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EP - A - 0 039 488
FR - A - 1 185 008
US - A - 2 768 141
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CHEMICAL ABSTRACTS, vol. 74, no. 10, 1971, page 108, abstract 44104u Columbus, Ohio, US

CHEMICAL ABSTRACTS, vol. 91, no. 22, November 1979, page 291, abstract 179971w Columbus, Ohio, US

CHEMICAL ABSTRACTS, vol. 81, no. 2, July 15, 1974, page 92, abstract 5461h Columbus, Ohio, US

CHEMICAL ABSTRACTS, vol. 82, April 16, 1975, page 146, abstract 100283f Columbus, Ohio, US

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Description

BACKGROUND OF THE INVENTION

This invention relates to fluid compositions useful especially for transmitting energy in mechanical systems and, more particularly, to water-based compositions useful in transmitting hydraulic energy having enhanced lubricity and anti-wear properties.

Water-based hydraulic fluids are well known and have been used commercially for a number of years especially in applications where fire resistance is desired. One commonly used class of such water-based fluids, as disclosed, for example, in U.S. Patent No. 2,602,780 to Zisman et al. and U.S. Patent No. 2,768,141 to Langer et al., contain water soluble glycols or glycol ethers for low temperature protection and a high molecular weight polymeric thickener such as water soluble poly(alkylene oxide) polymers for viscosity control. Such compositions also contain a variety of additives in "packages" that are added to enhance lubrication, corrosion protection, and other performance characteristics necessary for hydraulic devices and lubricants.

Water based hydraulic fluids commonly have high noninflammability, good temperature stability, and a relatively low cost, but generally have poorer anti-wear characteristics than petroleum-based fluids. Fluids used in energy transmission systems must possess sufficient lubricity and mechanical stability to enable them to be used in the self-lubricated pumps, valves etc. employed in commercial hydraulic systems. Good lubricating properties, especially good lubricity and film strength, are particularly important in reducing the wear of moving components of hydraulic systems where the clearance between frictional surfaces may be very small and pressures may be very high.

Heretofore, various attempts have been made to improve the lubricating properties and/or poor anti-wear properties of these fluids including, for example, modifying the poly(alkylene oxide) polymers generally added as viscosity control agents; incorporating additives such as conventional oil improvers, E.P. agents, corrosion inhibitors, and sequestering agents; and incorporating special water soluble additives such as the oxyalkylene adducts of polyamides disclosed in U.S. Patent No. 3,992,312 to Genjida et al. However, none of these methods have been found to be completely effective, particularly where anti-wear resistance under high pressure conditions is desired, and the development of water-based fluids that would meet these requirements would be highly desirable. Moreover, it would also be desirable to provide energy transmitting fluids that contain more water than the 50 percent to which such known fluids are generally limited in commercial applications.

SUMMARY OF INVENTION

In accordance with the present invention there is provided a water-based energy transmitting and lubricating fluid having enhanced anti-wear properties which comprises an aqueous composition having a viscosity of at least about 10 mm^2/s at 40°C which contains up to 80 percent by weight of water and has incorporated therein at least 0.1 percent by weight of an acidic lubricity agent and an amount of an anti-wear additive which is effective in enhancing the anti-wear characteristics of said composition, said anti-wear additive comprising the combination of a hydroxyl substituted aromatic acid component and a nitroaromatic compound component. Compositions of the invention may also contain from 0 to 50 percent by weight of a water soluble glycol or glycol ether having 2 to 14 carbon atoms used as a freezing point depressant and from 5 to 50 percent by weight of a water-soluble polymeric viscosity control agent.

Also provided in accordance with the present invention is a method for enhancing the anti-wear properties of water-based energy transmitting fluids containing an acidic lubricity agent which comprises incorporating in said water-based energy transmitting fluid an anti-wear additive comprising the combination of a hydroxyl substituted aromatic acid component and a nitroaromatic compound component in an amount which is effective in enhancing the anti-wear characteristics of said fluid compositions.

