In prior art suspensions, temperature and pH played a factor in the amount of time that a suspension remains homogenous and uniform in extended stagnant storage. Inorganic particles may remain in suspension in aqueous and non-aqueous solvents depending upon the size of the particle, lattice structure and density but in stagnant storage tend to agglomerate and settle out of suspension.

Also, there are no custom made suspending media. Suspending agents remain in the same medium which they are formed.

Summary of the Invention

The present invention relates to the suspension of particles in a carrier and to sol-gels or gel particles which can be used alone or in an organic or aqueous medium to suspend solid inert particles. Gel particles that include sols, sol-gels, gel particles, gelatinous precipitates, etc., (hereinafter "gel particles") are used to suspend inert particles and to act as lubricants in a variety of applications as particles alone or in a liquid medium. The suspension slurry composition formed can contain gel particles in amount ranging from about 0.1% up to about 80% of the carrier by weight. The gel particles and base carrier may be used without the addition of other suspended particles as a lubricant. The aqueous content of the carrier can contain about 1 to 100% by weight of water with an organic solvent added for any carrier less than 100% water. The organic medium can comprise a variety of solvents, preferably alkylene and polyalkylene glycols depending upon use.

The gel particles which are preferably aluminum hydroxide ($Al(OH)_3$) can be created in an aqueous, non-aqueous or aqueous organic medium, separated and transferred to a second medium, whether aqueous or non-aqueous or used alone in a variety of cases required as a lubricant or to custom formulate a suspension or slurry of abrasive or non-abrasive particles.

However, gel particles can be formed with other metal oxides, metal sulfides, hydroxides, and oxide hydrates that can form a suspended precipitate in water within the pH of about 3 to 12.

It is a general object of the invention to provide long-term stable slurry suspensions which can be used in wire saw applications for cutting slices from ingots, lapping applications, CMP applications, and in the separation of particles.

It is another object of the invention to provide a long-term stable suspension of abrasive or non-abrasive particles in a low toxicity and/or low viscosity carrier.

It is yet another object of the invention to provide a stable suspension of colloidal or NCOL abrasive or non-abrasive particles in a neutral or near neutral pH medium.

A further object of the invention is to provide a means for suspending colloidal or NCOL abrasive or other particles in a liquid not depending upon final slurry viscosity.

Another object of the invention is to provide gel particles which can be added to a variety of base carriers to suspend inert particles and also act as lubricants.

Description of the Preferred Embodiments

The present invention provides a means for providing a stable suspension of particles in an aqueous or organic medium or semi-aqueous medium without agglomeration or particle hard settling utilizing sol-gels or gel particles. According to one feature of the invention there is provided suspension and/or lubricating carriers and slurry compositions for wire saw applications as lubricants; lapping or polishing slurries, non- abrasive slurries and the like in which a suspension of particles is maintained at ambient as well as elevated temperature. The gel particles are maintained as an aqueous, semi-aqueous or non-aqueous suspension in about 0.1 to 80 weight percent of carrier.

The gel particles can be prepared separately and then used alone or in a carrier as a lubricant and/or suspension agent or combined with a polar or non-polar solvent. The gel particles can advantageously be used in different types of glycols so that the lubricating compositions can be custom made for a particular use.

It is desirable in many cases to use more than one suspending agent in order to have a uniform dispersion for as long as possible. The reason for this is that the particles to be suspended may have different densities and/or electrostatic charges from the suspending gel particles. For example, in wire saw cutting operations there are cutting particles and kerf particles from the ingot being cut. In other operations there can be contaminants with higher density or similar density as the suspending medium.

These suspending particles are metal or semi-metal oxides, hydroxides and oxide hydrates that form a suspended particulate precipitate (i.e., sols, sol-gels, gel particles, gelatinous precipitate etc.) in aqueous, semi-aqueous or non-aqueous media at a pH from about 3 to 12. The particles to be suspended comprise the conventional abrasive or non-abrasive particles, inert particles having a particle size of about 1 to 100 μm for pigment manufacture, wire saw cutting, metal finishing applications and smaller size for wafer lapping applications being in the range typically of about 0.1 to 10 μm and even lower for CMP applications the particles being the range of about 10-500 nm. The preferred suspending particles are those formed in situ or separately such as when a metal salt is formed into the metal hydroxide. In such a case, the density of the in-situ prepared precipitated gel particles is generally lower and the surface area of the gel particle formed in-situ is typically greater than commercially available forms. In addition, there is generally a broader particle size distribution of the in-situ formed gel particles of the invention. The advantage of having the gel particles separate from the carrier medium allows for mixing different particle sizes in certain applications particularly for coating.

