US 20060229215A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0229215 A1

Burrington et al. (43) Pub. Date: Oct. 12, 2006

(54) SOLID ADDITIVE COMPOSTION AND METHOD THEREOF

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(21) Appl. No.: **11/092,403**

(22) Filed: **Mar. 29, 2005**

Publication Classification

(51) **Int. Cl.**
C10M 159/12 (2006.01)

(52) **U.S. Cl.** **508/346**

(57) **ABSTRACT**

An additive composition comprises (A) an additive comprising a nitrogen-containing detergent, a fatty acid based friction modifier, or a mixture thereof and (B) a solid organic matrix material where the additive composition is a solid that melts in the range of about 25 to about 200° C. A method to enhance performance of a functional fluid, especially a fuel composition or power transmission fluid of a vehicle powered by an internal combustion engine, comprises adding a performance-enhancing amount of the additive composition to the functional fluid.

SOLID ADDITIVE COMPOSTION AND METHOD THEREOF

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a solid additive composition comprising an additive and a solid matrix material. The invention further relates to a method to enhance performance of a functional fluid comprising adding the solid additive composition to a functional fluid, such as a fuel composition or a power transmission fluid.

[0003] 2. Description of the Related Art

[0004] It is desirable to introduce supplemental or additional additives into a functional fluid in a convenient manner such as a solid additive composition to enhance the performance of the functional fluid. The enhancement in performance can be a) maintaining the performance under harsh operating conditions, b) a further improvement in performance under normal operating conditions, c) an extension of performance beyond the normal life of the fluid, d) a restoration of performance, e) combinations thereof.

[0005] Jakob et al. in U.S. Pat. No. 6,312,480 disclose a solid fuel additive.

[0006] Schuettenberg et al. in U.S. Pat. Nos. 4,515,740 and 4,639,255 disclose solid form additives and a method of forming them.

[0007] Martin et al. in U.S. Pat. No. 6,238,554 and US Patent Application Publication Nos. 2002/0195380 and 2004/0026291 disclose a fuel filter or a container for releasing additive into a fuel.

[0008] The present invention provides a solid additive composition in a form that allows for a convenient and effective enhancement in performance of a functional fluid, and in one embodiment preferably a hydrocarbon fuel composition or a power transmission fluid.

SUMMARY OF THE INVENTION

[0009] An object of the present invention is to enhance the performance of a functional fluid effectively and in a convenient way.

[0010] An additional object of this invention is to enhance the performance of a hydrocarbon fuel composition.

[0011] A further object of the invention is to enhance the performance of a power transmission fluid.

[0012] Additional objects and advantages of the present invention will be set forth in the Detailed Description which follows and, in part, will be obvious from the Detailed Description or may be learned by the practice of the invention. The objects and advantages of the invention may be realized by means of the instrumentalities and combinations pointed out in the appended claims.

[0013] To achieve the foregoing objects in accordance with the present invention as described and claimed in this application, an additive composition comprises

[0014] (A) an additive comprising a fuel or lubricant additive selected from the group comprising antioxidants, extreme pressure agents, wear reduction agents, viscosity index improvers, anti-foaming agents, combustion modifiers, friction reducing agents, extreme pressure (EP) agents, wear reduction agents, viscosity index improvers, anti-foaming agents, anti-misting agents, cloud-point depressants, pour-point depressants, mineral or synthetic oils, anti-knock agents, lead scavengers, dyes, cetane improvers, rust inhibitors, bacteriostatic agents, gum inhibitors, fluidizers, metal deactivators, demulsifiers, anti-icing agents, lubricity additives, friction modifiers, viscosity improvers, flow improvers, low temperature improvers, anti-static agents, valve-seat recession agents, intake valve deposit control additives, combustion chamber deposit control additives, fuel injector deposit control additives, a fuel-borne catalysts (organometallic compounds of e.g. Na, K, Co, Ni, Fe, Cu, Mn, Mo, Va, Zi, Be, Pt, Pa, Ce, Cr, Al, Th, Se, Bi, Cd, Te, Th, Sn, Ba, B, La, Ta, Ti, W, Zn, Ga, Pb, Ag, Au, Os, Ir) and combinations thereof in the fuel, and

[0015] (B) at least one solid organic matrix material wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition at about 5 to about 95% by weight.