It has been found that the particular combination of anti-wear additive components herein disclosed is efficient in enhancing the anti-wear and lubricity properties of water-based energy transmitting compositions which also contain conventional acidic lubricity agents and makes possible the preparation of such compositions with as much as 80 percent by weight of water, a significantly greater amount of water than may be used in water-based compositions heretofore employed as energy transmission fluids.

DESCRIPTION OF THE INVENTION

In accordance with the present invention, the water-based energy transmitting fluid is an aqueous composition having a viscosity of at least 10 mm^2/S at 40°C which contains up to 80 percent by weight of water and a conventional acidic lubricity agent to which has been added an anti-wear and lubricity additive which is the combination of a hydroxyl substituted aromatic acid component and a nitroaromatic compound component.

The acidic lubricity agents suitable for use in compositions of the invention are well known materials which are conventionally used as lubricity improvers in water-based hydraulic and the like fluids. Such suitable acidic materials include, for example, saturated and unsaturated aliphatic

carboxylic and polycarboxylic acids having at least 6 carbon atoms such as caproic acid, caprylic acid, pelargonic acid, capric acid, lauric acid, myrisitic acid, palmitic acid, stearic acid, oleic acid, linolic acid, undecanoic acid, oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, maleic acid, fumaric acid, glutaconic acid, butenetricarboxylic acid; aromatic carboxylic acids such as benzoic acid, dimethylbenzoic acid, phthalic acid, terephthalic acid, isophthalic acid and trimellitic acid; alkali metal or organic amine salts of said aliphatic and aromated carboxylic acids such as morpholine; polymerized fatty acids (dimer acids); oxycarboxylic acids such as malic and tartaric acid; and lecto-dicarboxylic acids such as acetonedicarboxylic acid.

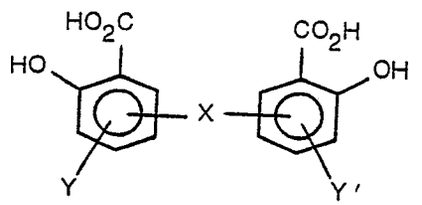
As a general rule, the acidic lubricity agent may be present in an amount between 0.1 and 10 percent by weight and are conventionally used in an amount between 0.5 and 2 percent by weight of the water-based composition, but greater amounts of said agent may be employed if desired for particular applications.

An essential component of the compositions of the invention is an anti-wear additive which is the combination of a hydroxyl substituted aromatic acid component and a nitroaromatic compound component.

Nitroaromatic compounds which are suitable for use as an anti-wear additive component in compositions of the invention are mononuclear aromatic compounds having at least one substituent nitro group. Such suitable nitroaromatic compounds are the nitro-substituted aromatic acids and compounds such as nitroaromatic salts, esters, and the like, that, in situ, effect the formation of the acid anion. Exemplary suitable nitroaromatic compounds are 3- nitrobenzoic acid, 4- nitrophthalic acid, 4-nitroisophthalic acid, 3,5- dinitrobenzoic acid, p-nitrocinnamic acid, and the like, and alkali metal, amine, or ammonium salts thereof.

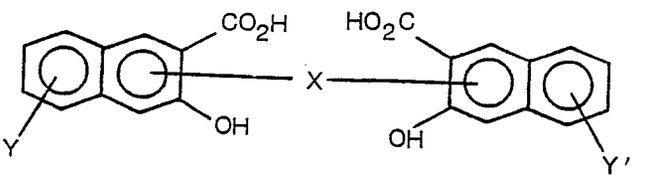
Hydroxyl substituted aromatic acids which are suitable for use in combination with said nitroaromatic compounds are the mononuclear hydroxyl-substituted aromatic acids such as, for example, salicylic acid, and dihydroxy substituted benzoic acid and the bridged dimer of hydroxyl-substituted aromatic carboxylic acids of the general formula:

1)



or

2)



wherein

X is a sulfur atom or a chemically stable group selected from lower alkylene, sulfonyl, and amino groups, and Y and Y' may be the same or different, and are a hydrogen atom, hydroxyl group, amino group, alkyl group or sulfonyl group.

