CLAIMS

1. A method comprising:

(i) providing a sol comprising a solvent and a metal alkoxide;

(ii) contacting the sol with a precipitation initiator to initiate precipitation of the sol, wherein the precipitation initiator is different to the solvent; and

(iii) applying the precipitating sol to a product.

2. The method of claim 1, wherein the precipitation initiator comprises water or ethanol.

3. The method of any preceding claim, wherein the precipitation initiator comprises one or more functional additives.

4. The method of any preceding claim, wherein the sol comprises one or more functional additives, optionally wherein the one or more functional additives comprise a photo initiator, resin, oils, dye, salt, mineral or other inorganic particles, surfactant, composite particle, and/or metal.

5. The method of any preceding claim, wherein the sol comprises one or more biopolymers, optionally wherein the one or more biopolymers comprises a starch, modified starch, flour, or a modified flour.

6. The method of any preceding claim, wherein the metal of the metal alkoxide comprises silicon, titanium, aluminium, zirconium, tin, or any combination thereof, optionally wherein the metal of the metal alkoxide comprises silicon, titanium, aluminium, zirconium, or any combination thereof.

7. The method of claim 6, wherein the metal of the metal alkoxide comprises silicon, titanium, or any combination thereof.

8. The method of claim 6 or 7, wherein the metal of the metal alkoxide comprises silicon or titanium.

9. The method of claim 1, wherein the alkoxide is selected from the group comprising $Ti(isopropoxy)_4$, $Al(isopropoxy)_3$, $Al(sec\text{-}butoxy)_3$, $Zr(n\text{-}butoxy)_4$, $Zr(n\text{-}propoxy)_4$, n-propyltriethoxysilane, tetrapropyl orthosilicate, titanium(IV) tert-butoxide, titanium(IV) isopropoxide, triethyloxysilane, methyltriethyloxysilane, triethoxy(octyl)silane, phenyl-triethoxysilane, titanium(iv) ethoxide, triethoxy-silylcyclopentane, (3-glycidyloxypropyl) trimethoxysilane, cyclopentyltriethoxysilane, 3-amino-propyltriethoxysilane, triethoxy- 3-(2-imidazolin-1-yl)propylsilane, and any combination thereof.

10. The method of claim 1, wherein the alkoxide is selected from the group comprising tetrapropyl orthosilicate, titanium(IV) tert-butoxide, titanium(IV) isopropoxide, triethyloxysilane, methyltriethyloxysilane, triethoxy(octyl)silane, phenyl-triethoxysilane, titanium(iv) ethoxide, triethoxy-silylcyclopentane, (3-glycidyloxypropyl) trimethoxysilane, cyclopentyltriethoxysilane, or any combination thereof.

11. The method of claim 1, wherein the alkoxide is selected from the group comprising $Si(OR)_4$, $Ti(OR)_4$, $Al(OR)_3$, $Zr(OR)_3$, $Sn(OR)_4$, $R_c\text{-}Si(OR)_3$, $R_c\text{-}Ti(OR)_3$, $R_c\text{-}Al(OR)_2$, $R_c\text{-}Zr(OR)_2$ and $R_c\text{-}Sn(OR)_3$, or any combination thereof.

12. The method of claim 1, wherein the alkoxide is selected from the group comprising $Ti(isopropoxy)_4$, $Al(isopropoxy)_3$, $Al(sec\text{-}butoxy)_3$, $Zr(n\text{-}butoxy)_4$, $Zr(n\text{-}propoxy)_4$, and n-propyltriethoxysilane based alkoxides, and any combination thereof.

13. The method of claim 1, wherein the alkoxide is selected from the group comprising tetraethoxysilane, phenyltriethoxysilane, methyltriethyloxysilane, and any combination thereof.

14. The method of any preceding claim, wherein the solvent comprises one or more organic solvents.

15. The method of claim 14, wherein the one or more organic solvents comprise an alcohol, optionally wherein the alcohol is selected from the group comprising methanol, ethanol, isopropanol, butanol, ethylene glycol, or any combination thereof.

16. The method of any preceding claim, wherein the precipitating sol is applied to the product within 15 minutes of contacting the sol with the precipitation initiator.

17. The method of any preceding claim, wherein the precipitating sol is applied to the product within 15 seconds of contacting the sol with the precipitation initiator.

18. The method of any preceding claim, wherein the ratio of sol to precipitation initiator is between 1 :200 and 1:2.

19. The method of any preceding claim, wherein the ratio of sol to precipitation initiator is between 1 :100 and 5:100.

20. The method of any preceding claim, wherein the precipitating sol is applied to the product to form a coating on the product.

21. The method of any preceding claim, wherein the product is selected from the group comprising wooden products, textile products, leather products, metal (including alloy) products, concrete products or construction materials, cardboard products, paper or pulp products, plastic products, glass products, ceramic products, composite materials, sands, bricks, marbles, soils, paints, painted products, food and beverage products, medical devices, pharmaceutical products and combinations thereof.

22. The method of any preceding claim, wherein the precipitating sol is mixed into the product.

23. The method of any one of claims 1 to 22, wherein the precipitating sol is applied to the product by brushing or by spraying or by rollers.

24. The method of claim 23, wherein the precipitating sol is applied to the product via a spray drying technique.

25. The method of any preceding claim, wherein the sol is formed less than 5 minutes prior to the step of contacting the sol with the precipitation initiator.

26. The method of any preceding claim, further comprising drying the product following application of the precipitating sol.

27. The method of any one of claims 1 to 26, wherein the product is not actively heated to dry the product following application of the precipitating sol.

28. The method of any preceding claim, the method further comprising providing an apparatus comprising:

a first storage vessel;

a second storage vessel;

one or more pumps; and

one or more delivery means for applying a sol and a precipitation initiator each stored in a respective one of the first and second storage vessels to a product.