The abrasive material for use in the above-recited composition may include powders of diamond, silica, tungsten carbide, silicon carbide, boron carbide, silicon nitride, silicon dioxide, cerium oxide, zirconium oxide, aluminum oxide, or other hard grit "powder" material. Generally, mean or average particle sizes range from about 0.5-30 microns and preferably from about 2-20 microns, or a mixture thereof. The concentrations of the inert particles being suspended in the suspension medium or carrier

for most applications typically may range from about 0.1 to 60 weight percent of the total suspension.

Solvents which may be used with the water are polar solvents which include alcohols, amides, esters, ethers, ketones, glycols, glycol ethers, alkyl lactones, or sulfoxides. Specifically, examples of polar solvents are dimethyl sulfoxide (DMSO), dimethylacetamide (DMAC), N-methyl pyrrolidone (NMP), (gamma) butyrolactone, diethylene glycol ethyl ether, dipropylene glycol methyl ether, tripropylene glycol monomethyl ether, various glycols, polyethylene glycols and poly propylene glycols and the like.

The organic solvents are used in some cases to provide needed viscosity levels to the resulting slurries prepared. Other uses for organic solvents may include a lowering of the slurry/carrier freezing point. The choice of the solvent is relatively immaterial as long as the solvent is inert, fully miserable or soluble in water, non-reactive with water or with the suspended particles or suspending gel particles, and has low toxicity and is of low odor.

The suspending particles that can be used include, but are not limited to, metal hydroxides, oxide hydrates and oxides other than the abrasive particles that form an aqueous or semi-aqueous suspension (i.e. gel particles, gelatinous precipitate, sol, sol-gels, colloidal or non-colloidal suspension, etc.). These suspending particles as an important component of the present invention will not settle out over time to form a hard agglomerate on the container bottom. This includes, but is not limited to, those compounds, which *in- situ* are within or without the medium converted to the hydroxide

form such as a metal sulfate that is converted to the hydroxide form using a metal or non-metal Bronstead base, for example, potassium hydroxide, tetramethyl ammonium hydroxide, sodium hydroxide, tetraethylammonium hydroxide, barium hydroxide, etc. as illustrated by the following example equation:

$$Al_2(SO_4)_3+6[CH_4N]OH \xrightarrow{water} 2Al(OH)_3+3[(CH_3)_4N]_2(SO_4)$$

Among the suitable metal hydroxides of use in this invention include, but are not limited to cupric hydroxide, aluminum hydroxide, and $Zn(OH)_2$.

Among the metal oxides, sulfides, salts or oxide hydrates which may be used to form or form in-situ the suspending particles are transition metal oxides such as nickel oxides, ZnO, Zn-salts, ZnS, SnO_2xH_2O, tin-salts, SnS, $Al_2O_3 \cdot xH_2O$, Al-salts and the like. These oxides, salts, sulfides and the like can also be used to form the corresponding hydroxides to provide a stable suspension medium that includes sol-gels, gel particles, gelatinous colloidal or non-colloidal suspension for the carrier system.

In the case of $Al(OH)_3$ or other aluminum oxide or hydroxide species, a pH range for use in the carrier is about 3-12. A preferred range is 5-10 and the most preferred range is 6-9.

Excluded as suspending precipitates or particles are those particles having a density significantly greater than that of the carrier solvent, and those that are not naturally precipitous or suspend-able. It is understood that there are those metal oxides or hydroxides which have a higher density except when formed or precipitated in-situ in

the carrier solvent or in another medium which is then added to the carrier systems of this invention.

A corrosion inhibitor may be added to the carrier formulations of the present invention to suppress or eliminate metal corrosion when required. Appropriate inhibitors should not cause foaming, interfere with the formulations' ability to provide long-term stable abrasive or solids suspensions, compromise the viscosity, rheology, or uniformity of the carrier formulations and their associated abrasive or solids suspensions.