Exemplary suitable bridged dimer acids are methylene or sulfur bridged, hydroxyl-substituted aromatic carboxylic acids such as 5,5'-methylenedisalicylic acid, pamoic acid, and thiodisalicylic acid. The compound may be present in the composition as a salt such as an alkali metal, amine, or ammonium salt.

In compositions of this invention, it is essential that both a nitroaromatic compound and a hydroxyl substituted acid be present in order to prepare water-based compositions that exhibit enhanced anti-wear and lubricity properties. As a general rule, the combination of anti-wear additive components hereinabove described should be present in a combined amount sufficient to impart the desired degree of anti-wear properties and lubricity to the composition, depending upon the operating conditions and service requirement for a particular application. The amount of the combination of anti-wear additive components that should be present will be called herein an "effective amount", which is defined as being the minimum amount required to achieve the anti-wear properties and lubricity required for a particular application. While the amount of each of the anti-wear additive components and the "effective amount" of the combination thereof may vary somewhat depending on the application, the amount of each of the additive components present should be at least 0.0025 gram-moles per liter (generally 0.003 weight percent) and preferably from 0.01 to 0.50 or even more, gram-moles per liter of aqueous composition (generally between 0.01 to 10 percent by weight). The relative

proportions of and the maximum amount of each of the additive components and the combination thereof that should be present is not critical, with economic factors generally determining the use of amounts greatly in excess of that actually required.

The water-based compositions of the invention should have a viscosity of at least 10 mm^2/s at 40°C and may contain up to 80 percent by weight of water. In general, the viscosity of the aqueous composition of the invention may vary depending upon the energy transmission application for which it is intended and the temperature range over which it will be used. For example, energy transmitting fluids such as hydraulic fluids may have viscosities in the range of 25 to 150 mm^2/s at 40°C, and preferably in the range of 30 to 85 mm^2/s and lubricating fluids may be used with similar viscosity requirements. While it is desirable to be able to provide an energy transmitting fluid which contains the greatest amount of water in order to provide fire resistance characteristics, it is also important that such fluid have a viscosity range that is capable of operating in existing equipment, as well as providing adequate boundary lubrication and lubrication for mechanical components. Accordingly, the water content of the compositions of the invention may vary in the range of from 20 percent to 80 percent and preferably from 30 percent to 70 percent by weight.

To achieve the range of viscosities that may be desired for a particular application and wherein the water content of such compositions may be varied over a broad range, a water-soluble polymeric viscosity control and/or thickening agent is generally employed in an amount that ranges from 5 percent to 50 percent, and preferably from 10 to 20 percent by weight of the composition. Water-soluble polymers that are suitable for use as viscosity control agents in the compositions of the invention are poly(alkylene oxide) polymers. Such polymers are known compounds which, even though of high molecular weight, are water-soluble. In general, these polymers will contain oxyethylene groups or both oxyethylene groups and higher oxyalkylene groups such as oxypropylene and oxybutylene groups either in random or block distribution in their molecules, and will have average molecular weights from 400 to 40,000 or even higher. The amount of oxyethylene groups in the molecule is such that the poly(alkylene oxide) polymers are soluble in water at ordinary temperatures, and the amount of oxypropylene or higher oxyalkylene groups is such that the poly(alkylene oxide) remains liquid at ordinary temperatures up to an average molecular weight of 40,000 and higher or may melt at temperatures below about 60°C. The oxypropylene/oxyethylene ratio may vary from zero to unity. These poly(alkylene oxide) polymers may be made by processes well known in the art by reacting ethylene oxide or mixtures of ethylene oxide and propylene oxide or higher alkylene oxide with a compound having at least one active hydrogen atom up to as many as six such active hydrogen atoms including, for example, water, monohydroxylic alcohols such as ethanol and propanol, dihydroxylic alcohols such as ethylene glycol, trihydroxylic alcohols such as glycerine and trimethylopropane, terthydroxylic alcohols such as pentaerythritol, hexahydroxylic alcohols such as sorbitol, and mono- or poly- functional amines such as butylamine and ethylene diamine. The poly(alkylene oxide) products of such reaction will have linear or branched oxyethylene or oxyethylene-higher oxyalkylene chains and such chains will terminate with hydroxyl groups. Some or all of these hydroxyl groups may be etherified by reaction with a dialkyl sulfate such as diethyl sulfate.