[0016] A more speficic embodiment is an additive composition comprising:

[0017] (A) an additive comprising

[0018] (1) a nitrogen-containing detergent comprising at least one component selected from (a) a Mannich detergent prepared from the reaction of a hydrocarbyl-substituted hydroxy-containing aromatic compound and an aldehyde and an amine having at least one primary or secondary amino group; (b) a polyetheramine prepared from the reaction of an alkoxylated alcohol or an alkoxylated alkylphenol with acrylonitrile to form a nitrile which is hydrogenated to form the polyetheramine; (c) an alkoxylated reaction product of the reaction product of a C6-36 aliphatic or aromatic carboxylic acid and polyethylenepolyamines; (d) a C6-36 aliphatic or aromatic amine or (e) a mixture thereof;

[0019] (2) a fatty acid derived friction modifier comprising of (a) a polyalkoxylated fatty amine; (b) a fatty acid derived oxazoline; and (c) a mixture thereof; or

[0020] (3) a mixture thereof and

[0021] (B) at least one solid organic matrix material

[0022] wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition in the range of about 5 to about 95% by weight of the additive composition.

[0023] In another embodiment a method to enhance the performance of a functional fluid comprises adding a performance enhancing amount of the additive composition to the functional fluid.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention comprises an additive composition comprising (A) an additive comprising (1) a nitrogen-containing detergent comprising (a) a Mannich deter-

gent prepared from the reaction of a hydrocarbyl-substituted hydroxy-containing aromatic compound and an aldehyde and an amine having at least one primary or secondary amino group; (b) a polyetheramine prepared from the reaction of an alkoxylated alcohol or an alkoxylated alkylphenol with acrylonitrile to form a nitrile which is hydrogenated to form the polyetheramine; (c) an alkoxylated reaction product of the reaction product of a fatty carboxylic acid and naphthenic acid and polyethylenepolyamines; and (d) a mixture thereof; (2) a fatty acid derived friction modifier comprising (a) a polyalkoxylated fatty amine; (b) a fatty acid derived oxazoline; and (c) a mixture thereof; or (3) a mixture thereof; and (B) at least one solid organic matrix material wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition in the range of about 5 to about 95% by weight of the additive composition.

[0025] The additive (A) of the present invention comprises (A)(1) a nitrogen-containing detergent, (A)(2) a fatty acid derived friction modifier, or (A)(3) a mixture thereof. Additive (A) can be a mixture comprising 2 or more detergents, 2 or more friction modifiers, 1 or more detergents and 1 or more friction modifiers or combinations thereof.

Nitrogen-Containing Detergent

[0026] The nitrogen-containing detergent of the invention can be (A)(1)(a) a Mannich detergent from the reaction of a hydrocarbyl-substituted hydroxy-containing aromatic compound and an aldehyde and an amine having at least one primary or secondary amino group. A hydrocarbyl group throughout this application is defined as a univalent group predominately hydrocarbon in nature that can have heteroatoms such as nitrogen and oxygen in the main chain of the hydrocarbon or attached to the main chain as a separate atom such as a halogen atom or in a group such as a hydroxy group. The hydrocarbyl substituent of the Mannich detergent can be derived from a polyolefin. The polyolefin can be a polymer of a C_2-C_{10} alkene or a mixture thereof. The hydrocarbyl substituent can have a number average molecular weight of about 200 to about 5,000; about 300 to about 3,000; about 400 to about 2,500; or about 900 to about 1,500. The hydrocarbyl substituent can be derived from a polyisobutylene or a polyisobutylene having a terminal double bond isomer content or vinylidene content of greater than about 50%, greater than about 60%, or greater than about 70%. The hydroxy-containing aromatic compound can have 1 or more hydroxy groups, none to 1 or more C_1-C_8 alkyl groups, or a mixture thereof to include for example phenol, catechol, and o-cresol. The aldehyde can have 1 to 6 carbon atoms to include formaldehyde in its reactive forms such as formalin and paraformaldehyde. The amine can be a monoamine, a polyamine, or a mixture thereof. The monoamine can be a primary monoamine, a secondary monoamine, an alkanolamine, or a mixture thereof. The monoamine can be for example a butylamine, dimethylamine, or ethanolamine. The polyamine can be an alkylenediamine or substituted derivative thereof such as ethylenediamine, a polyethylenepolyamine such as diethylenetriamine, an alkanolamine such as 2-(2-aminoethylamino)ethanol, or a mixture thereof. The preparation of Mannich detergents is known to those skilled in the art, and an illustrative preparative procedure is described in U.S. Pat. No. 5,876,468.

