriethoxysilane, dimethyldiethoxysilane, dimethyldimethoxysilane, trimethylmethoxysilane, trimethylethoxysilane, phenyltrimethoxysilane, phenyl triethoxysilane, and combinations of the foregoing.

10. The coated article of claim 1, wherein the organic polymer comprises an amorphous thermoplastic having a glass transition temperature of 200°C or greater.

11. The coated article of claim 1, wherein the article is an article of cookware.

12. A composition for forming a hybrid sol-gel coating comprising:

at least one organoalkoxysilane;

at least one organic polymer in the form of polymer particles having a median diameter D50 between 1 and 50 microns, wherein the organic polymer comprises at least one of the following:

a crystalline thermoplastic having a melt point of 200°C or greater;

an amorphous thermoplastic having a glass transition temperature of 200°C or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200°C or greater; ~~and~~

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a filler material; and

a solvent.

13. The composition of claim 12, wherein the organic polymer comprises 2 wt.% to 50 wt.% of the composition on a total dry weight basis.

14. The composition of claim 12, wherein the organic polymer comprises polyphenylene sulfide (PPS).

15. The composition of claim 12, wherein the filler material comprises silicon carbide.

16. A method of forming a coating comprising:

providing a mixture, wherein the mixture comprises an organosiloxane and an organic polymer in the form of polymer particles having a median diameter D50 between 1 and 50 microns, wherein the organic polymer comprises at least one of the following:

a crystalline thermoplastic having a melt point of 200°C or greater;

an amorphous thermoplastic having a glass transition temperature of 200°C or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200°C or greater;

applying the mixture to a substrate; and

curing the mixture to produce a hybrid sol-gel coating.

17. The method of claim 16, further comprising hydrolysing the organosiloxane with the catalyst before applying the mixture to the substrate.

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18. The composition of claim 12, wherein, based on the total amount of the composition on a wet basis:

the at least one organoalkoxysilane is present in an amount of between 20 and 40 wt.%; and

the at least one organic polymer is present in an amount of between 1.75 and 15 wt.%.

WE CLAIM:

1. A coated article comprising a hybrid sol-gel coating, said coating comprising:

a siloxane matrix having void spaces therein, the siloxane matrix formed from hydrolysis and condensation of at least one organoalkoxysilane of the formula:

$$R_xSi(OR')_{4-x}$$

wherein: R is one or more moieties chosen independently from linear, branched, or cyclic alkyl and aryl;

R' is methyl, ethyl, propyl or alkyl; and

x is at least 0 and less than 4; and

an organic polymer filler phase present as discrete and separate phase inclusions that are interspersed within, and throughout, the void spaces in the siloxane matrix, wherein the organic polymer comprises at least one of the following:

an amorphous thermoplastic having a glass transition temperature of 200 ºC or greater;

a crystalline thermoplastic having a melt point of 200ºC or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200ºC or greater.

2. The coated article of claim 1, wherein said coating further comprises an inorganic filler.

3. The coated article of claim 2, wherein the inorganic filler is silicon carbide.

4. The coated article of claim 1, wherein the organic polymer is selected from the group consisting of: polyphenylene sulfide (PPS); polyethersulones (PES), polyether ether ketone (PEEK); polyphenylsulfone (PPSU); polyethersulfone (PESU); polyamide-imides (PAI); polyetherimides (PEI), and combinations of the foregoing.

5. The coated article of claim 1, wherein the organic polymer comprises polyphenylene sulfide (PPS).

6. The coated article of claim 1, wherein the organic polymer comprises 2 wt.% to 50 wt.% of the composition on a total dry weight basis.

7. The coated article of claim 1, wherein R is C_6 aryl or C_1-C_6 linear or branched alkyl.

8. The coated article of claim 1, wherein the siloxane matrix is formed from an organoalkoxysilane selected from the group consisting of: methyltrimethoxysilane, methyltriethoxysilane, dimethyldiethoxysilane, dimethyldimethoxysilane, trimethylmethoxysilane, trimethylethoxysilane, phenyltrimethoxysilane, phenyl triethoxysilane, and combinations of the foregoing.

9. The coated article of claim 1, wherein the organic polymer comprises an amorphous thermoplastic having a glass transition temperature of 200ºC or greater.

10. The coated article of claim 1, wherein the article is an article of cookware.

11. A composition for forming a hybrid sol-gel coating comprising:

at least one organoalkoxysilane of the formula:

$$R_xSi(OR')_{4-x}$$

wherein: R is one or more moieties chosen independently from linear, branched, or cyclic alkyl and aryl;

R' is methyl, ethyl, propyl or alkyl; and

x is at least 0 and less than 4;

water; and

at least one organic polymer in the form of polymer particles having a median diameter D50 between 1 and 50 microns, wherein the organic polymer comprises at least one of the following:

a crystalline thermoplastic having a melt point of 200ºC or greater;

an amorphous thermoplastic having a glass transition temperature of 200ºC or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200ºC or greater; and

a filler material.

12. The composition of claim 11, wherein the organic polymer comprises 2 wt.% to 50 wt.% of the composition on a total dry weight basis.

13. The composition of claim 11, wherein the organic polymer comprises polyphenylene sulfide (PPS).

14. The composition of claim 11, wherein the filler material comprises silicon carbide.

15. The composition of claim 11, wherein, based on the total amount of the composition on a wet basis:

the at least one organoalkoxysilane is present in an amount of between 20 and 40 wt.%; and

the at least one organic polymer is present in an amount of between 1.75 and 15 wt.%.

16. A method of forming a coating comprising:

providing a mixture, wherein the mixture comprises an organosiloxane of the formula:

$$R_xSi(OR')_{4-x}$$

wherein: R is one or more moieties chosen independently from linear, branched, or cyclic alkyl and aryl;

R' is methyl, ethyl, propyl or alkyl; and

x is at least 0 and less than 4;

water; and an organic polymer in the form of polymer particles having a median diameter D50 between 1 and 50 microns, wherein the organic polymer comprises at least one of the following:

a crystalline thermoplastic having a melt point of 200ºC or greater;

an amorphous thermoplastic having a glass transition temperature of 200ºC or greater; and

a thermosetting polymer having a heat deflection/distortion temperature of 200ºC or greater;

applying the mixture to a substrate; and

curing the mixture to produce a hybrid sol-gel coating, wherein the organosiloxane polymerizes around the organic polymer to form a siloxane matrix with an organic polymer filler phase present as discrete and separate phase inclusions that are interspersed within, and throughout, the void spaces in the siloxane matrix.

17. The method of claim 16, further comprising hydrolysing the organosiloxane with the catalyst before applying the mixture to the substrate.