Another known class of water-soluble polymers that are suitable as thickeners or viscosity control agents are the polymer adducts of alkyl phenols and alkylene oxides such as, for example, the ethylene oxide/propylene oxide adducts of alkyl phenol disclosed in U.S. Patent No. 2,768,141 to Langer et al. and the ethoxylated dinonyl phenol disclosed in U.S. Patent No. 3,379,644 to Katzenstein.

Also suitable as viscosity control agents are the water-soluble polyalkyl methacrylates disclosed, for example, in U.S. Patent No. 3,352,783 to McCord which generally results from the polymerization of alkyl methacrylates in which the alkyl groups can have an average of from 3 to 10 carbon atoms. The urethane polymers such as disclosed in U.S. Patent No. 3,352,783 are other suitable water-soluble polymers for use as a viscosity control agent.

Other suitable water-soluble polymers are, for example, polyamide esters such as disclosed in U.S. Patent No. 3,341,573 to Shibe and polyamide alkoxylates such as disclosed in U.S. Patent No. 3,992,312 to Genjida et al.

In accordance with the present invention preferred embodiments of the compositions of the invention may also contain a water-soluble freezing point depressant. The water-soluble freezing point depressants conventionally employed are glycols or glycol ethers having 2 to 14 carbon atoms such as ethylene glycol, diethylene glycol, triethylene glycol, ethylene glycol ethers such as the ethyl, methyl, propyl and butyl ethers thereof, and similar ethers of diethylene and triethylene glycol. In general, it is preferred to use the simpler polyols as represented by ethylene glycol, propylene glycol, butylene glycol, glycerine, and diethylene glycol. As the basis of the energy transmitting fluid of the invention, it is preferable to use proportions of said glycols or glycol ethers which will give, in combination with water, the low temperature servicability desired.

The energy transmission fluids of this invention may also contain other components conventionally used in water-based fluids such as corrosion, oxidation, and foam inhibitors, pH conditioners, dyes, sequestering agents and the like which may be used in small amounts from 0.01 to 5 to 10 percent by weight of the composition. Exemplary of such materials that may be used are corrosion inhibitors including monoethanolamine, monoisopropanolamine, diethanolamine, triethanol-

amine, ethylenediamine, dimethylethanolamine, diethylenetriamine, cyclohexylamine, morpholine, 1,4-bis (2-aminoethyl)pyperadine, 2-heptadecyl-1-(2-hydroxyethyl)imidazoline, derivatives thereof such as alkaline oxide adducts, alkali metal salts of carboxylic acids and the like; pH conditioners including organic amines as mentioned as corrosion inhibitors and alkali metal hydroxides; antioxidants including benzotriazole, mercaptobenzoimidazole, and mercaptobenzothiazole; foam inhibitors including silicones of the emulsion type; dyes including basic dyes and acid dyes; and sequestering agents such as aminocarboxylic acids and derivates thereof including ethylenediamotetraacetic acid, diethylenetriaminepentaacetic acid, sodium or copper salts thereof, and oxycarboxylic acids and derivates thereof such as tartaric acid and sodium gluconate.

In preparing the water-based compositions of the invention, each of the components used may be added in any order of addition, or combinations of some of them may be prepared prior to incorporating in the composition. In general, each of the components to be used should be water-soluble or previously made into a water-soluble form such as the alkali metal or ammonium salts thereof, or should be capable of being solubilized in situ.

In accordance with the present invention, there is also provided a method whereby the anti-wear and lubricity characteristics of a water-based energy transmission fluid may be enhanced by adding to an aqueous composition having a viscosity of at least 10 mm^2/s at 40°C which contains up to 80 percent by weight of water and has incorporated therein an acidic lubricity agent as hereinabove described, an anti-wear additive which comprises the combination of nitroaromatic compound component and a hydroxyl substituted aromatic acid in an "effective amount" to enhance the anti-wear and lubricity properties thereof. Such additive components may be in the alkali metal or ammonium salt solubilized form thereof or in a form that is solubilized in situ.