[0027] The nitrogen-containing detergent of the invention can be (A)(1)(b) a polyetheramine prepared from the reaction of an alkoxylated alcohol or an alkoxylated alkylphenol with acrylonitrile to form a nitrile which is hydrogenated to form the polyetheramine. The alcohol can be an aliphatic alcohol, aromatic alcohol, or a mixture thereof. The aliphatic alcohol can have a branched carbon chain, a straight carbon chain, or a mixture thereof. The aliphatic alcohol can have about 1 to about 30, about 4 to about 24, or about 8 to about 20 carbon atoms. The aliphatic alcohol can be a mixture of about 2 or more alcohols where each alcohol has a different number of carbon atoms. The alkyl substituent of the alkylphenol can have about 1 to about 30, about 2 to about 24, or about 4 to about 18 carbon atoms. The alkoxylated alcohol or alkylphenol can be prepared by reacting the alcohol or alkylphenol with 1 or more units of an alkylene oxide per unit of alcohol or alkylphenol generally in a based catalyzed condensation. The alkylene oxide can be a single alkylene oxide or a mixture of about 2 or more alkylene oxides differing in carbon number. The mixture of alkylene oxides can be reacted with the alcohol or alkylphenol in a combination or sequentially. The alkylene oxide can have about 2 to about 18, about 2 to about 10, about 2 to about 4, or about 3 to about 4 carbon atoms. The alkylene oxide can be ethylene oxide, propylene oxide, butylene oxide, or a mixture thereof. The number of moles of alkylene oxide reacted per mole of alcohol or alkylphenol can be about 1 to about 50, about 10 to about 35, or about 18 to about 27. The alkoxylated alcohol or alkoxylated alkylphenol can then be reacted with acrylonitrile to form a nitrile which can then be reduced with a hydrogenation reagent to form a polyetheramine. The polyetheramine can be represented by the formula $RO(R^1O)_xCH_2CH_2CH_2NH_2$ where R represents the hydrocarbon group of the alcohol or alkylphenol, R^1 represents the hydrocarbon group of the alkylene oxide, and x represents the number of moles of alkylene oxide reacted with one mole of alcohol or alkylphenol. A method of preparing the polyetheramine (A)(1)(b) of this invention from an alcohol or alkylphenol is described in U.S. Pat. No. 5,094,667.

[0028] The nitrogen-containing detergent of this invention can be (A)(1)(c) an alkoxylated reaction product of the reaction product of a fatty carboxylic acid and naphthenic acid and polyethylenepolyamines. The fatty carboxylic acid can be linear, branched, or a mixture thereof. The fatty carboxylic acid can be saturated, unsaturated, or a mixture thereof. The fatty carboxylic acid can have about 4 to about 22, about 6 to about 22, or about 10 to about 20 carbon atoms. In embodiments of the invention the fatty carboxylic acid is oleic acid or stearic acid. The naphthenic acid can be derived from petroleum and is a mixture of saturated carboxylic acids of about 180 to about 350 molecular weight that generally contain cyclic groups. The polyethylenepolyamines can contain about 3 to about 10, about 3 to about 8, or about 3 to about 6 nitrogen atoms and include for example diethylenetriamine and triethylenetetramine. The reaction product of the fatty acid, naphthenic acid and polyethylenepolyamines can be alkoxylated with an alkylene oxide which can have about 2 to about 10, about 2 to about 8, or about 2 to about 6 carbon atoms and includes ethylene oxide, propylene oxide, butylene oxide, and mixtures thereof. The mole ratio of the fatty acid to naphthenic acid can be respectively about 0.1 to 1:0.1 to 1. The amount of the polyethylenepolyamines used is generally sufficient or

in a small excess to react with all the carboxylic groups of the fatty and naphthenic acids. In an embodiment of the invention naphthenic acid is reacted with oleic acid and triethylenetetramine at about 220 to about 260° C. to form an intermediate which is further reacted with ethylene oxide at about 160 to about 180° C. where the weight ratio of the reactants is respectively about 1:1.2:0.7:0.2.

[0029] In embodiments of the invention the nitrogen-containing detergent and additive (A) is (A)(1)(a) a Mannich detergent, (A)(1)(b) a polyetheramine, or a mixture thereof.

