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(54) **LIQUID CONDUCTIVITY ADDITIVES FOR NONAQUEOUS HYDRAULIC OILS**

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(57) **ABSTRACT**

Composition comprising nonaqueous hydraulic oils or lubricants and one or more conductivity additives which form clear solutions or mixtures with the hydraulic oil and optionally further customary additives for increasing the conductivity of nonaqueous hydraulic oils and/or lubricants.

LIQUID CONDUCTIVITY ADDITIVES FOR NONAQUEOUS HYDRAULIC OILS

[0001] This application claims benefit under 35 U.S.C. 119 (a) of German patent application 10 2008 001 674.8, filed on 9 May 2008.

[0002] Any foregoing applications, including German patent application DE 10 2008 001 674.8, and all documents cited therein or during their prosecution ("application cited documents") and all documents cited or referenced in the application cited documents, and all documents cited or referenced herein ("herein cited documents"), and all documents cited or referenced in herein cited documents, together with any manufacturer's instructions, descriptions, product specifications, and product sheets for any products mentioned herein or in any document incorporated by reference herein, are hereby incorporated herein by reference, and may be employed in the practice of the invention.

[0003] Hydraulic oils serve for power transmission in machines. A pump conveys oil through a conduit, at the end of which a piston is moved by the hydraulic oil. On the basis of the lever principle, it is thus possible to transmit large forces with comparatively low pump power.

[0004] According to the end use and required property, hydraulic fluids are of different structure. The liquids are divided according to ISO 6743 into mineral oil-based, low-flammability and environmentally friendly fluids.

[0005] The most frequently used hydraulic fluids, but also lubricants, are based on mineral oils with appropriate additives. They are also referred to as hydraulic oils. The requirements on these hydraulic oils are laid down in ISO 6743/4 with the designations HL, HM, HV. In Germany, the designations HL, HLP, HVLP according to DIN 51524 are customary.

[0006] [HL: comprising active ingredients to increase corrosion protection and ageing stability (including HL to DIN 51524, part 1); HM: comprising active ingredients to increase corrosion protection and ageing stability, and to reduce scuffing in the mixed friction range (including HLP to DIN 51524, part 2); HV: comprising active ingredients to increase corrosion protection and ageing stability, and to reduce scuffing in the mixed friction range and to improve the viscosity-temperature behaviour (including HVLP DIN 51524, part 3)].

[0007] Additionally of significance are anhydrous, synthetic, nonflammable fluids. They are based on the following compounds:

- [0008] phosphoric esters (HFD R), nowadays the most frequently used HFD fluid; but has the lowest nonflammability,
- [0009] chlorinated hydrocarbons (HFD S); for reasons of environmental protection, now used only in closed systems for coal mining,
- [0010] mixtures of HFD R and HFD S,
- [0011] other compositions (HFD U).

[0012] In addition, biodegradable hydraulic fluids based on vegetable oils (e.g. based on rape) are being produced and used in biologically critical environments (construction machinery in water protection areas, piste machinery in mountains, etc.). These fluids are pollutants in German Schadstoffklasse I and are abbreviated to: HE=Hydraulic Environmental. The individual substance classes are subdivided as follows:

- [0013] HETG (based on triglycerides=vegetable oils),
- [0014] HEES (based on synthetic esters),
- [0015] HEPG (based on polyglycols)
- [0016] HEPR (other base fluids, primarily poly-alpha-olefins).

[0017] Manufacturers of hydraulic equipment require predominantly products to DIN 51524 part 2 "HLP" or part 3 "HVLP". Oils of this quality must possess a particular water separation capacity, filterability, seal compatibility, air separation capacity, oxidation stability, wear protection, etc. (Some parts of DIN 51524 have been revised in 2005. The new version of DIN 51524 was published in April 2005. The significant change is the newly introduced 21/19/16 purity class).

[0018] The general assessment of a hydraulic overall system in relation to economic viability, reliability, low maintenance costs and high machine availability is influenced by the use of high-grade components, for example valves, control pumps, lubricant and hydraulic media.

[0019] Ultrafine particles considerably influence the lifetime of a hydraulic system through abrasion and other undesired side effects. For this reason, the manufacturers of hydraulic systems stipulate that the oil should be filled into the system through special filters.

[0020] In the analysis of damage to hydraulic and lubricant systems, damage to the components used, caused by hard solid particles which occur in high concentration in the operating medium, are usually diagnosed as the cause.

[0021] The intensity of component damage as a result of solid contamination in the lubricant and hydraulic oil depends on

- [0022] material of the contamination (the harder the particles are, the greater is the component damage)
- [0023] operating pressure (the higher the operating pressure, the more strongly the solid particles are forced into the lubricated gap).

[0024] The failure of hydraulic and lubricant components can usually be attributed to the following causes:

- [0025] coarse particles (>15 μm): sudden component failure,
- [0026] fine contamination (5-15 μm): component wear, leaks, valve blockages,
- [0027] ultrafine contamination (<2-5 μm): sludge accumulation in the oil, relatively rapid oil ageing.

[0028] The filters used in lubricant and hydraulic systems have the task of ensuring compliance with the solids contamination limits. In order that this aim can be achieved, these filters must be mounted very close to the soil introduction site, must have the necessary filter fineness, and must be installed within the largest volume flow, in order that a high tank circulation is achieved. If possible, the system filtration should be supported by effective tank circulation (secondary flow filtration).

[0029] In order that damage to the filter element is prevented, and an economically viable, cost-optimized element changeover is possible, the filter should be provided with an active contamination indicator which, if ignored, shuts down the system.

[0030] These recommendations should have the effect that the component lifetime required by the operator and hence the service life of the overall system can be satisfied. The task of the hydraulic filters used in the system and of the correct positioning thereof in the system is to implement and comply with these purity class requirements over the entire service life of the system. In the case of new oils in particular, which are supplied in vats, tankers or minicontainers, inadmissibly high solid contamination is to be expected.

[0031] The use of high-grade filters with elements which, in the multipass test to ISO 16889, display particle separation over a wide particle size range, have a high soil absorption, and guarantee a low pressure difference at the filter element and housing, a high collapse and bursting pressure resistance and a high dynamic pressure and volume flow pulsation resistance, noticeably reduces the concentration of the solid contamination in lubricant and hydraulic media, with the aim of preventing premature component failure. A low solid concentration in the individual particle sizes in the lubricant and hydraulic media is the prerequisite for the entire system being operable economically and reliably.

[0032] In the filtration processes, especially at low ambient temperatures, as exist, for example, in cold stores, charge separations occur, which lead to static charging.

[0033] The lower the temperature, the greater the problem of static charging, especially also at reduced air humidity and/or residual moisture content in closed systems.

[0034] Spark formation, which is possible as a result of static charging, constitutes a high safety risk. To prevent this problem, conductivity additives are needed, which ensure a minimum conductivity of the hydraulic fluid and thus ensure discharge. Typically, solid salts are used in conjunction with organic solvents. The latter are needed in order to achieve at least a minimum solubility. This configuration has various disadvantages. Firstly, the organic solvents increase the flammability and the combustibility of the hydraulic fluid; secondly, they are volatile and constitute a safety risk. Furthermore, the volatility has the effect that the solubility of the conductive salts decreases and they are filtered out with time and can even lead to damage to the hydraulic system as a result of friction. In addition, the hydraulic fluid thus loses its antistatic modification. In conjunction with the organic solvents still present in small amounts, the flammability and hence the safety risk increase as a consequence.

[0035] The maximum concentration of conductivity improver is thus limited, and hence also the maximum achievable conductivity of the hydraulic oils or lubricants.

[0036] In the context of this application, conductivity improvers are also referred to as conductivity additives, though both terms should be considered as synonymous with one another.

[0037] It is therefore an object of the present invention to overcome the indicated shortcomings in the prior art and to provide novel conductivity improvers which are capable of ensuring lasting antistatic modification of hydraulic oils and/or lubricants.

[0038] Surprisingly, liquid conductivity additives have now been found, which are soluble in the nonaqueous hydraulic fluid and/or the lubricant or at least form clear mixtures with the hydraulic fluid and/or the lubricant and can be used advantageously in hydraulic oils and/or lubricants.

[0039] These liquid conductivity additives contain ions with organic radicals and have very low vapour pressures and hence also low volatilities.

[0040] The invention therefore provides compositions comprising nonaqueous hydraulic oils or lubricants and one or more liquid conductivity additives which contain organic ions and may optionally contain further customary additives.

[0041] Preference is given to compositions which comprise liquid ionic conductivity additives in which at least either the cation and/or the anion has/have organic radicals.

[0042] Particular preference is given to compositions which comprise ionic conductivity additives which have at least one cation and/or anion with organic radicals.

[0043] The ionic conductivity additive preferably contains, in the cation and/or anion, at least one organic radical having at least eight carbon atoms, where the sum of the carbon atoms of all radicals is at least 14.

[0044] Particular preference is given to ionic conductivity additives with at least one radical in the cation and/or anion which contains at least 12 carbon atoms, where the sum of the carbon atoms of all radicals is at least 22.

[0045] Very particular preference is given to conductivity additives with two or more organic radicals in the cation and/or anion which contain at least 12 carbon atoms and in which the sum of all radicals is at least 26.

[0046] The invention further provides for the use of liquid organic conductivity additives in hydraulic or lubricant systems, especially in those in which the lubricant is filtered continuously or semicontinuously, especially at temperatures between +20° C. and −75° C., preferably between +10° C. and −50° C., more preferably between 5° C. and −25° C. Useful lubricant systems include lubricant systems in two-stroke engines, gasoline engines and diesel engines, automatic transmission, manual transmission, brake circuits, hydraulic systems, air and gas compressors, gearboxes, ball bearings, gas turbines, steam turbines, cooling circuits, which are used, for example, in automobiles, trucks, tractors, aircraft, ships and industrial systems. Preferred lubricant systems are hydraulic systems; particular preference is given to hydraulic systems which are filtered continuously.

[0047] The use of the inventive compositions allows the conductivity of the hydraulic oils to be increased and hence the hazard potential of electrical charging to be avoided; in addition, the required properties of the hydraulic oils with regard to vapour pressure/volatility, flammability, filtration capacity, turbidity and stability of the formulation are improved, but at least not adversely affected.

[0048] It is especially advantageous that the conductivity additive is liquid and does not separate out of the formulation in crystalline form, which can lead to the described problems with conventional additives when they are used in hydraulic or lubricant systems.

[0049] The conductivity additives used in accordance with the invention are composed preferably of at least one cation $[A^+]$, corresponding to a quaternary nitrogen compound and/or phosphorus compound and/or sulphur compound and at least one anion, and their melting point is below about +250° C., preferably below approx. +150° C., especially below approx. +100° C. The conductivity additives used in accordance with the invention or mixtures thereof are more preferably liquid at room temperature, preferably at the use temperatures.

[0050] A further advantage of the inventive formulations is that they, as a result of the increased solubility of the inventive conductivity additives, can also be used at temperatures below room temperature, even significantly below freezing point.

[0051] It is thus also possible at low temperatures to increase conductivity and counter static charge, especially in the course of filtration.