In an alternate embodiment, in the event that the water-base fluid composition to be treated does not contain an acidic lubricity agent as herein described, such component may be added to the fluid when the anti-wear additive components are added.

The invention will become more clear when considered together with the following examples, which are set forth as being merely illustrative of the invention and which are not intended, in any manner, to be limitative thereof. Unless otherwise indicated, all parts and percentages are by weight.

Example 1

Measurement of the wear and lubricating properties of the water-based energy transmitting compositions of this invention, as well as the compositions used for comparison purposes are performed on a hydraulic fluid test stand as described in ASTM D—2882—74 "Vam Pump Testing of Petroleum Hydraulic Fluids". The operational conditions for the tests are as follows:

Pump	Vickers V104, 30 1pm (8gpm) Vane Pumps
Pump Speed	1200 rpm
Pump Pressure	123 kg/cm^2 (1750 psig) 1207,5 N/cm^2 134 kg/cm^2 (1900 psig) 1311 N/cm^2 141 kg/cm^2 (2000 psig) 1380 N/cm^2
Fluid Temperature	66°C
Fluid Quantity	5000 ml

The apparatus and procedure described above are used to evaluate the wear of metal pump cam ring and vanes using various water-based compositions of this invention in comparison with a composition prepared without the anti-wear additive of the invention. The proportion of ingredients used in preparing the compositions evaluated in this Example are summarized below:

	Composition (%)			
	A	B	C	D
Deionized Water	40	40	40	40
Ethylene Glycol	43	43	44	43
Polymeric Thickener	16.9	13.65	13.255	13.7
Capric Acid	1.0	1.0	1.0	1.0
(DMEA)[a]	1.0	1.0	1.0	1.0
(MIPOLA)[b]	0.5	0.5	0.5	0.5
Copper Wear Additive	0.1	0.1	0.1	0.1
3,5-Dinitrobenzoic Acid	—	0.2	0.1	0.4
(3,5-DNBA gram-moles/liter)[c]	—	(0.01)	(0.005)	(0.02)
5,5'-Methylene-disalicylic Acid	—	0.15	0.075	0.3
(MDA gram-moles/liter)[c]	—	(0.01)	(0.005)	(0.02)

[a]DMEA — Dimethylethanolamine
[b]MIPOLA — Monisopropanolamine
[c]gram-moles equivalent of weight percent added

The polymeric thickener used in the compositions of this Example is a water-soluble product available under the trademark designation UCON 75—H—380,000 from Union Carbide Corporation. The copper wear additive is available commercially under the trademark designation REOMET 41 from Ciba-Geigy Corp.

The results of the wear tests are summarized in Table I.

TABLE I

	Composition			
Pump Test Data	A	B	C	D
Wear (mg/100 hours)[a]				
Pump Discharge Pressure 1750 psig (123 kg/cm²) 1207,5 N/cm²	3100	250	—	735
Pump Discharge Pressure 1900 psig (134 kg/cm²) 1311 N/cm²	—	380	300	—

[a]wear of cam ring and vanes

It is apparent from the data shown that the lubricity (anti-wear) properties at high pressures of compositions B to D is vastly superior to the lubricity of composition A which did not contain the anti-wear additive of the invention.

Example 2

The apparatus and procedure described in Example 1 is used to evaluate the lubricity (anti-wear properties) of water-based compositions containing the anti-wear additive of the invention and these

are compared with compositions prepared with one or the other of the anti-wear additive components but not with the combination thereof. The proportions of ingredients used and the lubricity test results are summarized in Table II. The polymeric thickener of Example was used in the compositions of this Example.

It is apparent from the data in Table II that compositions A and B which contain the anti-wear additive of the invention exhibit greatly superior wear resistance properties than composition C which did not contain any anti-wear additive components and Compositions D and E, which did not contain the combination of anti-wear additive components.