Fatty Acid Derived Friction Modifier

[0030] The fatty acid derived friction modifier of the invention can be (A)(2)(a) a polyalkoxylated fatty amine. Polyalkoxylated fatty amines are available commercially and are generally prepared by reacting a fatty carboxylic acid with ammonia to form an amide which is then reduced to a primary fatty amine with a hydrogenation reagent. The hydrocarbon group of the fatty amine can be straight chained, branched chained, or a mixture thereof. The hydrocarbon group of the fatty amine can be saturated, unsaturated, or a mixture thereof. The hydrocarbon group of the fatty amine can have about 4 to about 22, about 6 to about 22, or about 10 to about 20 carbon atoms. The fatty amine is generally further reacted with an alkylene oxide, such as for example a C_2-C_4 alkylene oxide like ethylene oxide, in a ratio of 2 or more moles of alkylene oxide per mole of fatty amine to form the polyalkoxylated fatty amine. The mole ratio of alkylene oxide to fatty amine can be about 2 to 50:1, about 2 to 20:1, about 2 to 10:1; or about 2 to 4:1. In embodiments of the invention the polyalkoxylated fatty amine is a diethoxylated tallowamine or a diethoxylated oleylamine.

[0031] The fatty acid derived friction modifier of the invention can be (A)(2)(b) a fatty acid derived oxazoline. The oxazoline can be prepared from the reaction of a fatty carboxylic acid and 2-aminoethanol or a derivative thereof having a primary amino group on a carbon beta to a carbon having a hydroxy group such as for example trishydroxymethylaminomethane (THAM). The fatty carboxylic acid can be an acid as described above in paragraph [0017] for subcomponent (A)(1)(c). In an embodiment of the invention the oxazoline is the reaction product of stearic acid and 2-aminoethanol. In another embodiment of the invention the oxazoline is the reaction product of isostearic acid and THAM. In further embodiments of the invention the mole ratio of fatty acid to 2-aminoethanol or a derivative thereof is 0.5 to 4:1, 1 to 3:1, 1.4 to 2.6:1, 2:1, or 1:1. The oxazoline can be prepared by reacting the fatty acid and the amino ethanol or derivative thereof at elevated temperatures of about 90 to about 200° C. with the removal of water from the reaction.

[0032] In embodiments of the invention the fatty acid derived friction modifier and additive (A) is (A)(2)(a) a polyalkoxylated fatty amine, (A)(2)(b) a fatty acid derived oxazoline, or (A)(2)(c) a mixture thereof.

Solid Organic Matrix Material

[0033] The solid organic matrix material (B) of the invention can be any material which when combined with additive (A) produces or results in an additive composition which is a solid. Component (B) can comprise (1) a hydrocarbon; (2) an alcohol; (3) an organic acid, a derivative of an organic acid, or a mixture thereof; (4) an organic compound other than (B)(1)-(B)(3) containing only atoms selected from the group consisting of carbon, hydrogen, oxygen and nitrogen; or (5) a mixture thereof. Component (B) can have a melting point of or greater than about 25° C., of or greater than about 50° C., of or greater than about 60° C., in the range of about 25 to about 200° C., in the range of about 25 to about 100° C., in the range of about 50 to about 200° C., or in the range of about 50 to about 100° C. The hydrocarbon (B)(1) can be natural, synthetic, or a mixture thereof. Natural hydrocarbons can comprise petroleum waxes including a paraffin or a mixture of paraffins where the paraffin or paraffins have sufficiently high molecular weights of about 254 or higher so that they are a solid such as for example a $C_{18}H_{38}$ or $C_{36}H_{74}$ or $C_{24}H_{50}$ paraffin. Synthetic hydrocarbons can comprise polyethylenes, hydrocarbons from a Fischer-Tropsch process, or a mixture thereof such as for example a linear low density polyethylene or a Fischer-Tropsch hydrocarbon wax. The alcohol (B)(2) can be linear, branched, or a mixture thereof. Linear alcohols that are solids generally have a molecular weight of 214 or higher such as for example a $C_{14}H_{29}OH$ or $C_{16}H_{33}OH$ or $C_{18}H_{37}OH$ alcohol. Component (B)(3) can comprise an organic acid, a derivative of an organic acid, or a mixture thereof. The organic acid can comprise a linear carboxylic acid, a branched carboxylic acid, an aromatic carboxylic acid, or a mixture thereof. Linear carboxylic acids that are solids will generally have about 10 or more carbon atoms such as for example decanoic acid and dodecanoic acid. Aromatic acids can include for example benzoic acid and a naphthoic acid. Derivatives of organic acids can comprise esters of carboxylic acids which can comprise natural esters, synthetic esters, or a mixture thereof. Natural esters can comprise esters from animal sources such as beeswax, esters from vegetable sources such as camauba wax, or a mixture thereof. Synthetic esters can comprise an aromatic carboxylic acid or a fatty carboxylic acid ester of a polyol. The fatty acid can be linear, branched, or a mixture thereof. The fatty acid can have about 8 to about 22, about 10 to about 22, or about 12 to about 20 carbon atoms. The fatty acid can be saturated, unsaturated, or a mixture thereof. The polyol can have 2 or more hydroxy groups or can have 3 or more hydroxy groups to include for example glycerol and sorbitol. The synthetic ester can include for example sorbitan tristearate, glyceryl tristearate, and glyceryl tribenzoate. In an embodiment of the invention component (B)(3) can comprise a linear fatty carboxylic acid, an aromatic carboxylic acid, a natural ester, a synthetic ester derived from a polyol and a linear fatty carboxylic acid or an aromatic carboxylic acid, or a mixture thereof. The component (B)(4) can comprise an organic compound as described above to include a poly(ethylene glycol), an ethylcellulose, or a mixture thereof. The poly(ethylene glycol) can have a number average molecular weight of or greater than about 400, about 600, or about 900.

