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(54) **Carrier oil composition**

(57) The present invention relates to a carrier oil composition comprising at least one base oil (a) having a paraffin content of greater than 80 wt% paraffins and a saturates content of greater than 98 wt% and comprising

a continuous series of iso-paraffins having n, n+1, n+2, n+3 and n+4 carbon atoms, wherein n is between 15 and 35, and (b) an alkylated aromatic component.

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Description

[0001] The present invention relates to a carrier oil composition for additives, a concentrate comprising the carrier oil and an additive, such as viscosity modifiers and other additives, for the preparation of a lubricant composition, to lubricating compositions comprising the concentrate, and to a process to prepare the concentrate and the lubricant composition.

[0002] Lubricant compositions, in particular for automotive crankcase or transmissions, are employed to reduce wear at metal-to-metal contact between moving parts, as well as to remove heat. In many applications, the lubricant compositions require the presence of polymeric viscosity modifier additives to obtain the desired viscometric properties over a broad range of shear and/or temperatures. These additives are usually highly viscous liquids or solids at room temperature. In order to be able to achieve homogenous distribution, avoid handling of solids and to be able to administer the amounts of additives added into lubricant compositions and thus ensure consistent product quality, these additives are usually added as concentrates in a carrier oil composition.

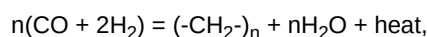
[0003] Fischer-Tropsch derived base oils are highly paraffinic API group III base oils (as specified in the American Petroleum Institute (API) Base Oil Interchangeability Guidelines) exhibiting very good cold flow properties, high oxidative stability and high viscosity indices. However, due to the high paraffin content the solvency of the base oils is generally low, resulting in incompatibility with other lubricant components and additives. Applicants found that Fischer-Tropsch base oils are usually not suitable as carrier oils to prepare concentrates for additives such as polymeric viscosity modifiers due to the low solvency of these base oils. It would therefore be highly desirable to use more suitable base oils in combination with Fischer-Tropsch base oils formulate additive concentrates.

[0004] Applicants have now found a carrier oil composition that not only permits to prepare suitable concentrates, but also permits to blend low sulphated ash, phosphor, sulphur containing (low SAPS) lubricant formulations.

[0005] Accordingly, the present invention relates to a carrier oil composition comprising at least one base oil (a) having a paraffin content of greater than 80 wt% paraffins and a saturates content of greater than 98 wt% and comprising a continuous series of iso-paraffins having n, n+1, n+2, n+3 and n+4 carbon atoms, wherein n is between 15 and 35, and (b) an alkylated aromatic compound.

[0006] The paraffinic base oil (a) is preferably a Fischer-Tropsch derived base oil having a paraffin content of greater than 80 wt% paraffins, a saturates content of greater than 98 wt% and comprises a continuous series of iso-paraffins having n, n+1, n+2, n+3 and n+4 carbon atoms, wherein n is between 15 and 35. In the present context, the term "Fischer-Tropsch derived" means that a material is, or derives from, a synthesis product of a Fischer-Tropsch condensation process. The term "non-Fischer-Tropsch derived" may be interpreted accordingly. A Fischer-Tropsch derived base oil will therefore be a hydrocarbon stream of which a substantial portion, except for added hydrogen, is derived directly or indirectly from a Fischer-Tropsch condensation process.

[0007] The Fischer-Tropsch condensation process is a reaction which converts carbon monoxide and hydrogen into longer chain, usually paraffinic, hydrocarbons:



in the presence of an appropriate catalyst and typically at elevated temperatures (e.g. 125 to 300 °C, preferably 175 to 250 °C) and/or pressures (e.g. 5 to 100 bar, preferably 12 to 50 bar).