[0052] In the context of the present invention, conductivity additives are salts of the general formulae (I), (II) and (III) listed below:

$$[A]_n^+[Y]^{n-} \quad (I)$$

in which

[0053] n is 1, 2, 3 or 4,

[0054] $[A]^+$ is a quaternary ammonium cation, an oxonium cation, a sulphonium cation or a phosphonium cation and

[0055] $[Y]^{n-}$ is an n-valent anion and/or mixed salts of the general formula (II)

$$[A^1]^+[A^2]^+[Y]^{2-} \quad (IIa)$$

$$[A^1]^+[A^2]^+[A^3]^+[Y]^{3-} \quad (IIb) \text{ or}$$

$$[A^1]^+[A^2]^+[A^3]^+[A^4]^+[Y]^{4-} \quad (IIc)$$

where

[0056] $[A^1]^+$, $[A^2]^+$ $[A^3]^+$ and $[A^4]^+$ are each independently selected from the groups specified for $[A]^+$**0** and $[Y]^{n-}$ is as defined for formula (I) and/or mixed salts of the general formulae (III)

$$[A^1]^+[A^2]^+[A^3]^+[M^1]^+[Y]^{4-} \quad (IIIa)$$

$$[A^1]^+[A^2]^+[M^1]^+[M^2]^+[Y]^{4-} \quad (IIIb)$$

$$[A^1]^+[M^1]^+[M^2]^+[M^3]^+[Y]^{4-} \quad (IIIc)$$

$$[A^1]^+[A^2]^+[M^1]^+[Y]^{3-} \quad (IIId)$$

$$[A^1]^+[M^1]^+[M^2]^+[Y]^{3-} \quad (IIIe)$$

$$[A^1]^+[M^1]^+[Y]^{2-} \quad (IIIf)$$

$$[A^1]^+[A^2]^+[M^4]^{2+}[Y]^{4-} \quad (IIIg)$$

$$[A^1]^+[M^1]^+[M^4]^{2+}[Y]^{4-} \quad (IIIh)$$

$$[A^1]^+[M^5]^{3+}[Y]^{4-} \quad (IIIi) \text{ or}$$

$$[A^1]^+[M^4]^{2+}[Y]^{3-} \quad (IIIj)$$

where

[0057] $[A^1]^+$, $[A^2]^+$ or $[A^3]^+$ are each independently selected from the groups specified for $[A]^+$,

[0058] $[Y]^{n-}$ is as defined for formula (I) and

[0059] $[M^1]^+$, $[M^2]^+$, $[M^3]^+$ are each monovalent metal cations,

[0060] $[M^4]^{2+}$ are divalent metal cations and

[0061] $[M^5]^{3+}$ are trivalent metal cations, or mixtures of all formulae (I) to (III).

[0062] The metal cations $[M^1]^+$, $[M^2]^+$, $[M^3]^+$, $[M^4]^{2+}$ and $[M^5]^{3+}$ specified in the formulae (IIIa) to (IIIj) are generally metal cations of groups 1, 2, 6, 7, 8, 9, 10, 11, 12 and 13 of the Periodic Table in the IUPAC nomenclature. Suitable metal cations are, for example, Li^+, Na^+, K^+, Cs^+, Mg^{2+}, Ca^{2+}, Ba^{2+}, Cr^{3+}, Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Ag^+, Zn^{2+} and Al^{3+}.

[0063] The inventive conductivity additives consist of anions, for example halides, carboxylates, phosphates, thiocyanates, isothiocyanates, dicyanamides, sulphates, alkylsulphates, sulphonates, alkylsulphonates, tetra-fluoroborate, hexafluorophosphate or else bis(trifluoromethylsulphonyl)imide, combined with, for example, substituted ammonium, phosphonium, pyridinium or imidazolium cations, where the aforementioned anions and cations constitute a small selection from the large number of possible anions and cations and hence are not intended to make any claim of completeness or even impose a restriction.

[0064] The conductivity additives which are used with preference in the context of the invention may consist, for example, of at least one organic cation $[A^+]$ of the general formulae

$$R^1R^2R^3R^4N^+ \quad (IV)$$

$$R^1R^2N^+{=}CR^3R^4 \quad (V)$$

$$R^1R^2R^3R^4P^+ \quad (VI)$$

$$R^1R^2P^+{=}CR^3R^4 \quad (VII)$$

$$R^1R^2R^3S^+ \quad (VIII)$$

in which

[0065] R^1, R^2, R^3, R^4 are the same or different with the proviso that at least one radical is not hydrogen, and are each hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms, a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more heteroatoms (oxygen, NH, NR' where R' is a C_1-C_{30}-alkyl radical which may contain double bonds, especially —CH_3), a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more functionalities selected from the group of —O—C(O)—, —(O)C—O—, —NH—C(O)—, —(O)C—NH, —(CH_3)N—C(O)—, —(O)C—N(CH_3)—, —S(O_2)—O—, —O—S(O_2)—, —S(O_2)—NH—, —NH—S(O_2)—, —S(O_2)—N(CH_3)—, —N(CH_3)—S(O_2)—, a linear or branched aliphatic or cycloaliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is functionalized terminally with OH, OR', NH_2, N(H)R', $N(R')_2$ in which R' is a C_1-C_{30}-alkyl radical which may contain double bonds, or a polyether of blockwise or random construction according to —$(R^5$—$O)_n$—R^6,

where

[0066] R^5 is a linear or branched hydrocarbon radical containing 2 to 4 carbon atoms,

[0067] n is 1 to 100, preferably 2 to 60, and

[0068] R^6 is hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms or a —C(O)—R^7 radical where

[0069] R^7 is a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms.

[0070] Preference is given to quaternary ammonium salts of alkoxylated fatty acids—also referred to as alkanolamine ester quats—characterized by the generic formula of the $R^1R^2R^3R^4N^+A^-$ (IV) type in which R^1 is an alkyl radical having 1 to 20 carbon atoms, R^2 is an alkyl radical having 1 to 4 carbon atoms, R^3 is a $(CH_2CHRO)_n$—H radical where n is 1 to 200 and R is H or CH_3, R^4 is an alkyl radical having 1 to 4 carbon atoms or a $(CH_2CHRO)_n$—H radical where n is 1 to 200 and R is H or CH_3, and A^- is a monovalent anion.

[0071] Among these compounds, preference is given to substances of the formula

$$R^6_{4-m}N^+[(CH_2)_n\text{-}Q\text{-}R^7]_m X^- \quad (i)$$

where

[0072] each R^6 radical is independently an alkyl group or hydroxyalkyl group having 1 to 6 carbon atoms, or a benzyl group and preferably a methyl group,

[0073] R^7 is independently hydrogen, a linear or branched alkyl group having 11 to 22 carbon atoms, a linear or branched alkenyl group having 11 to 22 carbon atoms, with the condition that at least one R^7 radical is not hydrogen,

[0074] Q is independently selected from the groups of the formulae —O—C O)—, —C(O)O, —NR^8—C(O)—, —C(O)—NR^8—, —O—C(O)—O, —CHR^9—O—C(O)— or —CH($OCOR^7$)—CH_2—O—C(O)—, where R^8 is hydrogen or a methyl, ethyl, propyl or butyl radical and R^9 is hydrogen or methyl, and Q is preferably —O—C(O)— or —NH—C(O)—;

[0075] M is 1 to 4 and preferably 2 or 3;

[0076] N is 1 to 4 and preferably 2; and

[0077] X is an anion compatible with hydraulic oils, for example methylsulphate, ethyl sulphate, methylsulphonate, butylsulphate, octylsulphate, phosphinate or 2-(2-methoxyethoxy)ethylsulphate, preferably methylsulphate, 2-(2-methoxyethoxy)ethylsulphate, octylsulphate and phosphinate. The quaternary ammonium compound may comprise mixtures of the compounds with different R^7 groups which are not hydrogen, the value of which ranges from 1 up to m. Such mixtures preferably contain an average of 1.2 to 2.5 R^7 groups which are not hydrogen. The proportion of non-hydrogen R^7 groups is preferably 1.4 to 2.0 and preferentially 1.6 to 1.9.

[0078] The preferred quaternary ammonium compounds are the compounds of the type:

$$R^6N^+[CH_2CHR^9OH—][CH_2CHR^9OC(O)R^7]_2 X^- \quad (ii)$$

$$R^6N^+[CH_2CHR^9OC(O)R^7]_2 X^- \quad (iii)$$

$$R^6N^+[CH_2CHR^9OH—][CH_2CH_2NHC(O)R^7]_2 X^- \quad (iv)$$

where R^6, R^7 and X are each as defined for formula (i) above, with the condition that R^7 is not hydrogen.

[0079] The —C(O)R^7 fragment is preferably a fat-containing acyl group. Usable fat-containing acyl groups are derived from the natural sources of the triglycerides, preferably tallow, vegetable oils, partially hydrogenated tallow and partially hydrogenated vegetable oils. Usable sources of the triglycerides are soybean oil, tallow, partially hydrogenated tallow, palm oil, palm kernels, rapeseeds, porcine fat, coconut, rape, safflower oil, maize, rice and tall oil, and mixtures of these components.

[0080] The person skilled in the art is aware that the composition of the fatty acid-containing compounds is subject to certain natural variations, as a function of the harvest or of the multitude of vegetable oil sources. The R^7 groups are usually mixtures of the linear and branched carbon chains of the saturated and unsaturated aliphatic fatty acids.

[0081] The proportion of the unsaturated R^7 groups in such mixtures is preferably at least 10%, more preferably at least 25% and most preferably 40% to 70%. The proportion of the polyunsaturated R^7 groups in such mixtures is less than 10%, preferably less than 5% and more preferably less than 3%. If required, partial hydrogenation can be carried out, in order to raise the saturated character and hence to improve the stability (e.g. odour, colour, etc.) of the end product. The content of unsaturated fractions, expressed by the iodine number, should be within a range of 5 to 150 and preferably within a range of preferably 5 to 50. The ratio of cis and trans isomers of the double bonds in the unsaturated R^7 groups is preferably greater than 1:1 and more preferably in the range of 4:1 to 50:1.

[0082] Preferred examples of the compounds of formula (i) are:

[0083] N,N-di(tallowyloxyethyl)-N,N-dimethylammonium chloride;

[0084] N,N-di(canolyloxyethyl)-N,N-dimethylammonium chloride;

[0085] N,N-di(tallowyloxyethyl)-N-methyl,N-(2-hydroxyethyl)-ammonium methylsulphate;

[0086] N,N-di(canolyloxyethyl)-N-methyl,N-(2-hydroxyethyl)-ammonium methylsulphate;

[0087] N,N-di(tallowylamidoethyl)-N-methyl,N-(2-hydroxyethyl)-ammonium methylsulphate;

[0088] N,N-di(2-tallowyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride;

[0089] N,N-di(2-canolyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride;

[0090] N,N-di(2-tallowyloxyethylcarbonyloxyethyl)-N,N-dimethylammonium chloride;

[0091] N,N-di(2-canolyloxyethylcarbonyloxyethyl)-N,N-dimethylammonium chloride;

[0092] N(2-tallowoyloxy-2-ethyl)-N-(2-tallowyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride;

[0093] N(2-canolyloxy-2-ethyl)-N(2-canolyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride;

[0094] N,N,N-tri(tallowyloxyethyl)-N-methylammonium chloride;

[0095] N,N,N-tri(canolyloxyethyl)-N-methylammonium chloride;

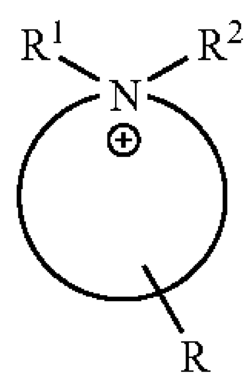
[0096] 1,2-ditallowyloxy-3-N,N,N-trimethylammoniopropyl chloride; and

[0097] 1,2-dicanolyloxy-3-N,N,N-trimethylammoniopropyl chloride.