Suitable corrosion inhibitors which may be added to the aqueous and semi-aqueous carriers of the present invention may include, but are not limited to aliphatic and aromatic carboxylic acids, neutralized carboxylic acids using alkanol amines (i.e. diethanol amine, triethanol amine, etc.), tetra-alkylammonium hydroxides, other similar non-metal hydroxide bases, alkyl or aromatic amines or other Bronstead bases. Also included may be other known metal corrosion inhibitors in the art such as long chain modified carboxylates commercially under such trade names as DeForest DeCore-APCI-95, DeTrope CA-100. Further examples of known corrosion inhibitors equally suitable for the corrosion prevention or suppression of metals used in CMP processes (i.e. Al/Cu, Cu, Al/Si, Al/Si/Cu, GaAs, LnP, and the like) may include but are not limited to benzoic acid, pyrogallol, gallic acid, ammonium thiosulfate, 8-hydroxy quinoline, catachol, benzotrizole, etc., or combinations thereof.

Additionally, there are other suitable corrosion inhibitors which function as oxygen absorbers or scavengers which include but are not limited to hydroquinone, poly-hydroxy aromatics, 8-hydroxyquinoline, nitrites, sulfites, etc.

What Is Claimed Is

1. A method for the suspension of inert colloidal or non-colloidal abrasive or non-abrasive particles in an aqueous, semi aqueous or non-aqueous organic carrier medium which comprises producing suspending particles selected from the group consisting of stable gel particles, sol-gel and gelatinous precipitates so as to establish suspending particles to inert particles interference to settling of said inert particles in said carrier medium, said carrier medium comprising about 0.1 to 60% by weight of the suspending particles which differ from said inert particles and are selected from the group consisting of oxides, hydroxides, and oxide hydrates that form said suspending particle within and inclusive of said carrier medium at a pH of about 3 to 12, whereby particles are suspended as a result of at least one of physical interference, different densities and electrostatic charges.

2. The method of claim 1 wherein said aqueous carrier medium comprises a polar solvent.

3. The method of claim 1 wherein said suspending gel particles are formed in a separate medium from the final carrier medium.

4. The method of claim 1 wherein said aqueous carrier medium contains at least one inert polar solvent.

5. The method of claim 4 wherein said polar solvent is selected from the group consisting of dialkylene glycol, alkylene glycol, glycol ether, polyalkylene glycol, alkyl lactone, N-methyl pyrrolidone, alkylene carbonates, acetonitrile, and dimethyl acetamide.

6. The method of claim 1 wherein said suspending particles, sol-gels, gel particles, gelatinous precipitates are metal, semi-metal or transition metal hydroxides.

7. The method of claim 6 wherein said suspending particles are formed in situ with the carrier medium.

8. The method of claim 1 wherein inert particles being suspended are selected from the group consisting of titanium dioxide, silicon carbide, carbon, zirconium oxide, silica, cerium oxide, aluminum oxide, silicon nitride, tungsten carbide, diamond, silicon dioxide and dry pigment particles.

9. A suspension composition which comprises:

A) a carrier medium;

B) up to about 80% by weight of said carrier medium of particles selected from the group consisting of gelatinous particles, sol-gel and gel particles being formed from a member selected from the group consisting of metal or semi-metal oxides, hydroxides, and oxide hydrates, plus said carrier medium comprising;

about 0 to 100% by weight water, and the remainder being an inert polar solvent.

10. The composition of claim 9 wherein the gelatinous, sol-gel or gel particles are formed in a carrier medium separate from the final carrier medium.

11. The composition of claim 9 including inert non-abrasive or abrasive particles.

12. The method of claim 1 including a corrosion inhibitor.

In prior art suspensions, temperature and pH played a factor in the amount of time that a suspension remains homogenous and uniform in extended stagnant storage. Inorganic particles may remain in suspension in aqueous and non-aqueous solvents depending upon the size of the particle, lattice structure and density but in stagnant storage tend to agglomerate and settle out of suspension.

Also, there are no custom made suspending media. Suspending agents remain in the same medium which they are formed.

Summary of the Invention

The present invention relates to the suspension of particles in a carrier and to sol-gels or gel particles which can be used alone or in an organic or aqueous medium to suspend solid inert particles. Gel particles that include sol-gels, gel particles, gelatinous precipitates, etc., (hereinafter "gel particles") are used to suspend inert particles and to act as lubricants in a variety of applications as particles alone or in a liquid medium. The suspension slurry composition formed can contain gel particles in amount ranging from about 0.1% up to about 80% of the carrier by weight. The gel particles and base carrier may be used without the addition of other suspended particles as a lubricant. The aqueous content of the carrier can contain about 1 to 100% by weight of water with an organic solvent added for any carrier less than 100% water. The organic medium can comprise a variety of solvents, preferably alkylene and polyalkylene glycols depending upon use.