Additive Composition

[0034] The additive composition of this invention can comprise components (A) and (B), as described above, where the additive composition is a solid. The additive composition can be a solid that melts at or greater than about 25° C., at or greater than about 50° C., at or greater than about 60° C., in the range of about 25 to about 200° C., in the range of about 25 to about 100° C., in the range of about 50 to about 200° C., or in the range of about 50 to about 100° C., The weight % ratio of component (A) to component (B)

in the additive composition can be respectively about 5-**95:95-5**, about 15-85:85-15, or about 25-75:75-25. Components (A) and (B) can each be present in the additive composition on a weight basis at about 5 to about 95%, about 15 to about 85%, or about 25 to about 75%.

[**0035**] The additive composition, comprising the additive (A) and the solid organic matrix material (B) and any other components, can be prepared in any process or procedure that results in a solid additive composition or in a homogeneous solid additive composition. The additive composition can generally be prepared by combining the components and mixing the combination at an ambient temperature or at an elevated temperature. The combining of components can be by putting all of them together at the start of the preparation process or by adding one or more components to one or more components simultaneously or sequentially. The mixing can be carried out by any mixing means or mixing device comprising a mixer such as for example a stirrer, an agitator or a dispersator; a grinding mill such as for example a ball mill, a rod mill or a tube mill; a sonic device; a blending system employing in-line dynamic (moving) or static (non-moving) mixing elements to agitate or mix together a stream of components; or a combination thereof. In one embodiment of the invention where component (B) or any other of the components is a low melting solid generally melting at or below about 100° C., the additive composition can be prepared by combining the components, applying sufficient heat to melt the solid components mixing the components mixing means or device such as a mixer, and allowing the mixture to cool to form a solid additive composition. In another embodiment of the invention where component (B) or any other of the components is a high melting solid generally melting above about 100° C., the additive composition can be prepared by combining the components and mixing them with a mixing means or mixing device such as a grinding mill to form a solid additive composition. The solid mixture can be further processed by compression into a pellet, tablet or pill shape by using any of the methods for manufacture of pellets from powders known to those skilled in the art. This includes the use of a pressurized die, such as is used for making KBr pellets for recording infrared spectra of solids, or an automated form of this process such as by use of a pelletizing machine, which converts powders to tablets. The solid can also be processed into granular form by any of the readily available techniques known to those skilled in the art for granularization.

[**0036**] The additive (A) of the present invention can be a gel. The gel can comprise component (A)(1), component (A)(2) or a mixture thereof dissolved or dispersed in a gel composition. The gel composition can comprise one or more additives in the form of an additive gel that slowly releases an additive component or components into a functional fluid such as a lubricant or fuel composition. The one or more additives comprising the gel composition can be selected from detergents, dispersants, acids, bases, overbased detergents and combinations thereof. In one embodiment of the invention the gel composition can further comprise additional fuel or lubricant additives comprising metal-containing detergents such as overbased sulfonates, dispersants such as polyisobutenylsuccinimides, extreme pressure and antiwear agents such as zinc dithiophosphates, antioxidants such as hindered phenols and derivatives thereof, auxiliary friction modifiers such as fatty acid based imidazolines, corrosion and rust inhibitors such as polyisobutenylsuccinic acids, viscosity modifiers such as nitrogen-containing esters of maleic anhydride-styrene copolymers, auxiliary nitrogen-containing detergents such as hydrocarbon-substituted amines derived from polyisobutylene, seal swell agents such as sulfolanes, antifoamants such as silicone oils, metal deactivators such as tolyltriazole, and combustion improvers such as octane and cetane improvers. Gel compositions, their preparation and their use are described in US Patent Application Publication No. 2004/0014614. The components of additive (A), comprising (A)(1), (A)(2), or (A)(3), can be dissolved or dispersed into the gel composition to form a gel before, during or after the preparation of the gel composition.