TABLE II

	(Composition (%)				
Ingredients	A	B	C	D	E
Deionized Water	40	40	38	40	40
Ethylene Glycol	43	—	45	44	44
Diethylene Glycol	—	43	—	—	—
Polymeric Thickener	14.05	14.05	13.8	13.2	13.25
Reomet 41	—	0.1	0.2	0.1	0.1
Benzotriazole	0.1	—	—	—	—
Capric Acid	1.0	1.0	1.5	1.0	1.0
DMEA[a]	1.0	1.0	1.0	1.0	1.0
MIPOLA[b]	0.5	0.5	0.5	0.5	0.5
3,5-Dinitrobenzoic Acid	0.2	0.2	—	0.2	—
(3,5-DNBA gram-moles/ liter)	(0.01)	(0.01)	—	(0.01)	—
5,5′-Methylenedisalicylic Acid	0.15	0.15	—	—	0.15
(5,5′-MDA gram-moles/ liter)	(0.01)	(0.01)	—	—	(0.01)
Wear Test Data (mg/100 hours)					
Discharge Pressure 1750 psig 1207 N/cm²	440	400	6800	3000	3000
Discharge Pressure 1900 psig 1311 N/cm²	—	—	—	—	—

[a]DMEA — Dimethylethanolamine
[b]MIPOLA — monisopropanolamine

Example 3

Using the apparatus and procedure described in Example 1, the lubricity (anti-wear) properties of a series of fluid compositions containing various amounts of water are evaluated. The proportion of ingredients in each of the compositions and wear data obtained with each of the compositions is summarized in Table III.

TABLE III

	Composition (%)			
	A	B	C	D
Deionized Water	60	70	75	75
Ethylene Glycol	20	9	1	2.5
Polymeric Thickener	16.9	18.3		
Capric Acid	1.0	1.0	1.3	1.0
DMEA	1.0	1.0	1.0	1.0
MIPOLA	0.5	0.5	0.6	0.5
Reomet 41	0.1	0.1	0.1	0.1
Benzoic Acid	0.01	0.01		
3,5-Dinitrobenzoic Acid	0.1	0.1	0.5	0.1
(DNBA-gram-moles/liter)	(0.005)	(0.005)	(0.025)	(0.005)
Salicylic Acid	0.035	0.035	—	0.035
(gram-moles/liter)	(0.005)	(0.005)	—	(0.005)
5,5′ Methylenedisalicylic	—	—	0.3	—
Pump Test Data (Wear-Mg/100 hours)				
Discharge Pressure				
690 N/cm² 1000 psig	—	—	50	—
1207,5 N/cm² 1750 psig	61	300	3000+	3950
1380 N/cm² 2000 psig	99	—	—	—

Example 4

Using the apparatus and procedure of Example 1, the lubricity of a series of water-based fluid compositions using various types of acidic lubricity agents and anti-wear additive components are evaluated. The proportion of ingredients used in each of the compositions and pump-wear test results are summarized in Table IV. The Polymeric Thickener of Example 1 is used in the compositions of this Example.

It is apparent from the results shown that each of the compositions evaluated exhibited enhanced anti-wear properties through Composition E prepared with lauric acid as the acid lubricity agent exhibits somewhat higher wear.

TABLE IV

Ingredients	Composition A	B	C	D	E	F	G
Deionized Water	40	40	40	44	44	40	40
Ethylene Glycol	44	44	44	40	40	44	44
Polymeric Thickener	13.15	12.99	13.05	13.12	13.04	13.07	14.65
Capric Acid	1.0	1.0	1.0	—	—	1.0	1.0
Lauric Acid	—	—	—	—	1.0	—	—
Pelargonic Acid	—	—	—	1.0	—	—	—
Benzoic Acid	—	0.01	—	0.01	0.01	0.01	0.01
DMEA	1.0	1.0	1.0	1.0	1.0	1.0	—
MIPOLA	0.5	0.5	0.5	0.5	0.5	0.5	—
Reomet 41	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3,5-Dinitrobenzoic Acid	—	0.2	0.2	0.2	0.2	—	0.2
m-Nitrobenzoic Acid	—	—	—	—	—	0.17	—
R_T Nitrobenzoic Acid	0.1	—	—	—	—	—	—
Salicylic Acid	—	—	—	0.07	—	—	—
2,4-Dihydroxybenzoic Acid	—	—	—	—	—	—	0.8
Methylenedisalicylic Acid	0.15	—	—	—	0.15	0.15	—
Disodium Pamoate	—	0.2	—	—	—	—	—
4,4'-Sulfonyldibenzoic Acid	—	—	0.15	—	—	—	—
Pump Test Wear (Mg/100 hours)							
Pressure 1750 psig 1207,5 N/cm²	20	—	—	—	1700	32	75
1900/2000 psig	—	280	350	145	—	—	—
1311/1380 N/cm²							