The gel particles which are preferably aluminum hydroxide ($Al(OH)_3$) can be created in an aqueous or aqueous-organic medium, separated and transferred to a second medium, whether aqueous or non-aqueous or used alone in a variety of cases required as a lubricant or to custom formulate a suspension or slurry of abrasive or non-abrasive particles.

However, gel particles can be formed with other metal sulfides, hydroxides, and oxide hydrates, that can form a suspended precipitate in water within the pH of about 3 to 12.

It is a general object of the invention to provide long-term stable slurry suspensions which can be used in wire saw applications for cutting slices from ingots, lapping applications, CMP applications, and in the separation of particles.

It is another object of the invention to provide a long-term stable suspension of abrasive or non-abrasive particles in a low toxicity and/or low viscosity carrier.

It is yet another object of the invention to provide a stable suspension of colloidal or NCOL abrasive or non-abrasive particles in a neutral or near neutral pH medium.

A further object of the invention is to provide a means for suspending colloidal or NCOL abrasive or other particles in a liquid not depending upon final slurry viscosity.

Another object of the invention is to provide gel particles which can be added to a variety of base carriers to suspend inert particles and also act as lubricants.

Description of the Preferred Embodiments

The present invention provides a means for providing a stable suspension of particles in an aqueous or organic medium or semi-aqueous medium without agglomeration or particle hard settling utilizing sol-gels or gel particles. According to one feature of the invention there is provided suspension and/or lubricating carriers and slurry compositions for wire saw applications as lubricants, lapping or polishing slurries, non-abrasive slurries and the like in which a suspension of particles is maintained at ambient as well as elevated temperature. The gel particles are maintained as an aqueous or semi-aqueous suspension in about 0.1 to 80 weight percent of carrier.

The gel particles can be prepared separately and then used alone or in a carrier as a lubricant and/or suspension agent or combined with a polar or non-polar solvent. The gel particles can advantageously be used in different types of glycols so that the lubricating compositions can be custom made for a particular use.

It is desirable in many cases to use more than one suspending agent in order to have a uniform dispersion for as long as possible. The reason for this is that the particles to be suspended may have different densities and/or electrostatic charges from the suspending gel particles. For example, in wire saw cutting operations there are cutting particles and kerf particles from the ingot being cut. In other operations there can be contaminants with higher density or similar density as the suspending medium.

These suspending particles are in situ formed alkaline earth metal or transition metal hydroxides, oxy-hydroxides and oxide hydrates that form a suspended particulate precipitate (i.e., sol-gels, gel particles, gelatinous precipitate etc.) in aqueous or semi-aqueous media at a pH from about 3 to 12. The particles to be suspended comprise the conventional abrasive or non-abrasive particles, inert particles having a particle size of about 1 to 100 μm for pigment manufacture, wire saw cutting, metal finishing applications and smaller size for wafer lapping applications being in the range typically of about 0.1 to 10 μm and even lower for CMP applications the particles being the range of about 10-500 nm. The preferred suspending particles are those formed in situ or separately such as when a metal salt is formed into the metal hydroxide. In such a case, the density of the in-situ prepared precipitated gel particles is greater and the surface area of the gel particle formed in-situ is typically less than commercially available forms. In addition, there is generally a broader particle size distribution of the in-situ formed gel particles of the invention. The advantage of having the gel particles separate from the carrier medium allows for mixing different particle sizes in certain applications particularly for coating.

The abrasive material for use in the above-recited composition may include powders of diamond, silica, tungsten carbide, silicon carbide, boron carbide, silicon nitride, silicon dioxide, cerium oxide, zirconium oxide, aluminum oxide, or other hard grit "powder" material. Generally, mean or average particle sizes range from about 0.5-30 microns and preferably from about 2-20 microns, or a mixture thereof. The concentrations of the inert particles being suspended in the suspension medium or carrier

for most applications typically may range from about 0.1 to 60 weight percent of the total suspension.

Solvents which may be used with the water are polar solvents which include alcohols, amides, esters, ethers, ketones, glycols, glycol ethers, alkyl lactones, or sulfoxides. Specifically, examples of polar solvents are dimethyl sulfoxide (DMSO), dimethylacetamide (DMAC), N-methyl pyrrolidone (NMP), (gamma) butyrolactone, diethylene glycol ethyl ether, dipropylene glycol methyl ether, tripropylene glycol monomethyl ether, various glycols, polyethylene glycols and poly propylene glycols and the like.