[**0037**] The additive composition of the present invention can be prepared or fabricated in a dosage unit for convenient use in a given application such as for example an aftermarket treatment of a functional fluid to enhance its performance. The additive composition can be fabricated as an uncoated dosage unit or as a coated dosage unit. The coating can be nontoxic; soluble in a hydrocarbon medium comprising an oil of lubricating viscosity such as a natural and/or synthetic lubricating oil or base stock, or a hydrocarbon fuel such as a gasoline or diesel fuel; and have a melting point of about 50° C., or higher, about 60° C. or higher, about 65° C., or higher, or about 75° C., or higher. The coating can comprise one or more of the solid organic matrix materials of component (B) described above in paragraph [0022] or a wrapper such as for example an aluminum foil wrapper. The dosage unit can be prepared or fabricated by procedures known in the art such as processing the additive composition in a semi-solid to solid state through for example a pellet mill or an extruder to form the additive composition in a dosage unit or processing the additive composition in a melt or liquid state into a dosage size mold or into a mold from which dosage units can be prepared. In one embodiment of the invention the additive composition comprising components (A) and (B) is fabricated as a dosage unit in a dosing device. The fabrication of the additive composition as a dosage unit in a dosing device can be done by processing the additive composition in a melt or liquid state into a dosage-sized dosing device such as for example a cylindrical container which after further fabrication allows for insertion or injection into a functional fluid.

[**0038**] The additive composition of this invention optionally can further comprise (C) at least one additional additive. The additional additive (C) can comprise one or more of the additional fuel or lubricant additives described in paragraph [0025] which the gel composition can further comprise.

Method to Enhance Performance of a Functional Fluid

[**0039**] In one embodiment of the invention a method to enhance performance of a functional fluid comprises adding a performance enhancing amount of the solid additive composition, as described throughout this application, to the functional fluid. The enhancement in performance comprises maintaining performance of a fluid with for example a keep clean dose or doses, improving performance of a fluid with for example a clean up dose or doses, extending the life of a fluid with for example one or more supplemental doses, restoring performance of a functional fluid with for example one or more fixative doses, or a combination thereof. The method of the present invention employing an additive composition in a concentrated solid form to enhance per-

formance of a functional fluid is effective, convenient and safe. The solid additive composition fabricated in dosage units that are coated and/or in a dosing device simplifies treating a functional fluid including sealed fluids such as gear oils and transmission fluids, requires no measuring or handling of solvents or diluents, and eliminates or minimizes contact with additives. The solid additive composition can be fabricated in dosage units to deliver on a weight basis 1 to 100,000 ppm (parts per million), 1 to 10,000 ppm or 10 to 1,000 ppm actives to a functional fluid. In an embodiment of the method of the invention the functional fluid is a functional fluid for a vehicle powered by an internal combustion engine to include a spark-ignited or compression-ignited engine, and in other embodiments the functional fluid for the vehicle powered by an internal combustion engine comprising a motor oil, a fuel composition, a power transmission fluid, a gear oil, and a hydraulic fluid. In further embodiments of the method involving a functional fluid in a vehicle powered by an internal combustion engine, the functional fluid is a fuel composition comprising a major amount of a hydrocarbon fuel comprising a gasoline or diesel fuel and a minor amount of the solid additive composition, or the functional fluid is a power transmission fluid comprising a major amount of an oil of lubricating viscosity and a minor amount of the solid additive composition. In further embodiments of the method to enhance performance of a functional fluid the solid additive composition rapidly dissolves in the functional fluid in or less than about 1 minute to about 1 hour, or gradually dissolves in the functional fluid from greater than about 1 hour to about 1 month.

[0040] The following examples illustrate advantages of the invention.