Claims

1. A water-based energy transmitting fluid having enhanced anti-wear properties which comprises an aqueous composition having a viscosity of at least 10 mm²/s (centistokes) at 40°C which contains up to 80 percent by weight of water, at least 0.1 percent by weight of an acidic lubricity agent and an anti-wear additive which comprises the combination of at least 0.0025 gram-moles/liter of a hydroxyl substituted aromatic acid component and at least 0.0025 gram-moles/liter nitro-substituted aromatic acids or compounds that, in situ, effect the formation of the acid anion.

2. The water-based fluid of claim 1 which contains at least 20 percent by weight of water.

3. The water-based fluid of claim 1 or 2 wherein said nitroaromatic compound component is a nitro substituted mononuclear aromatic acid.

4. The water-based fluid of claim 1 to 3 wherein said hydroxyl substituted aromatic acid component is a mononuclear hydroxyl-substituted aromatic acid or a bridged dimer of a hydroxyl-substituted aromatic carboxylic acid.

5. The water-based fluid of claim 1 to 4 wherein said acid lubricity agent is a member selected from the group consisting of saturated and unsaturated aliphatic carboxylic and polycarboxylic acids having at least 6 carbon atoms, aromatic carboxylic acids and alkali metal or organic amine salts of said aliphatic and aromatic acids.

6. The water-based fluid of claim 1 to 5 wherein said aqueous composition comprises up to 50 percent by weight of a glycol or glycol ether having 2 to 14 carbon atoms.

7. The water-based fluid of claim 1 to 6 wherein said aqueous composition comprises a water-soluble polymeric viscosity control agent in an amount from 5 percent to 50 percent by weight.

8. The method of anhancing the anti-wear and lubricity properties of a water-based energy transmitting fluid containing an acidic lubricity agent which comprises incorporating in said water-based fluid an anti-wear additive comprising the combination of at least 0.0025 gram-moles/liter of a hydroxyl substituted aromatic acid component and at least 0.0025 gram-moles/liter nitro-substituted aromatic acid or compounds that, in situ, effect the formation of the acid anion.

Patentansprüche

1. Energieübertragungsflüssigkeit auf der Basis von Wasser verbesserter Verschleißeigenschaften mit einer Viskosität von zumindest 10 mm²/s bei 40°C enthaltend bis zu 80 Gew.-% Wasser, zumindest 0,1 Gew.-% eines sauren Schmiermittels und einen Antiverschleiß-Zusatz in Form von zumindest 0,0025 g-mol/l einer hydroxy-substituierten aromatischen Säure und zumindest 0,0025 g-mol/l von nitro-substituierten aromatischen Säuren oder Verbindungen, die *in situ* das Säure-Anion zu bilden vermögen.

2. Energieübertragungsflüssigkeit nach Anspruch 1 enthaltend zumindest 20 Gew.-% Wasser.

3. Energieübertragungsflüssigkeit nach Anspruch 1 oder 2, in welcher die nitro-aromatische Verbindung eine mit einer Nitrogruppe substituierte einkernige aromatische Säure ist.

4. Energieübertragungsflüssigkeit nach Anspruch 1 bis 3, worin die hydroxy-substituierte aromatische Säure eine einkernige hydroxy-substituierte aromatische Säure oder ein Brücken-Dimeres einer hydroxysubstituierten aromatischen Carbonsäure ist.