The organic solvents are used in some cases to provide needed viscosity levels to the resulting slurries prepared. Other uses for organic solvents may include a lowering of the slurry/carrier freezing point. The choice of the solvent is relatively immaterial as long as the solvent is inert, fully miscible or soluble in water, non-reactive with water or with the suspended particles or suspending gel particles, and has low toxicity and is of low odor.

The suspending particles that can be used include, but are not limited to, metal hydroxides, oxide hydrates and oxy-hydroxides other than the abrasive particles that form an aqueous or semi-aqueous suspension (i.e. gel particles, gelatinous precipitate, sol-gels, colloidal or non-colloidal suspension, etc.). These suspending particles as an important component of the present invention will not settle out over time to form a hard agglomerate on the container bottom. This includes, but is not limited to those compounds, which *in-situ* are within or without the aqueous medium converted to the hydroxide

form such as a metal sulfate that is converted to the hydroxide form using a metal or non-metal Bronstead base, for example, potassium hydroxide, tetramethyl ammonium hydroxide, sodium hydroxide, tetraethylammonium hydroxide, etc. as illustrated by the following example equation:

$$Al_2(SO_4)_3 + 6[CH_4N]OH \xrightarrow{water} 2Al(OH)_3 + 3[(CH_3)_4N]_2(SO_4)$$

Among the suitable metal hydroxides of use in this invention include, but are not limited to copper hydroxide, aluminum hydroxide, and $Zn(OH)_2$.

Among the metal sulfides, salts, or oxide hydrates which may be used to form or form in-situ the suspending particles are transition metal such as Zn-salts, ZnS, SnO_2xH_2O, tin-salts, SnS, $Al_2O_3 \cdot xH_2O$, Al-salts, and the like. These salts, sulfides, oxy-hydroxides, oxide hydrates, and the like can also be used to form the corresponding hydroxides to provide a stable suspension medium that includes sol-gels, gel particles, gelatinous particles suspension for the carrier system.

In the case of $Al(OH)_3$ or other aluminum oxy-hydroxide species, a pH range for use in the carrier is about 3-12. A preferred range is 5-10 and the most preferred range is 6-9.

Included as suspending precipitates or particles are those particles having a density greater than that of the carrier solvent, and those that are not naturally precipitous or suspendable. It is understood that there are those metal oxy-hydroxides or hydroxides which have a higher density except when formed or precipitated in-situ in the

aqueous or semi-aqueous medium which is then added to the carrier systems of this invention.

A corrosion inhibitor may be added to the carrier formulations of the present invention to suppress or eliminate metal corrosion when required. Appropriate inhibitors should not cause foaming, interfere with the formulations' ability to provide long-term stable abrasive or solids suspensions, compromise the viscosity, rheology, or uniformity of the carrier formulations and their associated abrasive or solids suspensions.

Suitable corrosion inhibitors which may be added to the aqueous and semi-aqueous carriers of the present invention may include, but are not limited to aliphatic and aromatic carboxylic acids, neutralized carboxylic acids using alkanol amines (i.e. diethanol amine, triethanol amine, etc.), tetra-alkylammonium hydroxides, other similar non-metal hydroxide bases, alkyl or aromatic amines or other Bronstead bases. Also included may be other known metal corrosion inhibitors in the art such as long chain modified carboxylates commercially under such trade names as DeForest DeCore-APCI-95, DeTrope CA-100. Further examples of known corrosion inhibitors equally suitable for the corrosion prevention or suppression of metals used in CMP processes (i.e. Al/Cu, Cu, Al/Si, Al/Si/Cu, GaAs, LnP, and the like) may include but are not limited to benzoic acid, pyrogallol, gallic acid, ammonium thiosulfate, 8-hydroxy quinoline, catachol, benzotrizole, etc., or combinations thereof.

Additionally, there are other suitable corrosion inhibitors which function as oxygen absorbers or scavengers which include but are not limited to hydroquinone, poly-hydroxy aromatics, 8-hydroxyquinoline, nitrites, sulfites, etc.