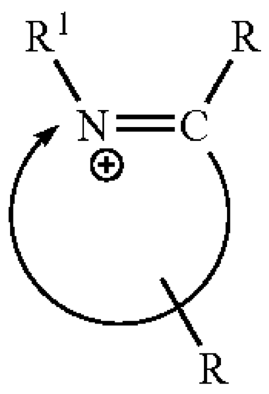
[0098] Further preferred quaternary ammonium salts are ditallowdimethylammonium chloride, ditallowdimethylammonium methylsulphate, dimethylammonium chloride of di(hydrogenated tallow) distearyldimethylammonium chloride and dibehenyldimethylammonium chloride.

[0099] Useful cations are also ions which derive from saturated or unsaturated cyclic compounds and from aromatic compounds having in each case at least one trivalent nitrogen atom in a 4- to 10-membered, preferably 5- to 6-membered, heterocyclic ring which may optionally be substituted. Such cations can be described in simplified form (i.e. without a statement of the exact position and number of double bonds in the molecule) by the general formulae (IX), (X) and (XI) below, where the heterocyclic rings may optionally also contain a plurality of heteroatoms such as nitrogen, oxygen or sulphur

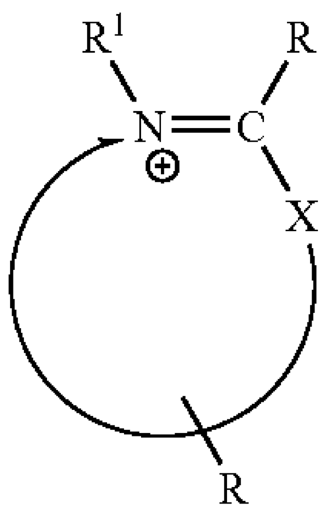
(IX)



(X)



(XI)



[0100] where R^1 and R^2 are each as defined above,

[0101] R is a hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms or an alkylaryl radical having 7 to 40 carbon atoms, and

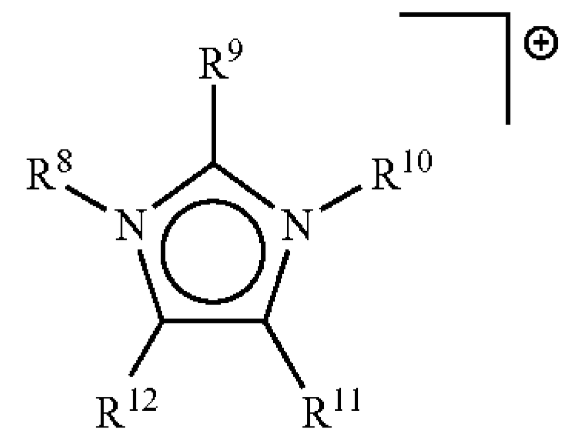
[0102] X is an oxygen atom, a sulphur atom or a substituted nitrogen atom (X=O, S, NR^1).

[0103] Examples of cyclic nitrogen compounds of the aforementioned type are pyrrolidine, dihydropyrrole, pyrrole, imidazoline, oxazoline, oxazole, thiazoline, thiazole, isoxazole, isothiazole, indole, carbazole, piperidine, pyridine, the isomeric picolines and lutidines, quinoline and isoquinoline. The cyclic nitrogen compounds of the general formulae (IX), (X) and (XI) may be unsubstituted (R=H), monosubstituted or else polysubstituted by the R radical, where, in the case of polysubstitution by R, the individual R radicals may be the same or different.

[0104] Useful cations also include ions which derive from saturated acyclic, saturated or unsaturated cyclic compounds and from aromatic compounds having in each case more than one trivalent nitrogen atom in a 4- to 10-membered, preferably 5- to 6-membered, heterocyclic ring. These compounds may be substituted both on the carbon atoms and on the nitrogen atoms. They may also be fused by optionally substituted benzene rings and/or cyclohexane rings to form polycyclic structures. Examples of such compounds are pyrazole, 3,5-dimethylpyrazole, imidazole, benzimidazole, N-methyl imidazole, dihydropyrazole, pyrazolidine, pyridazine, pyrimidine, pyrazine, 2,3-, 2,5- and 2,6-dimethylpyrazine, cinnoline, phthalazine, quinazoline, phenazine and piperazine. Especially cations derived from imidazole and the alkyl and phenyl derivatives thereof can be used.

[0105] Useful cations are also ions which contain two nitrogen atoms and are represented by the general formula (XII)

(XII)



in which

[0106] R^8, R^9, R^{10}, R^{11}, R^{12} are the same or different and are each hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is interrupted by one or more heteroatoms (oxygen, NH, NR' where R' is a C_1-C_{30}-alkyl radical which may contain double bonds), a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is interrupted by one or more functionalities, selected from the group of —O—C(O)—, —(O)C—O—, —NH—C(O)—, —(O)C—NH, —(CH_3)N—C(O)—, —(O)C—N(CH_3)—, —S(O_2)—O—, —O—S(O_2)—, —S(O_2)—NH—, —NH—S(O_2)—, —S(O_2)—N(CH_3)—, —N(CH_3)—S(O_2)—, a linear or branched aliphatic or cycloaliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is functionalized terminally with OH, OR', NH_2, N(H)R', N(R')$_2$ where R' is a C_1-C_{30}-alkyl radical which may contain double bonds, or a polyether of blockwise or random structure formed from —(R^5—O)$_n$—R^6,

where

[0107] R^5 is a hydrocarbon radical containing 2 to 4 carbon atoms,

[0108] n is 1 to 100 and

[0109] R^6 is hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms or a —C(O)—R^7 radical where

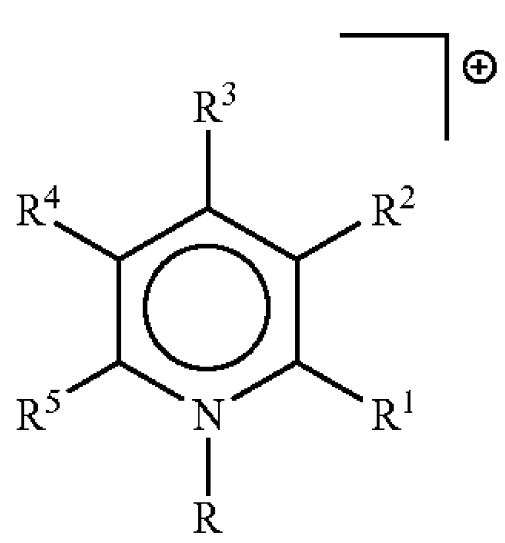
[0110] R^7 is a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms.

[0111] Very particularly preferred imidazolium ions (XII) include 1-(1-octyl)imidazolium, 1-(1-dodecyl)imidazolium, 1-(1-tetradecyl)imidazolium, 1-(1-hexadecyl)imidazolium, 1-(1-butyl)-3-methylimidazolium, 1-(1-butyl)-3-ethylimidazolium, 1-(1-hexyl)-3-methylimidazolium, 1-(1-hexyl)-3-ethylimidazolium, 1-(1-hexyl)-3-butylimidazolium, 1-(1-octyl)-3-methylimidazolium, 1-(1-octyl)-3-ethylimidazolium, 1-(1-octyl)-3-butylimidazolium, 1-(1-dodecyl)-3-methylimidazolium, 1-(1-dodecyl)-3-ethylimidazolium, 1-(1-dodecyl)-3-butylimidazolium, 1-(1-dodecyl)-3-octylimidazolium, 1-(1-tetradecyl)-3-methylimidazolium, 1-(1-tetradecyl)-3-ethylimidazolium, 1-(1-tetradecyl)-3-butylimidazolium, 1-(1-tetradecyl)-3-octylimidazolium, 1-(1-hexadecyl)-3-methylimidazolium, 1-(1-hexadecyl)-3-ethylimidazolium, 1-(1-hexadecyl)-3-butylimidazolium, 1-(1-hexadecyl)-3-octylimidazolium, 1-(1-butyl)-2,3-dimethylimidazolium, 1-(1-hexyl)-2,3-dimethylimidazolium, 1-(1-octyl)-2,3-di-methylimidazolium, 3-butylimidazolium, 1,4-dimethyl-3-octylimidazolium, 1,4,5-trimethyl-3-butylimidazolium and 1,4,5-trimethyl-3-octylimidazolium.

[0112] Useful cations additionally include ions which are especially formed from the aforementioned cations owing to dimerization, trimerization or polymerization to form dications, trications or polycations. These also include those dications, trications and polycations which possess a polymeric backbone, for example based on siloxanes, polyethers, polyesters, polyamides or polyacrylates, especially branched and hyperbranched polymers.

[0113] Additionally useful are conductivity additives in which the cation $[A]^+$ is a pyridinium ion (XIIIa) in which

(XIIIa)



one or more of the

[0114] R^1 to R^5 radicals are independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-Ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R^1 to R^5 radicals are each hydrogen or methyl or ethyl, R^3 is dimethylamino and the remaining R^1, R^2, R^4 and R^5 radicals are each hydrogen, all R^1 to R^5 radicals are hydrogen, R^2 is carboxyl or carboxamide and the remaining R^1, R^2, R^4 and R^5 radicals are each hydrogen, or R^1 and R^2 or R^2 and R^3 are 1,4-buta-1,3-dienylene and the remaining R^1, R^2, R^4 and R^5 radicals are each hydrogen,

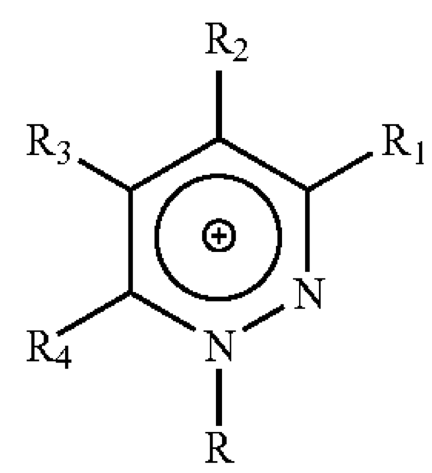
and especially one in which

[0115] R^1 to R^5 are each hydrogen, or one of the R^1 to R^5 radicals is methyl or ethyl and the remaining R^1 to R^5 radicals are each hydrogen.

[0116] Very particularly preferred pyridinium ions (XIIIa) include 1-(1-hexyl)pyridinium, 1-(1-octyl)pyridinium, 1-(1-hexyl)pyridinium, 1-(1-octyl)pyridinium, 1-(1-dodecyl)pyridinium, 1-(1-tetradecyl)pyridinium, 1-(1-hexadecyl)pyridinium, 1-(1-hexyl)-2-methylpyridinium, 1-(1-octyl)-2-methylpyridinium, 1-(1-dodecyl)-2-methylpyridinium, 1-(1-tetradecyl)-2-methylpyridinium, 1-(1-hexadecyl)-2-methylpyridinium, 1-(1-hexyl)-2-ethylpyridinium, 1-(1-octyl)-2-ethylpyridinium, 1-(1-dodecyl)-2-ethylpyridinium, 1-(1-tetradecyl)-2-ethylpyridinium, 1-(1-hexadecyl)-2-ethylpyridinium, 1-(1-hexyl)-2-methyl-3-ethylpyridinium and 1-(1-octyl)-2-methyl-3-ethylpyridinium, 1-(1-dodecyl)-2-methyl-3-ethylpyridinium, 1-(1-tetradecyl)-2-methyl-3-ethylpyridinium and 1-(1-hexadecyl)-2-methyl-3-ethylpyridinium.