Maintenance of Fuel System Cleanliness

[0041] A solid additive composition is prepared by combining about 7 g of a polyetheramine and about 14 g of a linear C_{16}-C_{18} alcohol, melting and mixing this combination, and allowing the melted mixture to solidify in a syringe cylinder modified to have an open end. The polyetheramine is prepared by reacting a C_{13} alcohol with butylene oxide in respectively about a 1:20 mole ratio and reacting the polyalkoxylated alcohol with acrylonitrile to form a nitrile which is catalytically hydrogenated to form the polyetheramine. The fuel additive "stick" is injected from the modified syringe into a partially filled 20-gallon gasoline tank of a vehicle powered by a spark-ignited engine and the tank is filled up. The gasoline in the tank is found to contain 1 about 00 ppm by weight of the polyetheramine which has been shown to be an effective level for keeping intake valves clean.

Restoration of Power Transmission Performance

[0042] A solid additive composition is prepared by combining about 2.4 g of a diethoxylated tallowamine friction modifier and about 12.6 g of an oxazoline friction modifier and about 15 g of a paraffin wax, melting and mixing this combination, and allowing the melted mixture to solidify in a syringe modified to have an open end. The oxazoline is prepared by reacting isostearic acid with trishydroxymethylaminomethane in respectively about a 2:1 mole ratio with removal of reaction water. The lubricant additive "stick" in the modified syringe is divided into about 2.5 g pellets. A pellet is inserted into a seal-for-life automatic transmission having a "noise" performance problem. After dissolution of the pellet, the "noise" is gone and satisfactory transmission performance is restored.

[0043] Each of the documents referred to in this Detailed Description of the Invention section is incorporated herein by reference. All numerical quantities in this application used to describe or claim the present invention are understood to be modified by the word "about" except for the examples or where explicitly indicated otherwise. All chemical treatments or contents throughout this application regarding the present invention are understood to be as actives unless indicated otherwise even though solvents or diluents may be present.

What is claimed is:

1. An additive composition, comprising:

(A) an additive comprising a fuel or lubricant additive selected from the group comprising antioxidants, extreme pressure agents, wear reduction agents, viscosity index improvers, anti-foaming agents, combustion modifiers, friction reducing agents, extreme pressure (EP) agents, wear reduction agents, viscosity index improvers, anti-foaming agents, anti-misting agents, cloud-point depressants, pour-point depressants, mineral or synthetic oils, anti-knock agents, lead scavengers, dyes, cetane improvers, rust inhibitors, bacteriostatic agents, gum inhibitors, fluidizers, metal deactivators, demulsifiers, anti-icing agents, lubricity additives, friction modifiers, viscosity improvers, flow improvers, low temperature improvers, anti-static agents, valve-seat recession agents, intake valve deposit control additives, combustion chamber deposit control additives, fuel injector deposit control additives, a fuel-borne catalysts (organometallic compounds of e.g. Na, K, Co, Ni, Fe, Cu, Mn, Mo, Va, Zi, Be, Pt, Pa, Ce, Cr, Al, Th, Se, Bi, Cd, Te, Th, Sn, Ba, B, La, Ta, Ti, W, Zn, Ga, Pb, Ag, Au, Os, Ir) and combinations thereof in the fuel, and

(B) at least one solid organic matrix material

wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition at about 5 to about 95% by weight.

2. An additive composition, comprising:

(A) an additive comprising

(1) a nitrogen-containing detergent comprising at least one component selected from (a) a Mannich detergent prepared from the reaction of a hydrocarbyl-substituted hydroxy-containing aromatic compound and an aldehyde and an amine having at least one primary or secondary amino group; (b) a polyetheramine prepared from the reaction of an alkoxylated alcohol or an alkoxylated alkylphenol with acrylonitrile to form a nitrile which is hydrogenated to form the polyetheramine; (c) an alkoxylated reaction product of the reaction product of C6-36 aliphatic or aromatic carboxylic acid and polyethylene-polyamines; (d) a C6-36 aliphatic or aromatic amine or (e) a mixture thereof;

(2) a fatty acid derived friction modifier comprising (a) a poly-alkoxylated fatty amine; (b) a fatty acid derived oxazoline; and (c) a mixture thereof; or

(3) a mixture thereof; and

(B) at least one solid organic matrix material

wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition at about 5 to about 95% by weight.

2. The additive composition of claim 1 wherein component (A) is a gel.

3. The additive composition of claim 1 wherein component (A) and component (B) are fabricated as an uncoated dosage unit or as a coated dosage unit.

4. The additive composition of claim 3 wherein the coating is nontoxic, soluble in a hydrocarbon medium, and melts at about 50° C., or higher.

5. The additive composition of claim 3 wherein component (A) and component (B) are fabricated as a dosage unit in a dosing device.