5. Energieübertragungsflüssigkeit nach Anspruch 1 bis 4, worin das saure Schmiermittel eine gesättigte und/oder ungesättigte aliphatische Carbonsäure und/oder Polycarbonsäure mit zumindest 6 C-Atomen, eine aromatische Carbonsäure und/oder deren Alkalisalze und/oder organische Aminsalze der aliphatischen und aromatischen Säuren ist.

6. Energieübertragungsflüssigkeit nach Anspruch 1 bis 5, die bis zu 50 Gew.-% Glykol oder Glykolether mit 2 bis 14 Kohlenstoffatomen enthält.

7. Energieübertragungsflüssigkeit nach Anspruch 1 bis 6, welche ein wasserlösliches polymeres die Viskosität einstellendes Mittel in einer Menge von 5 bis 50 Gew.-% enthält.

8. Verfahren zur Verbesserung der Antiverschleiß- und Schmiereigenschaften einer Energieübertragungsflüssigkeit auf der Basis von Wasser enthaltend ein saures Schmiermittel, indem ein Antiverschleiß-Zusatz in Form einer Kombination von zumindest 0,0025 g-mol/l einer hydroxy-substituierten aromatischen Säure und zumindest 0,0025 g-mol/l nitro-substituierter aromatischer Säure oder Verbindung, welche *in situ* das Säure-Anion zu bilden vermag, zugesetzt wird.

Revendications

1. Liquide à base aqueuse de transmission d'énergie doué de très bonnes propriétés anti-usure, qui comprend une composition aqueuse ayant une viscosité d'au moins 10 mm²/s (centistokes) à 40°C qui contient jusqu'à 80% en poids d'eau, au moins 0,1% en poids d'un agent lubrifiant acide et un additif anti-usure qui résulte de l'association d'au moins 0,0025 molécule-gramme/litre d'un composant acide aromatique à substituant hydroxyle et d'au moins 0,0025 molécule-gramme/litre d'acides aromatiques à substituant nitro ou de composés qui, in situ, entraînent la formation de l'anion des acides.

2. Liquide à base d'eau suivant la revendication 1, qui contient au moins 20% en poids d'eau.

3. Liquide à base d'eau suivant la revendication 1 ou 2, dans lequel ledit composant formé d'un composé aromatique nitré est un acide aromatique mononucléaire substitué par un groupe nitro.

4. Liquide à base d'eau suivant les revendications 1 à 3, dans lequel ledit composant acide aromatique à substituant hydroxyle est un acide aromatique mononucléaire à substituant hydroxyle ou un dimère ponté d'un acide carboxylique aromatique à substituant hydroxyle.

5. Liquide à base d'eau suivant les revendications 1 à 4, dans lequel ledit agent lubrifiant acide est un représentant du groupe comprenant des acides carboxyliques et polycarboxyliques aliphatiques saturés et insaturés ayant au moins 6 atomes de carbone, des acides carboxyliques aromatiques et des sels de métaux alcalins ou d'amines aromatiques desdits acides aliphatiques et aromatiques.

6. Liquide à base d'eau suivant les revendications 1 à 5, dans lequel ladite composition aqueuse comprend jusqu'à 50% en poids d'un glycol ou d'un éther de glycol ayant 2 à 14 atomes de carbone.

7. Liquide à base d'eau suivant les revendications 1 à 6, dans lequel ladite composition aqueuse comprend un agent polymérique hydrosoluble influençant la viscosité en une quantité de 5 à 50% en poids.

8. Procédé pour améliorer les propriétés anti-usure et les propriétés d'onctuosité d'un liquide à base aqueuse de transmission d'énergie contenant un agent lubrifiant acide, qui consiste à incorporer audit liquide aqueux un additif anti-usure résultant de l'association d'au moins 0,0025 molécule-gramme/litre d'un composant acide aromatique à substituant hydroxyle et d'au moins 0,0025 molécule-gramme/litre d'un acide aromatique à substituant nitro ou de composés qui, in situ, entraînent la formation de l'anion des acides.