[0117] Additionally useful are conductivity additives in which the cation $[A]^+$ is a pyridazinium ion (XIIIb)

(XIIIb)

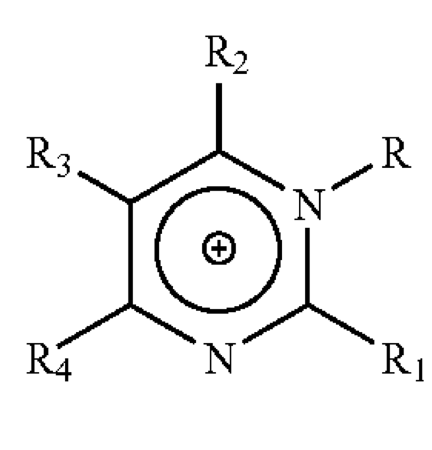


in which

[0118] R_1 to R_4 are each hydrogen, or one or more of the R_1 to R_4 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0119] Very particular preference is given to conductivity additives in which the cation $[A]^+$ is a pyrimidinium ion (XIIIc)

(XIIIc)

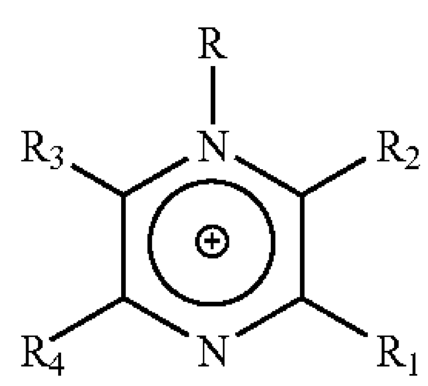


in which

[0120] R_1 is hydrogen, methyl or ethyl and R_2 to R_4 are each independently hydrogen or methyl, or one or more of the R_1 to R_4 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0121] Other useful conductivity additives are those in which the cation $[A]^+$ is a pyrazinium ion (XIIId)

(XIIId)



in which

one or more of the

[0122] R_1 to R_4 radicals are each independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl,

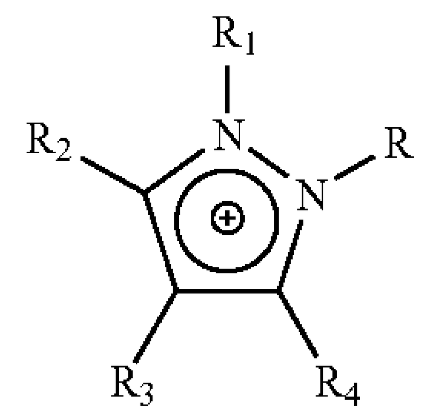
[0123] R_1 is hydrogen, methyl or ethyl, R_2 and R_4 are each methyl and R_3 is hydrogen,

[0124] R_1 to R_4 are each methyl, or

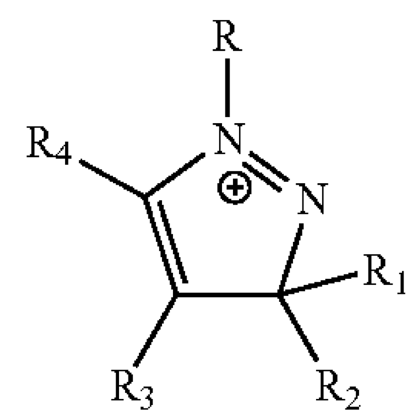
[0125] R_1 to R_4 are each methyl or hydrogen.

[0126] Further useful conductivity additives are those in which the cation $[A]^+$ is a pyrazolium ion (XIIIf), (XIIIg) or (XIIIg') in which

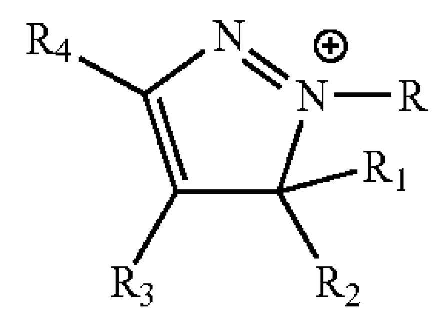
(XIIIf)



(XIIIg)



(XIIIg')

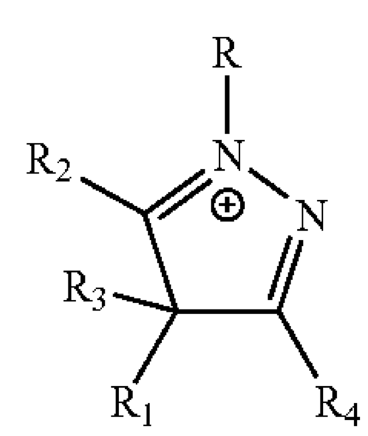


[0127] R_1 is hydrogen, methyl or ethyl and

[0128] R_2 to R_4 are each independently hydrogen or methyl, one or more of the R_1 to R_4 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0129] Further useful conductivity additives are those in which the cation $[A]^+$ is a pyrazolium ion (XIIIh)

(XIIIh)



in which

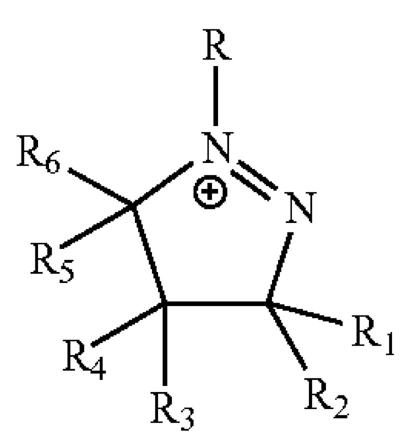
one or more of the

[0130] R_1 to R_4 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-

dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0131] Additional useful conductivity additives are those in which the cation $[A]^+$ is a 1-pyrazolinium ion (XIIIi)

(XIIIi)



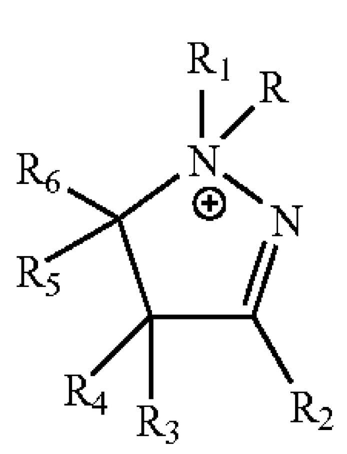
in which

one or more of the

[0132] R_1 to R_4 radicals are independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0133] Further useful conductivity additives are those in which the cation $[A]^{+\ is\ a}$ 2-pyrazolinium ion (XIIIj)

(XIIIj)



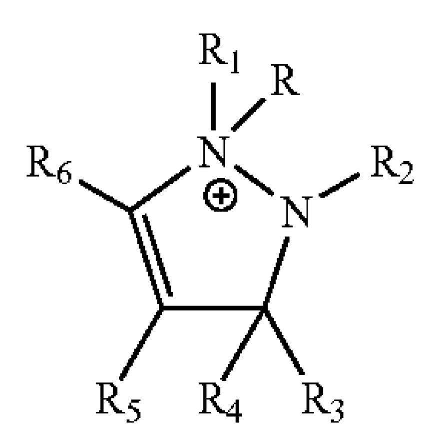
in which

one or more of the

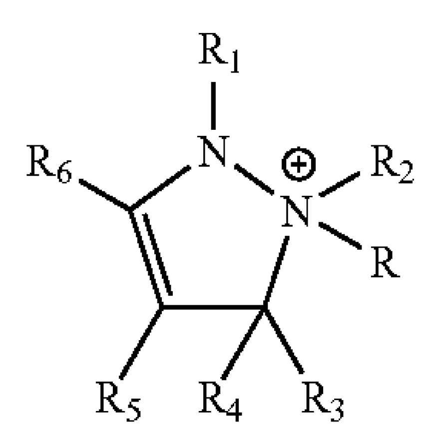
[0134] R_1 to R_4 radicals are independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0135] Useful conductivity additives are also those in which the cation $[A]^+$ is a 3-pyrazolinium ion (XIIIk) or (XIIIk')

(XIIIk)



(XIIIk')



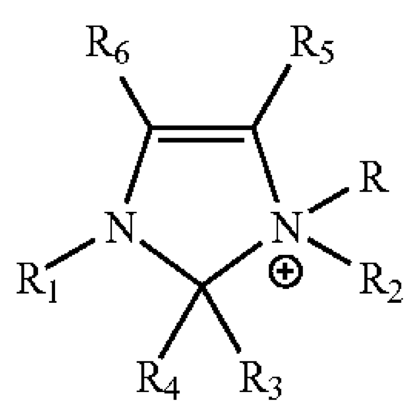
in which

one or more of the

[0136] R_1 to R_4 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0137] Additionally useful conductivity additives are those in which the cation $[A]^+$ is an imidazolinium ion (XIIIl)

(XIIIl)



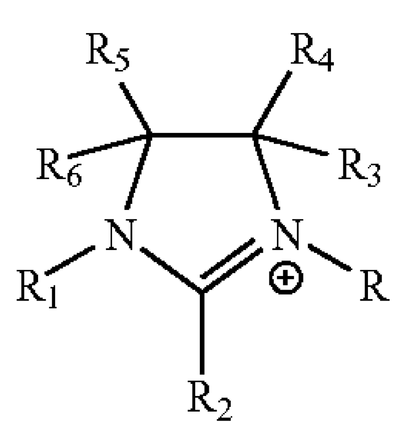
in which

[0138] R is H or methyl,

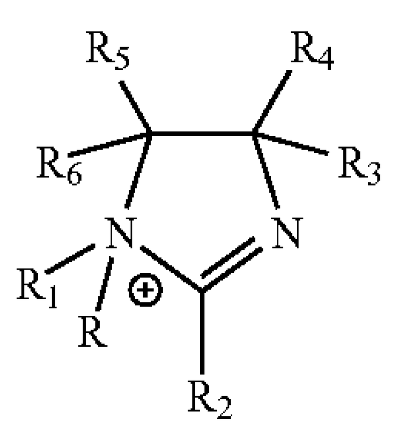
[0139] R_1 and R_2 are each independently hydrogen, methyl or ethyl, or a linear saturated or unsaturated acyl radical having 14 to 22 and preferably 16 to 18 carbon atoms, and R_3 to R_6 are each independently hydrogen, a linear saturated alkyl radical which has 1 to 4 carbon atoms and optionally contains OH groups, preferably methyl or a fatty acid radical; especially preferably, R_1 and R_2 are each fatty acid acyl radicals, and R or R_2 and R_3 are each fatty acid acyl radicals. Of particular significance are the substances of the formula (XIIIm).
In some cases, the literature also introduces erroneous formulae for these (analogous to formula XIIIm' or XIIIl).

[0140] Other useful conductivity additives are those in which the cation $[A]^+$ is an imidazolinium ion (XIIIm) or (XIIIm')

(XIIIm)



(XIIIm')



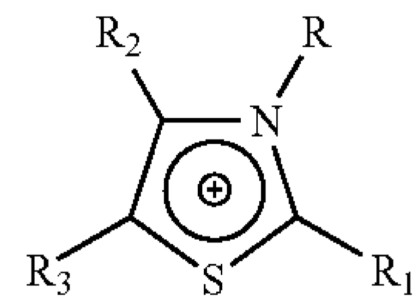
in which

[0141] R is H or methyl,

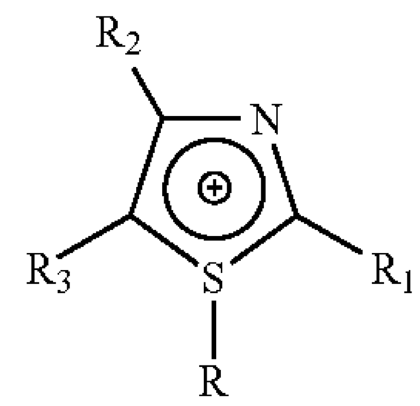
[0142] R_1 and R_2 are each independently hydrogen, methyl or ethyl, or a linear saturated or unsaturated acyl radical having 14 to 22 and preferably 16 to 18 carbon atoms, and R_3 to R_6 are each independently hydrogen, a linear saturated alkyl radical which has 1 to 4 carbon atoms and may contain OH groups, preferably methyl or a fatty acid radical; especially preferably R_1 and R_2 are each fatty acid acyl radicals, and R or R_2 and R_3 are each fatty acid acyl radicals. Of particular significance are the substances of the formula (XIIIm). In some cases, the literature also introduces erroneous formulae for these (analogous to formula XIIIm' or XIIIl).