6. The additive composition of claim 1 wherein component (A) is (A)(1)(a), (A)(1)(b), or a mixture thereof.

7. The additive composition of claim 1 wherein component (A) is (A)(2)(a), (A)(2)(b), or (A)(2)(c).

8. The additive composition of claim 1 wherein component (B) comprises (1) a hydrocarbon; (2) an alcohol; (3) an organic acid, a derivative of an organic acid, or a mixture thereof; (4) an organic compound other than (B)(1)-(B)(3) containing only atoms selected from the group consisting of carbon, hydrogen, oxygen and nitrogen; or (5) a mixture thereof.

9. The additive composition of claim 8 wherein component (A) comprises (1) the ethoxylatyed amine derived from tallow amine and ethylene oxide (2) isostearic acid/tris(hydroxymethyl)aminomethane, or a mixture thereof, and (B) comprises a C80 wax derived from the Fischer Tropsch process.

10. The additive composition of claim 9 where the weight ratio of component (A): (B) is 70:30, and the weight ratio of component (A)(1) : (A)(2) is 8:50.

11. The additive composition of claim 8 wherein component (A) comprises (1) oleylamine, (2) the hydroxyethylated aminoethylamide derived from the reaction of polyethyleneamines with a mixture of naphthenic acid and oleic acid and from reaction of the resulting product with ethylene oxide, (3) the polyether amine derived from reaction of a C1-C36-alkyl epoxide and a C1-C36-alkyl propylamine, (4) the alkyl amine derived from polyisobutenyl phenol, formaldehyde and dimethylamine, (5) poly[oxy(methyl-1,2-ethanediyl)], alpha-(3-aminopropyl)-omega-hydroxy-, C12-C15 alkyl ethers, or a mixture thereof, and (B) comprises (1) transstilbene, **2**) cholesterol; (3) oleylamide, or a mixture thereof.

12. The additive composition of claim 11 wherein component (A) comprises a mixture of (1) and (2) and (B) comprises a mixture of (1) and (3).

13. The additive composition of claim 12 wherein the weight ratio of component (A):(B) is 10:90 and the weight ratio of (A)(1):(A)(2) is 1:1.

14. The additive composition of claim 1 further comprising (C) at least one additional additive.

15. A method to enhance performance of a functional fluid, comprising: adding a performance-enhancing amount of the additive composition wherein the additive composition comprises (A) an additive comprising a fuel or lubricant additive selected from the group comprising antioxidants, extreme pressure agents, wear reduction agents, viscosity index improvers, anti-foaming agents, combustion modifiers, friction reducing agents, extreme pressure (EP) agents, wear reduction agents, viscosity index improvers, anti-foaming agents, anti-misting agents, cloud-point depressants, pour-point depressants, mineral or synthetic oils, anti-knock agents, lead scavengers, dyes, cetane improvers, rust inhibitors, bacteriostatic agents, gum inhibitors, fluidizers, metal deactivators, demulsifiers, anti-icing agents, lubricity additives, friction modifiers, viscosity improvers, flow improvers, low temperature improvers, anti-static agents, valve-seat recession agents, intake valve deposit control additives, combustion chamber deposit control additives, fuel injector deposit control additives, a fuel-borne catalysts (organometallic compounds of e.g. Na, K, Co, Ni, Fe, Cu, Mn, Mo, Va, Zi, Be, Pt, Pa, Ce, Cr, Al, Th, Se, Bi, Cd, Te, Th, Sn, Ba, B, La, Ta, Ti, W, Zn, Ga, Pb, Ag, Au, Os, Ir) and combinations thereof in the fuel, and (B) at least one solid organic matrix material wherein the additive composition is a solid that melts in the range of about 25 to about 200° C., and each of component (A) and component (B) is present in the additive composition at about 5 to about 95% by weight, to the functional fluid.

16. The method of claim 10 wherein the functional fluid is a functional fluid for a vehicle powered by an internal combustion engine.

17. The method of claim 11 wherein the functional fluid comprising a motor oil, a fuel composition, a power transmission fluid, a gear oil, and a hydraulic fluid.

18. The method of claim 12 wherein the functional fluid is a fuel composition comprising a major amount of a hydrocarbon fuel and a minor amount of the additive composition.

19. The method of claim 12 wherein the functional fluid is a power transmission fluid comprising a major amount of an oil of lubricating viscosity and a minor amount of the additive composition.

20. The method of claim 10 wherein the additive composition dissolves into the functional fluid at a rate selected from the group consisting of rapidly dissolves, gradually dissolves, intermediately dissolves and combinations thereof into the functional fluid.

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