What Is Claimed Is

1. A method for the suspension of inert colloidal or non-colloidal abrasive or non-abrasive particles in a stable aqueous or semi aqueous organic carrier medium which comprises producing in-situ formed suspending particles having a density greater than that of the carrier medium selected from the group consisting of stable gel particles, sol-gel particles and gelatinous precipitates so as to establish an appropriate concentration of suspending particles to inert particles interference to settling of said inert particles in said carrier medium, said carrier medium comprising a range from 0.1 to 50% by weight of the suspending particles, which differ from said inert particles, and are selected from the group consisting of alkaline earth metal and transition metal hydroxides, oxy hydroxides, and oxide hydrates that form in-situ said suspending particles within and inclusive of said carrier medium at a pH between 3 and 10, whereby said inert particles are suspended in said carrier medium by at least one of physical interference, density differences, particle size differences and electrostatic charge repulsion of the suspending particles.

2. The method of claim 1 wherein said suspending stable gel particles are formed in a separate medium from the final carrier medium.

3. The method of claim 1 wherein said aqueous carrier medium contains at least one inert polar solvent.

4. The method of claim 3 wherein said inert polar solvent is selected from the group consisting of dialkylene glycol, alkylene glycol, glycol ether, polyalkylene glycol, alkyl lactone, N-methyl pyrrolidone, alkylene carbonates, acetonitrile, and dimethyl acetamide.

5. The method of claim 1 wherein said suspending gel particles, sol gel particles, and gelatinous precipitates are alkaline earth metal or transition metal hydroxides, oxy hydroxides, or oxide hydrates.

6. The method of claim 5 wherein said suspending particles are formed in situ with the carrier medium.

7. The method of claim 1 wherein said inert particles being suspended are selected from the group consisting of titanium dioxide, silicon carbide, zirconium oxide, silica, cerium oxide, aluminum oxide, silicon nitride, boron carbide, tungsten carbide, diamond, silicon dioxide and dry pigment particles.

8. The method of claim 1 including a corrosion inhibitor.

9. The method of claim 1 which includes an inert salt to provide further density difference or electrostatic repulsion between suspended particles.

10. The method of claim 1 which includes the removal of inert salt produced by the formation of the suspending particles.

11. The method of claim 5 wherein said suspending particles are formed from a member selected from the group consisting of aluminum hydroxide, aluminum oxy hydroxide, zinc hydroxide, copper hydroxide, magnesium hydroxide and tin hydroxide.

12. A stable aqueous or semi-aqueous composition for suspending inert colloidal or non-colloidal abrasive or non-abrasive particles for use in an abrading or coating

process which comprises in-situ formation of suspending particles having a density greater than that of the carrier medium selected from the group consisting of stable gel particles, sol-gel particles and gelatinous precipitates in an aqueous carrier medium having an appropriate concentration of suspending particles to inert particles sufficient to establish interference to settling of said inert particles in said carrier medium and a pH of about 3 to 10, said suspending particles, which differ from said inert particles, being selected from the group consisting of alkaline earth metal or transition metal hydroxides, oxy hydroxides and oxide hydrates and are present in said carrier medium at a concentration of 0.1 to 50% by weight, whereby said inert particles are suspended in a carrier medium by at least one of physical interference, density differences, particle size differences, and electrostatic charge repulsion of the suspending particles.

13. The composition of claim 12 wherein the gel particles, sol-gel particles and gelatinous precipitates are formed in a carrier medium separate from the final carrier medium.

14. The composition of claim 12 comprising a mixture of gel particles.

15. The composition of claim 12 including a corrosion inhibitor.

16. The composition of claim 12 wherein the inert abrasive particles are selected from the group consisting of titanium dioxide, silicon carbide, zirconium oxide, silica, cerium oxide, aluminum oxide, diamond, silicon nitride, boron carbide, tungsten carbide and silicon dioxide.

17. The composition of claim 12 wherein the suspending particles are formed in-situ within the aqueous or semi-aqueous medium to yield a member selected from the

group consisting of aluminum hydroxide, aluminum oxy hydroxide, zinc hydroxide, copper hydroxide, magnesium hydroxide, and tin hydroxide.

18. The composition of claim 12 comprising a mixture of different suspending particles.

19. The composition of claim 12 including a polar solvent.

20. The composition of claim 19 wherein said polar solvent is selected from the group consisting of dialkylene glycol, alkylene glycol, glycol ether, polyalkylene glycol, alkyl lactone, N-methyl pyrrolidone, alkylene carbonates, acetonitrile, and dimethyl acetamide.