[0143] Additional useful conductivity additives are those in which the cation $[A]^+$ is a thiazolium ion (XIIIo) or (XIIIo'), or else is an oxazolium ion (XIIIp),

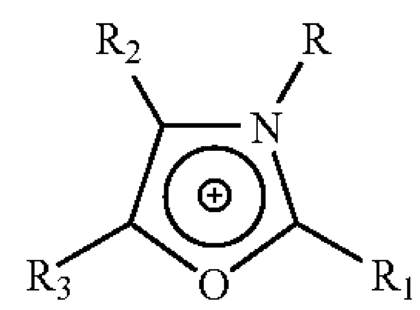
(XIIIo)



(XIIIo')



(XIIIp)



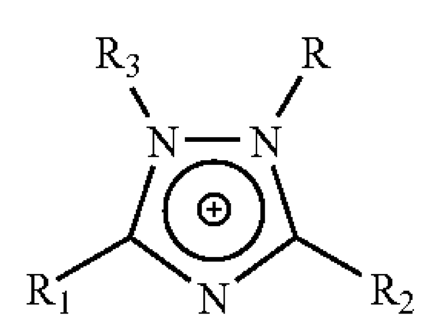
in which

one or more of the

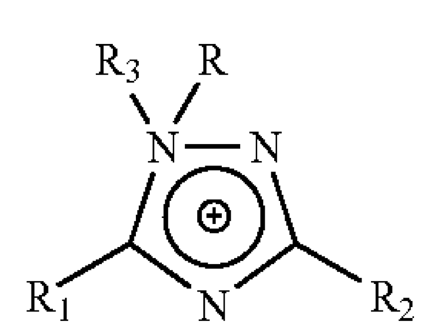
[0144] R_1 to R_3 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0145] Also useful are conductivity additives in which the cation $[A]^+$ is a 1,2,4-triazolium ion (XIIIq), (XIIIq') or (XIIIq")

(XIIIq)

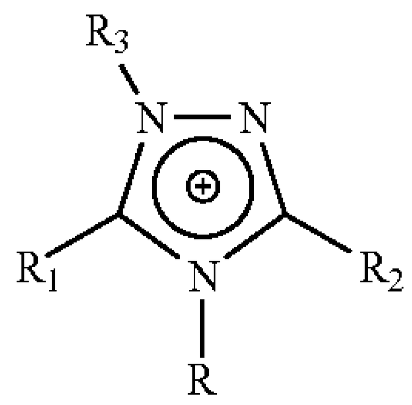


(XIIIq')



-continued

(XIIIq″)



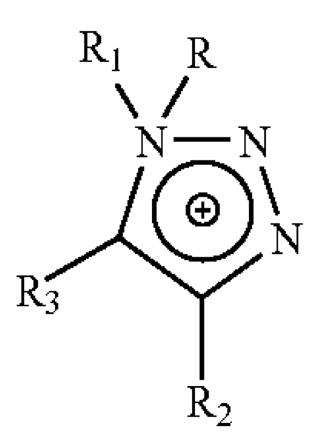
in which

one or more of the

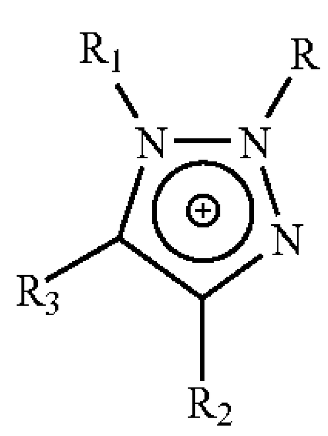
[0146] R_1 to R_3 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl.

[0147] Further useful conductivity additives are those in which the cation $[A]^+$ is a 1,2,3-triazolium ion (XIIIr), (XIIIr') or (XIIIr")

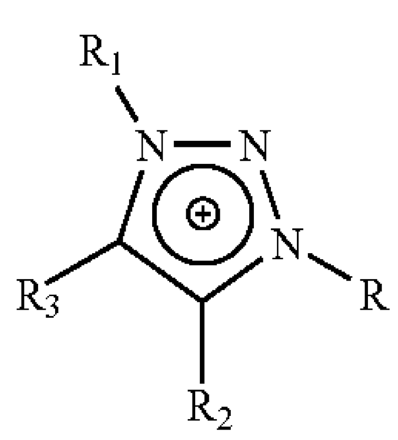
(XIIIr)



(XIIIr′)



(XIIIr″)



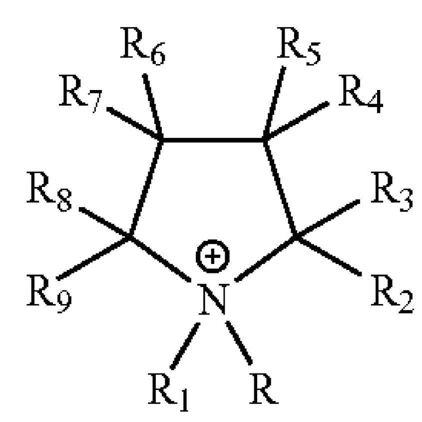
in which

[0148] R_1 is hydrogen, methyl or ethyl and

[0149] R_2 and R_3 are each independently hydrogen or methyl, or R_2 and R_3 together are 1,4-buta-1,3-dienylene, one or more of the R_1 to R_3 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_3 radicals are each hydrogen or methyl or ethyl.

[0150] Additionally useful conductivity additives are those in which the cation $[A]^+$ is a pyrrolidinium ion (XIIIs)

(XIIIs)



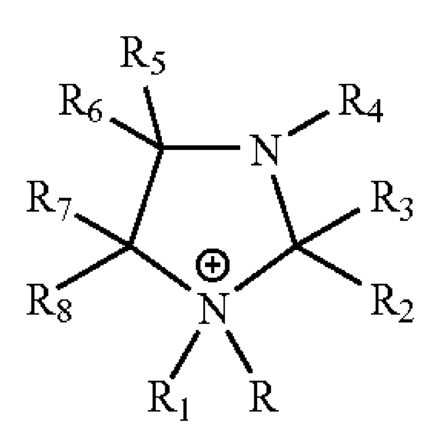
in which

[0151] R_1 is hydrogen, methyl, ethyl or phenyl and

[0152] R_2 to R_9 are each independently hydrogen or methyl, one or more of the R_1 to R_3 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_3 radicals are each hydrogen or methyl or ethyl.

[0153] Additional useful conductivity additives are those in which the cation $[A]^+$ is an imidazolidinium ion (XIIIt)

(XIIIt)



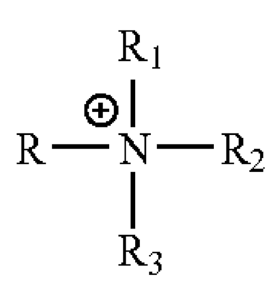
in which

one or more of the

[0154] R_1 to R_8 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining radicals R_1 to R_8 are each hydrogen or methyl or ethyl.

[0155] Also useful are conductivity additives in which the cation $[A]^+$ is an ammonium ion (IV)

(IV)



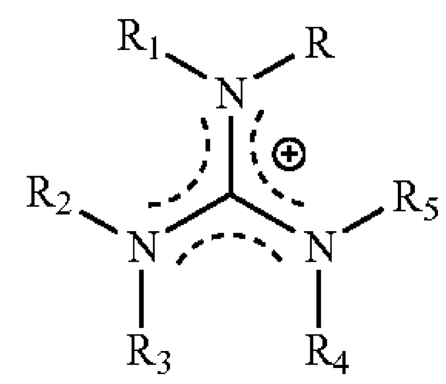
in which

one or more of the

[0156] R_1 to R_3 radicals are independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl; or R_1 to R_3 are each independently hydrogen or C_1-C_{18}-alkyl and R_4 is 2-hydroxyethyl; or R_1 and R_2 together are 1,5-pentylene or 3-oxa-1,5-pentylene and R_3 is alkyl, 2-hydroxyethyl or 2-cyanoethyl.

[0157] Additionally useful conductivity additives are those in which the cation $[A]^+$ is a guanidinium ion (IVv)

(IVv)



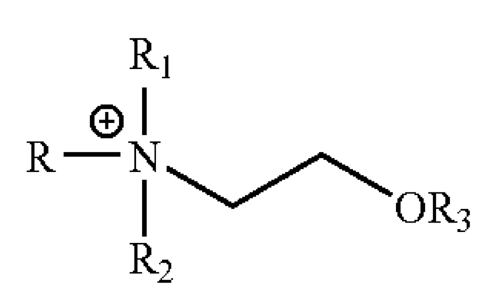
in which

one or more of the

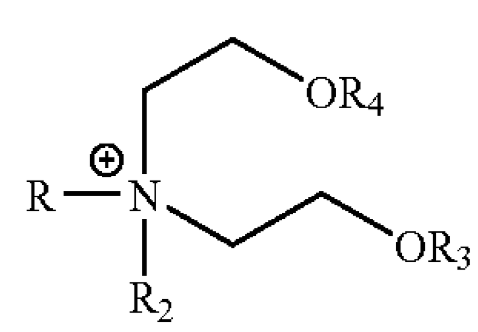
[0158] R_1 to R_5 radicals is independently 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, and the remaining R_1 to R_4 radicals are each hydrogen or methyl or ethyl; R_1 to R_5 are each independently C_1-C_{18}-alkyl; or R_1 to R_5 are independently hydrogen or C_1-C_{18}-alkyl or 2-hydroxyethyl.

[0159] Useful conductivity additives are also those in which the cation $[A]^+$ is a derivative of an ethanolamine, for example a cholinium ion (XIIIw), or of a diethanolamine (XIIIw'), or of a triethanolamine (XIIIw"),

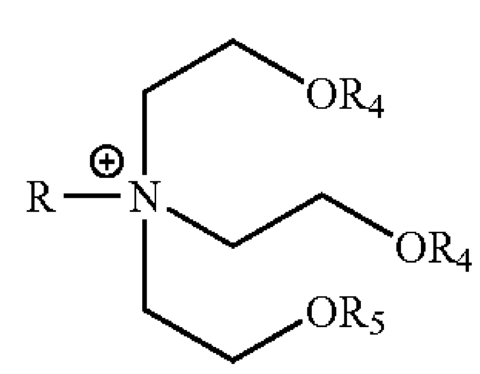
(XIIIw)



(XIIIw¢)



(XIIIw^{2})



[0160] R_1 and R_2 are each independently methyl, ethyl, 1-butyl or 1-octyl and R_3 is hydrogen, methyl, ethyl, acetyl, —SO_2OH or —$PO(OH)_2$; R_1 is methyl, ethyl, 1-butyl or 1-octyl, R_2 is a —CH_2—CH_2—OR_4— group and R_3 and R_4 are each independently hydrogen, methyl, ethyl, acetyl, —SO_2OH or —$PO(OH)_2$; or R_1 is a —CH_2—CH_2—

OR_4— group, R_2 is a —CH_2—CH_2—OR_5— group, and R_3 to R_5 are each independently hydrogen, methyl, ethyl, acetyl, —SO_2OH or —$PO(OH)_2$; R_1 is methyl, ethyl, 1-butyl, 1-octyl, acetyl; —SO_2OH, or —$PO(OH)_2$, and R_3 to R_5 are each independently hydrogen, methyl, ethyl, acetyl, —SO_2OH, —$PO(OH)_2$, or —$(C_nH_{2n}O)_mR_1$ where n=1 to 5 and m=1 to 100.

[0161] Preference is also given to compounds in which R, R_1 and R_2 are each alkyl groups having 1 to 4 carbon atoms, more preferably each a methyl group, and R_3 and/or R_4 are saturated or unsaturated fatty acid or acyl radicals having 8 to 22 carbon atoms, preferably 12 to 18 carbon atoms. It is also possible for mixtures of the acyl or fatty acid radicals (especially, for example, in naturally occurring ratios) to be present.

[0162] Very particular preference is given to the formula (XIIIw") where R, R_1, R_2 are each an alkyl radical having 1 to 4 carbon atoms, especially methyl groups, and R_3 is a fatty acid radical and R_4 and R_5 are each a fatty acid radical or hydrogen.

[0163] Useful conductivity additives are those in which the cation $[A]^+$ is a phosphonium ion (VI) in which R_1 to R_3 are each independently C_1-C_{18}-alkyl, especially butyl, isobutyl, 1-hexyl or 1-octyl.

[0164] Particular preference is given to the tributyloctylphosphonium, triisobutyloctylphosphonium, trioctylethylphosphonium, trioctylbutylphosphonium, tributylhexylphosphonium, tetraoctylphosphonium, tributyltetradecylphosphonium, trihexyloctylphosphonium, trihexyltetradecylphosphonium, and the tetratetradecylphosphonium cation.

[0165] The conductivity additives used in accordance with the invention consist of at least one of the aforementioned cations combined with in each case at least one anion. Useful anions are in principle all anions which, in conjunction with the cation, lead to a liquid which forms a clear solution in the nonaqueous hydraulic oil.

[0166] The anion $[Y]^{n-}$ of the conductivity additives is, for example, selected from:

[0167] the group of the halides and halogenated compounds of the formulae: F^- Cl^-, Br^-, I^-, BF_4^-, PF_6^-, $AlCl_4^-$, $Al_2Cl_7^-$, $Al_3Cl_{10}^-$, $AlBr_4^-$, $FeCl_4^-$, BCl_4^- SbF_6^-, AsF_6^-, $ZnCl_3^-$, $SnCl_3^-$, $CuCl_2^-$, $CF_3SO_3^-$, $(CF_3SO_3)_2N^-$, $CF_3CO_2^-$, $CCl_3CO_2^-$, CN^-, SCN^-, OCN^-, NO_2^-, NO_3^-, $N(CN)^-$;

[0168] the group of the sulphates, sulphites and sulphonates of the general formulae: SO_4^{2-}, HSO_4^-, $SO_3^{2''}$, HSO_3^-, $R^aOSO_3^-$, $R^aSO_3^-$;

[0169] the group of the phosphates of the general formulae: PO_4^{3-}, HPO_4^{2-}, H_2PO^{4-}, $R^aPO_4^{2-}$, HR^aPO_{4-}, $R^aR^bPO_{4-}$; **p1** the group of the phosphonates and phosphinates of the general formula: $R^aHPO_3^-$, $R^aR^bPO_2^-$, $R^aR^bPO_3^-$;

[0170] the group of the phosphites of the general formulae: PO_3^{3-}, HPO_3^{2-}, $H_2PO_3^-$, $R^aPO_3^{2-}$, $R^aHPO_3^-$, $R^aR^bPO_3^-$;

[0171] the group of the phosphonites and phosphinites of the general formula: $R^aR^bPO_2^-$, $R^aHPO_2^-$, $R^aR^bPO^-$, R^aHPO^-;

[0172] the group of the carboxylates of the general formulae: R^aCOO^-;

[0173] the group of the borates of the general formulae: BO_3^{3-}, HBO_3^{2-}, $H_2BO_3^-$, $R^aR^bBO_3^-$, $R^aHBO_3^-$, $R^aBO_3^{2-}$, $B(OR^a)(OR^b)(OR^c)(OR^d)^-$, $B(HSO_4)^-$, $B(R^aSO_4)^-$;

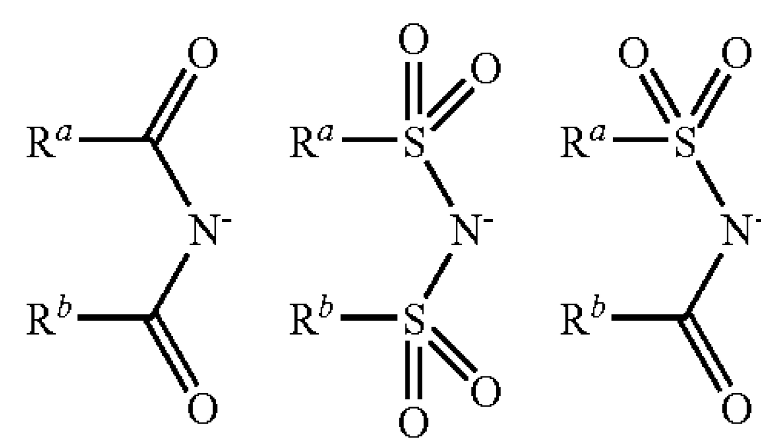
[0174] the group of the boronates of the general formulae: $R^aBO_2^{2-}$, $R^aR^bBO^-$;

[0175] the group of the carbonates and carbonic esters of the general formulae: HCO_3^-, CO_3^{2-}, $R^aCO_3^-$;

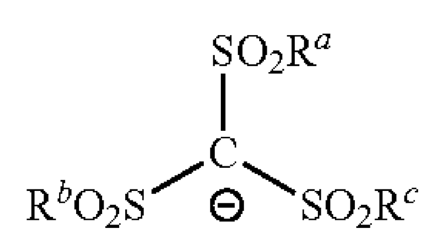
[0176] the group of the silicates and silicic esters of the general formulae: SiO_4^{4-}, $HSiO_4^{3-}$, $H_2SiO_4^{2-}$, $H_3SiO_4^-$, $R^aSiO_4^{3-}$, $R^aR^bSiO_4{}^{2}$–, $R^aR^bR^cSiO_4^-$, HR^a-SiO_4^{2-}, $H_2R^aSiO_4^-$, $HR^aR^bSiO_4^-$;

[0177] the group of the alkyl- and arylsilane salts of the general formulae: $R^aSiO_3^{3-}$, $R^aR^bSiO_2^{2-}$, $R^aR^bR^cSiO^-$, $R^aR^bR^cSiO_3^-$, $R^aR^bR^cSiO_2^-$, $R^aR^bSiO_3^{2-}$;

[0178] the group of the carboximides, bis(sulphonyl)imides and sulphonylimides of the general formulae:



[0179] the group of the methides of the general formula:



[0180] the group of the alkoxides and aryl oxides of the general formula: R^aO^-;

[0181] the group of the halometallates of the general formula $[M_rHal_t]^{s-}$ where M is a metal and Hal is fluorine, chlorine, bromine or iodine, r and t are positive integers and specify the stoichiometry of the complex and s is a positive integer and specifies the charge of the complex;

[0182] the group of the sulphides, hydrogensulphides, polysulphides, hydrogenpolysulphides and thiolates of the general formulae:

[0183] S^{2-}, HS^-, $[S_v]^{2-}$, $[HS_v]^-$, $[R^aS]^-$, where v is a positive integer of 2 to 10;

[0184] the group of the complex metal ions such as $Fe(CN)_6^{3-}$, $Fe(CN)_6^{4-}$, MnO_4^-, $Fe(CO)_4^-$.

[0185] In these formulae, R^a, R^b, R^c and R^d are each independently

[0186] hydrogen;

[0187] C_1-C_{30}-alkyl and the aryl-, heteroaryl-, cycloalkyl-, halogen-, hydroxyl-, amino-, carboxyl-, formyl-, —O—, —CO—, —CO—O— or —CO—N<-substituted components thereof, for example methyl, ethyl, 1-propyl, 2-propyl, 1-butyl, 2-butyl, 2-methyl-1-propyl (isobutyl), 2-methyl-2-propyl (tert-butyl), 1-pentyl, 2-pentyl, 3-pentyl, 2-methyl-1-butyl, 3-methyl-1-butyl, 2-methyl-2-butyl, 3-methyl-2-butyl, 2,2-dimethyl-1-propyl, 1-hexyl, 2-hexyl, 3-hexyl, 2-methyl-1-pentyl, 3-methyl-1-pentyl, 4-methyl-1-pentyl, 2-methyl-2-pentyl, 3-methyl-2-pentyl, 4-methyl-2-pentyl, 2-methyl-3-pentyl, 3-methyl-3-pentyl, 2,2-dimethyl-1-butyl, 2,3-dimethyl-1-butyl, 3,3-dimethyl-1-butyl, 2-ethyl-1-butyl, 2,3-dimethyl-2-butyl, 3,3-dimethyl-2-butyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, phenylmethyl (benzyl), diphenylmethyl, triphenylmethyl, 2-phenylethyl, 3-phenylpropyl, cyclopentylmethyl, 2-cyclopentylethyl, 3-cyclopentylpropyl, cyclohexylmethyl, 2-cyclohexylethyl, 3-cyclohexylpropyl, methoxy, ethoxy, formyl, acetyl or $C_qF_{2(q-a)+(1-b)}H_{2a+b}$ where q<30, 0≦a≦q and b=0 or 1 (for example CF_3, C_2F_5, $CH_2CH_2—C_{(q-2)}F_{2(q-2)+1}$, C_6F_{13}, C_8F_{17}, $C_{10}F_{21}$, $C_{12}F_{25}$);

[0188] C_3-C_{12}-cycloalkyl and the aryl-, heteroaryl-, cycloalkyl-, halogen-, hydroxyl-, amino-, carboxyl-, formyl-, —O—, —CO— or —CO—O-substituted components thereof, for example cyclopentyl, 2-methyl-1-cyclopentyl, 3-methyl-1-cyclopentyl, cyclohexyl, 2-methyl-1-cyclohexyl, 3-methyl-1-cyclohexyl, 4-methyl-1-cyclohexyl or $C_qF_{2(q-a)-(1-b)}H_{2a-b}$ where q≦30, 0≦a≦q and b=0 or 1;

[0189] C_2-C_{30}-alkenyl and the aryl-, heteroaryl-, cycloalkyl-, halogen-, hydroxyl-, amino-, carboxyl-, formyl-, —O—, —CO— or —CO—O-substituted components thereof, for example 2-propenyl, 3-butenyl, cis-2-butenyl, trans-2-butenyl or $C_1F_{2(q-a)-(1-b)}H_{2a-b}$ where q≦30, 0≦a≦q and b=0 or 1;

[0190] C_3-C_{12}-cycloalkenyl and the aryl-, heteroaryl-, cycloalkyl-, halogen-, hydroxyl-, amino-, carboxyl-, formyl-, —O—, —CO— or —CO—O-substituted components thereof, for example 3-cyclopentenyl, 2-cyclohexenyl, 3-cyclohexenyl, 2,5-cyclohexadienyl or $C_qF_{2(q-a)-3(1-b)}H_{2a-3b}$ where q≦30, 0≦a≦q and b=0 or 1;

[0191] aryl or heteroaryl having from 2 to 30 carbon atoms and the alkyl-, aryl-, heteroaryl-, cycloalkyl-, halogen-, hydroxyl-, amino-, carboxyl-, formyl-, —O—, —CO— or —CO—O-substituted components thereof, for example phenyl, 2-methylphenyl (2-tolyl), 3-methylphenyl (3-tolyl), 4-methylphenyl, 2-ethylphenyl, 3-ethylphenyl, 4-ethylphenyl, 2,3-dimethylphenyl, 2,4-dimethylphenyl, 2,5-dimethylphenyl, 2,6-dimethylphenyl, 3,4-dimethylphenyl, 3,5-dimethylphenyl, 4-phenylphenyl, 1-naphthyl, 2-naphthyl, 1-pyrrolyl, 2-pyrrolyl, 3-pyrrolyl, 2-pyridinyl, 3-pyridinyl, 4-pyridinyl or $C_6F_{(5-a)}H_a$ where 0≦a≦5; or

[0192] two radicals are an unsaturated, saturated or aromatic ring which is optionally substituted by functional groups, aryl, alkyl, aryloxy, alkyloxy, halogen, heteroatoms and/or heterocycles and optionally interrupted by one or more oxygen and/or sulphur atoms and/or one or more substituted or unsubstituted imino groups.

[0193] Useful anions are, for example, chloride; bromide; iodide; thiocyanate; hexafluorophosphate; trifluoromethanesulphonate; methanesulphonate; formate; acetate; glycolate; lactate; oxalate; citrate; malate; maleate; tartrate; mandelate; nitrate; nitrite; trifluoroacetate; sulphate; hydrogensulphate; methylsulphate; ethylsulphate; 1-propylsulphate; 1-butylsulphate; 1-hexylsulphate; 1-octylsulphate; phosphate; dihydrogenphosphate; hydrogenphosphate; C_1-C_4-dialkylphosphates; propionate; tetrachloroaluminate; $Al_2Cl_7^-$; chlorozincate; chloroferrate; bis(trifluoromethylsulphonyl)imide; bis(pentafluoroethylsulphonyl)imide; bis(methylsulphonyl)imide; bis(p-tolylsulphonyl)imide; tris(trifluoromethylsulphonyl)methide; bis(pentafluoroethylsulphonyl)methide; p-tolylsulphonate; tetracarbonylcobaltate; dimethyleneglycolmonomethylethersulphate; oleate; stearate; acrylate; methacrylate; hydrogencitrate; vinylphosphonate; bis(pentafluoroethyl)phosphinate; borates such as bis[salicylato(2-)]borate, bis[oxalato(2-)]borate, bis[1,2-benzenediolato(2-)-O,O']borate, tetracyanoborate, tetrafluoroborate; dicyanamide; tris(pentafluoroethyl)trifluorophosphate; tris(heptafluoropropyl)trifluorophosphate, cyclic arylphosphates such as pyrocatecholphosphate $(C_6H_4O_2)P(O)O^-$ and chlorocobaltate.

[0194] Preferred anions are selected from the group of—without any claim to completeness—the halides, bis(perfluoroalkylsulphonyl)amides and -imides, for example bis(trifluoromethylylsulphonyl)imide, alkyl- and aryltosylates, perfluoroalkyltosylates, nitrate, sulphate, hydrogensulphate, alkyl- and arylsulphates, polyethersulphates and -sulphonates, perfluoroalkylsulphates, sulphonate, alkyl- and arylsulphonates, perfluorinated alkyl- and arylsulphonates, alkyl- and arylcarboxylates, perfluoroalkylcarboxylates, perchlorate, tetrachloroaluminate, saccharinate. Also preferred are dicyanamide, thiocyanate, isothiocyanate, tetraphenylborate, tetrakis(pentafluorophenyl)borate, tetrafluoroborate, hexafluorophosphate, polyetherphosphates, dialkylphosphates, isostearates, alkylbenzylsulphonates, bis(alkyl)phosphinates, phosphatides, decanoates and phosphate.

[0195] Very particularly preferred anions are: chloride, bromide, hydrogensulphate, tetrachloroaluminate, thiocyanate, methylsulphate, ethyl sulphate, methanesulphonate, formate, acetate, glycolate, lactate, dimethylphosphate, diethylphosphate, p-tolylsulphonate, tetrafluoroborate, hexafluorophosphate, diethylphosphate, isostearate, dodecylbenzylsulphonate, bis(2,4,4-trimethylpentyl)phosphinate, phosphatide, decanoate, and tosylate.

[0196] According to the invention, in a further preferred embodiment, those conductivity additives or mixtures thereof are used which comprise a combination of a 1,3-dialkylimidazolium, 1,2,3-trialkylimidazolium, 1,3-dialkylimidazolinium and 1,2,3-trialkylimidazolinium cation with an anion selected from the group of the halides, bis(trifluoromethylylsulphonyl)imide, perfluoroalkyltosylates, alkylsulphates and -sulphonates, perfluorinated alkylsulphonates and -sulphates, perfluoroalkylcarboxylates, perchlorate, dicyanamide, thiocyanate, isothiocyanate, tetraphenylborate, tetrakis(pentafluorophenyl)borate, tetrafluoroborate, hexafluorophosphate, acetate, glycolate, lactate.

[0197] The mixing ratios of hydraulic oil and conductivity additive are between 100 000:1 and 10:1, preferably between 10 000:1 and 20:1, more preferably 5000:1 and 25:1, most preferably between 1000:1 and 50:1 (all ratios are % by weight)

[0198] The composition composed of hydraulic oil and conductivity additive may comprise further customary additives. These include, for example, viscosity index improvers, defoamers, pour point depressants, extreme pressure additives, anti-wear additives, corrosion inhibitors, friction modifier additives, demulsifying additives, antioxidants or detergents.

[0199] The minimum conductivity required is, for example, for applications in cold store hydraulic fluids, at least 1000 pS/m. The desired conductivity is significantly higher, but cannot be achieved in a lasting manner by the conductivity improvers known to date, since the volatile solvent evaporates and there are associated precipitations of salts or other substances. In any case, no upper limit in the conductivity is needed, since the desired action, the tendency to static discharge, decreases ever further with rising conductivity. The inventive ionic conductivity additives with organic radicals in the ions do not have these disadvantages. In other fields of use, the minimum conductivities and desired conductivities may differ, and maximum conductivities may also be relevant.

[0200] The inventive conductivity additives and the use thereof will be described below by way of example, without any possibility that the invention can be considered as restricted to these illustrative embodiments. Where ranges, general formulae or compound classes are specified hereinafter, these shall encompass not just the corresponding ranges or groups of compounds which are mentioned explicitly, but also all subranges and subgroups of compounds which can be obtained by selection of individual values (ranges) or compounds.

WORKING EXAMPLES

[0201] The present invention is described by way of example in the examples adduced below, without any possibility that the invention, whose scope of protection is evident from the overall description and the claims, can be read as being restricted to the embodiments specified in the examples.

[0202] Experimental Procedure:

[0203] 100 g of Kühlhaus 50468783 hydraulic oil (from Jungheinrich) were initially charged and in each case 1 g or 5 g of the conductivity additive were weighed in. The sample was stirred until it was homogeneous and then the electrical conductivity at rest and the turbidity value FNU (formazine nephelometric units) were determined.

[0204] The conductivity at rest was determined to DIN 51412 part 1 (2005-06).

[0205] To determine the opacity, a NEPHLA LPG239 laboratory turbidity photometer (manufacturer: Dr. Bruno Lange GmbH, Dusseldorf) was used. The standard used was DIN standard formazine.

[0206] The turbidity value was used to quantitatively detect the qualitative phenomenon of turbidity. The aim of the turbidity measurement is to obtain statements about the content of scattering particles. FNU (also FTU: formazine turbidity unit) is a unit of measurement of turbidity used according to standard ISO 7027, which was measured with scattered light. In order to make scattered light measurements comparable, these instruments were calibrated with a suspension, for example formazine, in order to be able to reference the measurements to a common standard.

[0207] Procedure of the Turbidity Measurement:

[0208] The measurement cuvette was filled with the particular sample up to the black ring and conditioned to the appropriate temperature (in each case 0° C. and room temperature). Thereafter, the cuvette was placed into the apparatus. At least 3 measurements were carried out in different cuvette positions, and the mean was calculated. To prevent condensation of atmospheric moisture, the conditions employed were 0° C. in protective gas atmosphere.

TABLE 1

Turbidity and conductivity at rest at room temperature of additized hydraulic oil (Kühlhaus 50468783 hydraulic oil (from Jungheinrich))

	Conductivity at rest pS/m	Turbidity value FNU
blank value, pure hydraulic oil	50	0.24
1% addition of trihexyltetradecyl-phosphonium bis(2,4,4-trimethylpentyl)phosphinate	38 520	2.7
5% addition of trihexyltetradecyl-phosphonium bis(2,4,4-trimethylpentyl)phosphinate	210 000	
1% addition of TEGO ® IL ZTO	50 000	0.24
5% addition of TEGO ® IL ZTO	281 700	0.24

TEGO ® IL ZTO, a fatty acid amine polyglycol ether diester quat, CAS No. 217813-30-4, but also with TEGO ® IL ZTI, a talloylamine polyglycol ether diester quat, and with TEGO ® IL IM36, a 2-(C_{17} and C_{17}-unsaturated alkyl)-1-[2-(C_{18} and C_{18}-unsatd. amido)ethyl]-4,5-dihydro-1-methylimidazolium methylsulphate and trihexyltetradecyl-phosphonium bis(2,4,4-trimethylpentyl)phosphinate, show high conductivities coupled with very low turbidity values achieved (TEGO ® is a trademark of Evonik Goldschmidt GmbH.

[0209] Even at temperatures around freezing point (0° C.), the organic conductivity improver remains in solution and hence the high relative conductivity is maintained. These conductivities are significantly higher compared to an inorganic conductive salt in maximum concentration (i.e. with sediment).

[0210] The results show clearly that the inventive formulations can be equipped with a much higher proportion of conductivity additive compared to industrial solutions used to date. Higher absolute values for the conductivity are thus also achievable and establishable compared to the prior art.

[0211] Having thus described in detail various embodiments of the present invention, it is to be understood that the invention defined by the above paragraphs is not to be limited to particular details set forth in the above description as many apparent variations thereof are possible without departing from the spirit or scope of the present invention.

1. Composition comprising nonaqueous hydraulic oils or lubricants and one or more conductivity additives which form clear solutions or mixtures with the hydraulic oil and optionally further customary additives.

2. Composition according to claim **1**, characterized in that the conductivity additive is liquid and of ionic structure and contains ions with organic radicals.

3. Composition according to claim **1**, characterized in that the ionic conductivity additive comprises at least one cation and/or one anion with organic radicals.

4. Composition according to claim **1**, characterized in that the ionic conductivity additive in the cation and/or anion contains at least one organic radical with at least 8 carbon atoms, where the sum of the carbon atoms of all radicals is at least 14.

5. Composition according to claim **1**, comprising, as a conductivity additive, a compound of the formulae (I), (II) or (III)

$$[A]_n^+[Y]^{n-} \quad (I)$$

in which

n is 1, 2, 3 or 4,

$[A]^+$ is a quaternary ammonium cation, an oxonium cation, a sulphonium cation or a phosphonium cation and

$[Y]^{n-}$ is an n-valent anion and/or mixed salts of the general formulae (II)

$$[A^1]^+[A^2]^+[Y]^{2-} \quad \text{(IIa),}$$

$$[A^1]^+[A^2]^+[A^3]^+[Y]^{3-} \quad \text{(IIb), or}$$

$$[A^1]^+[A^2]^+[A^3]^+[A^4]^{+[Y]4-} \quad \text{(IIc),}$$

where

$[A^1]^+$, $[A^2]^+$ $[A^3]^+$ and $[A^4]^+$ are each independently selected from the groups specified for $[A]^+$,

$[Y]^{n-}$ is as defined for formula (I) and/or

mixed salts of the general formulae (III)

$$[A^1]^+[A^2]^+[A^3]^+[M^1]^+[Y]^{4-} \quad \text{(IIIa),}$$

$$[A^1]^+[A^2]^+[M^1]^+[M^2]^+[Y]^{4-} \quad \text{(IIIb),}$$

$$[A^1]^+[M^1]^+[M^2]^+[M^3]^+[Y]^{4-} \quad \text{(IIIc),}$$

$$[A^1]^+[A^2]^+[M^1]^+[Y]^{3-} \quad \text{(IIId),}$$

$$[A^1]^+[M^1]^+[M^2]^+[Y]^{3-} \quad \text{(IIIe),}$$

$$[A^1]^+[M^1]^+[Y]^{2-} \quad \text{(IIIf),}$$

$$[A^1]^+[A^2]+[M^4]^{2+}[Y]^{4-} \quad \text{(IIIg),}$$

$$[A^1]^+[M^1]^+[M^4]^{2+}[Y]^{4-} \quad \text{(IIIh),}$$

$$[A^1]^+[M^5]^{3+}[Y]^{4-} \quad \text{(IIIi), or}$$

$$[A^1]^+[M^4]^{2+}[Y]^{3-} \quad \text{(IIIj),}$$

where

$[A^1]^+$, $[A^2]^+$ or $[A^3]^+$ are each independently selected from the groups specified for $[A]^+$,

$[Y]^{n-}$ is as defined for formula (I) and

$[M^1]^+$, $[M^2]^+$, $[M^3]^+$ are each monovalent metal cations,

$[M^4]^{2+}$ are divalent metal cations and

$[M^5]^{3+}$ are trivalent metal cations

or mixtures of all formulae (I) to (III).

6. Composition according to claim **5** comprising, as a cation $[A^+]$, structural elements of the general formulae (IV) to (VIII)

$$R^1R^2R^3R^4N^+ \quad \text{(IV)}$$

$$R^1R^2N^+{=}CR^3R^4 \quad \text{(V)}$$

$$R^1R^2R^3R^4P^+ \quad \text{(VI)}$$

$$R^1R^2P^+{=}CR^3R^4 \quad \text{(VII)}$$

$$R^1R^2R^3S^+ \quad \text{(VIII)}$$

in which

R^1, R^2, R^3, R^4 are the same or different and are each hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, with the proviso that at least one radical is not hydrogen, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms, a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more heteroatoms such as oxygen, NH, NR' where R' is a C_1-C_{30}-alkyl radical which may contain double bonds, a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more functionalities selected from the group of —O—C(O)—, —(O)C—O—, —NH—C(O)—, —(O)C—NH, —(CH_3)N—C(O)—, —(O)C—N(CH_3)—, —S(O_2)—O—, —O—S(O_2)—, —S(O_2)—NH—, —NH—S(O_2)—, —S(O_2)—N(CH_3)—, —N(CH_3)—S(O_2)—, a linear or branched aliphatic or cycloaliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is functionalized terminally with OH, OR', NH_2, N(H)R', $N(R')_2$ in which R' is a C_1-C_{30}-alkyl radical which may contain double bonds, or a polyether of blockwise or random construction according to $—(R^5—O)_n—R^6$,

where

R^5 is a linear or branched hydrocarbon radical containing 2 to 4 carbon atoms,

n is 1 to 100 and

R^6 is hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms or a $—C(O)—R^7$ radical where

R^7 is a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms.

7. Composition according to claim **6**, characterized in that the metal cations $[M^1]^+$, $[M^2]^+$, $[M^3]^+$, $[M^4]^{2+}$ and $[M^5]^{3+}$ are selected from the metal cations of groups 1, 2, 6, 7, 8, 9, 10, 11, 12 and 13 of the Periodic Table in the IUPAC nomenclature.

8. Composition according to claim **7**, characterized in that the anions $[Y]^{n-}$ are selected from the group of the halides, carboxylates, phosphates, thiocyanates, isothiocyanates, dicyanamides, sulphates, alkylsulphates, sulphonates, alkylsulphonates, tetrafluoroborate, hexafluoro-phosphate, bis(trifluoromethylsulphonyl)imide, dialkylphosphates, isostearates, alkylbenzylsulphonates, bis(alkyl)phosphinates, phosphatides, decanoates.

9. Composition according to claim **5**, characterized in that the anions $[Y]^{n-}$ are combined with cations $[A^1]^+$, $[A^{2]+}$ $[A^3]^+$ and $[A^4]^+$ in the form of substituted ammonium, phosphonium, pyridinium or imidazolium cations.

10. Composition according to claim **9**, characterized in that the conductivity additive or the mixture of conductivity additives is composed of at least one quaternary nitrogen and/or phosphorus compound and/or sulphur compound and at least one anion $[Y]^{n-}$ and the melting point of the composition is below about +250° C.

11. Composition according to claim **10**, characterized in that the conductivity additive or mixtures thereof is/are liquid at room temperature.

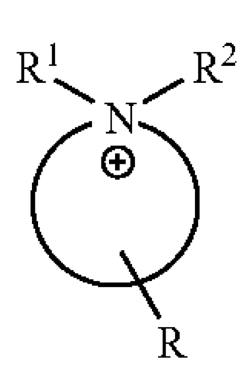
12. A method of increasing the electrical conductivity in hydraulic and/or lubricant system which comprises of adding an effective amount of the composition of claim **1** to a hydraulic and/or lubricant system.

13. The method of claim **12**, wherein the one or more hydraulic oils or lubricants comprise of one or more compounds selected from N,N-di(tallowyloxyethyl)-N,N-dimethylammonium chloride; N,N-di(canolyloxyethyl)-N,N-dimethylammonium chloride; N,N-di(tallowyloxyethyl)-N-methyl,N-(2-hydroxyethyl)ammonium methylsulphate; N,N-di(canolyloxyethyl)-N-methyl,N-(2-hydroxyethyl) ammonium methylsulphate; N,N-di(tallowylamidoethyl)-N-methyl,N-(2-hydroxyethyl)ammonium methylsulphate; N,N-di(2-tallowyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride; N,N-di(2-canolyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride; N,N-di(2-tallowyloxyethylcarbonyloxyethyl)-N,N-dimethylammonium chloride; N,N-di(2-canolyloxyethylcarbonyloxyethyl)-N,N-dimethylammonium chloride; N(2-tallowoyloxy-2-ethyl)-N-(2-tallowyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride; N(2-canolyloxy-2-ethyl)-N(2-canolyloxy-2-oxo-ethyl)-N,N-dimethylammonium chloride; N,N,N-tri(tallowyloxyethyl)-N-methylammonium chloride; N,N,N-tri (canolyloxyethyl)-N-methylammonium chloride; 1,2-ditallowyloxy-3-N,N,N-trimethylammoniopropyl chloride, 1,2-dicanolyloxy-3-N,N,N-trimethylammoniopropyl chloride, ditallowdimethylammonium chloride, ditallowdimethylammonium methylsulphate, dimethylammonium chloride of di(hydrogenated tallow) distearyldimethylammonium chloride and/or dibehenyldimethylammonium chloride as a conductivity additive, in hydraulic systems or lubricant systems.

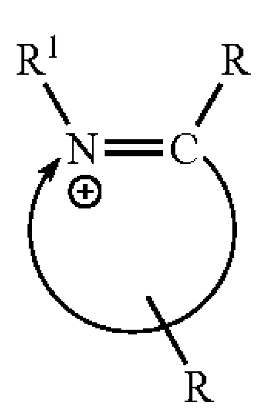
14. The method of claim **12**, wherein the composition further comprises as a conductivity additive, compounds which contain, as cations, structure fragmente which derive from saturated or unsaturated cyclic compounds and from aromatic compounds having in each case at least one trivalent nitrogen atom in a 4- to 10-membered, which may optionally be substituted, in hydraulic systems or lubricant systems.

15. The method of claim **14**, wherein the cation of the conductivity additive has the structure of the formulae (IX), (X) and (XI), where the heterocyclic rings may optionally also contain a plurality of heteroatoms, such as nitrogen, oxygen or sulphur, and

(IX)



(X)



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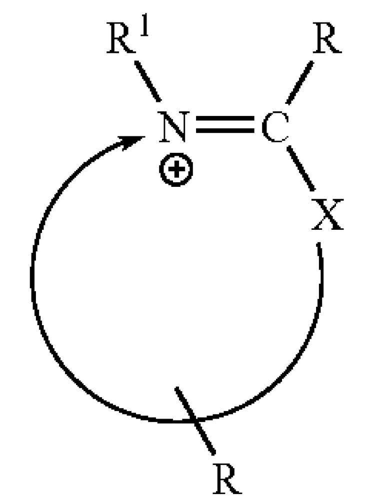
(XI)



R^1 and R^2 are the same or different; R^1,R^2 are the same or different with the proviso that at least one radical is not hydrogen, and are each hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having to 40 carbon atoms, a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more heteroatoms (oxygen, NH, NR' where R' is a C_1-C_{30}-alkyl radical which may contain double bonds, especially —CH_3), a linear or branched aliphatic hydrocarbon radical which has 2 to 30 carbon atoms, may contain double bonds and is interrupted by one or more functionalities selected from the group of —O—C(O)—, —(O)C—O—, —NH—C(O)—, —(O)C—NH, —(CH_3)N—C(O)—, —(O)C—N(CH_3)—, —S(O_2)—O—, —O—S (O_2)—, —S(O_2) —NH—, —NH—S(O_2)—, —S(O_2)—N(CH_3)—, —N(CH_2)—S(O_2)—, a linear or branched aliphatic or cycloaliphatic hydrocarbon radical which has 1 to 30 carbon atoms, may contain double bonds and is functionalized terminally with OH, OR', NH_2, N(H)R', $N(R')_2$ in which R' is a C_1-C_{30}-alkyl radical which may contain double bonds, or a polyether of blockwise or random construction according to —$(R^5$—$O)_n$—R^6,

where

R^5 is a linear or branched hydrocarbon radical containing 2 to 4 carbon atoms,

n is 1 to 100, preferably 2 to 60, and

R^6 is hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms or a —C(O)—R^7 radical where

R^7 is a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms, an alkylaryl radical having 7 to 40 carbon atoms.

R is a hydrogen, a linear or branched aliphatic hydrocarbon radical which has 1 to 30 carbon atoms and may contain double bonds, a cycloaliphatic hydrocarbon radical which has 5 to 40 carbon atoms and may contain double bonds, an aromatic hydrocarbon radical having 6 to 40 carbon atoms or an alkylaryl radical having 7 to 40 carbon atoms, and

X is an oxygen atom, a sulphur atom or a substituted nitrogen atom (X=O, S, NR') and the cyclic nitrogen compounds may be unsubstituted (R=H), monosubstituted or else polysubstituted by the R radical, where, in the case of polysubstitution by R, the individual R radicals may be the same or different, in hydraulic systems or lubricant systems.

16. The method of claim **14**, wherein the cations of the conductivity additive can be derived from saturated acyclic, saturated or unsaturated cyclic compounds and from aromatic compounds having in each case more than one trivalent nitrogen atom in a 4- to 10-membered, heterocyclic ring and may be substituted both on the carbon atoms and on the nitrogen atoms and may optionally be fused by substituted benzene rings and/or cyclohexane rings to form polycyclic structures, in hydraulic systems or lubricant systems.

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