[0008] The carbon monoxide and hydrogen may themselves be derived from organic or inorganic, natural or synthetic sources, typically either from natural gas or from organically derived methane. In general the gases which are converted into liquid fuel components using Fischer-Tropsch processes can include natural gas (methane), LPG (e.g. propane or butane), "condensates" such as ethane, synthesis gas (CO/hydrogen) and gaseous products derived from coal, biomass and other hydrocarbons. The base oil containing a continuous iso-paraffinic series as described above is obtained by hydroisomerisation of a paraffinic wax, preferably followed by some type of dewaxing, such as solvent or catalytic dewaxing. The paraffinic wax is a Fischer-Tropsch derived wax.

[0009] The Fischer-Tropsch derived base oil used in the present invention is suitably obtained by hydrocracking a Fischer-Tropsch wax and preferably dewaxing the resultant waxy raffinate. The product of the dewaxing stage can be distilled to produce a number of different products, including base oil streams having a VK 100 of around 4, 5 and 8 centistokes and a lower boiling dewaxed gas oil.

[0010] The base oil used in the present invention may be derived from any of these base oil grades. Its boiling range and viscosity will therefore be determined by those required for the 4 centistokes base oil grade, a 5 centistokes base oil grade, an 8 centistokes base oil grade, and/or mixtures thereof. Other Fischer-Tropsch derived base oil grades may include residual dewaxed base oils, as disclosed in WO-A-2004/063941 and WO-A-20-05/063941.

[0011] By virtue of the Fischer-Tropsch process, a Fischer-Tropsch derived product comprises essentially no, or undetectable levels of, sulphur and nitrogen. Further, the Fischer-Tropsch process as usually operated produces no or virtually no aromatic components. Accordingly, the aromatics content of a Fischer-Tropsch derived base oil, suitably determined by ASTM D-4629, will typically be below 1 wt %, preferably below 0.5 wt % and more preferably below 0.1 wt %.

[0012] Generally speaking, Fischer-Tropsch derived hydrocarbon products have relatively low levels of polar components, in particular polar surfactants, for instance compared to petroleum derived products. This may contribute to improved antifoaming and dehazing performance.

[0013] Since the base oil used in the present invention is derived from a Fischer-Tropsch wax, it will be largely paraffinic in nature, and will typically contain a major proportion of iso-paraffins. Suitably, the base oil has a total paraffin content of at least 80 wt %, preferably at least 85, more preferably at least 90, yet more preferably at least 95 and most preferably at least 99 wt %. It suitably has a saturates content (as measured by IP-368) of greater than 98 wt %. Preferably the saturates content of the base oil is greater than 99 wt %, more preferably greater than 99.5 wt %. It further preferably has a maximum n-paraffin content of 0.5 wt %. The base oil preferably also has a content of naphthenic compounds of from 0 to less than 20 wt %, more preferably of from 0.5 to 10 wt %.

[0014] The base oil component (a) suitably has a kinematic viscosity at 100 °C (VK 100, as measured by ASTM D-445) of from 1 to 25 mm²/sec (cSt). Preferably, it has a VK 100 of from 3 to 25 mm²/sec, more preferably of from 2.5 to 8.5 mm²/sec, yet more preferably from 4.0 to 8.0 mm²/sec.

[0015] It will suitably have a kinematic viscosity at 40 °C (VK 40, also measured by ASTM D-445) of from 10 to 100 mm²/sec (cSt), preferably from 15 to 50 mm²/sec.

[0016] The content and the presence of the a continuous series of the series of iso-paraffins having n, n+1, n+2, n+3 and n+4 carbon atoms in the base oil or base stock (i) may be measured by Field desorption/Field Ionisation (FD/FI) technique, as disclosed in EP-A-1368446.

[0017] Examples of Fischer-Tropsch processes which for example can be used to prepare the above-described Fischer-Tropsch derived base oil are the so-called commercial Slurry Phase Distillate technology of Sasol, the Shell Middle Distillate Synthesis Process and the "AGC-21" Exxon Mobil process. These and other processes are for example described in more detail in EP A-776959, EP-A-668342, US A-4943672, US A 5059299, WO A 9934917 and WO A 9920720.

[0018] Typically these Fischer-Tropsch synthesis products will comprise hydrocarbons having 1 to 100 and even more than 100 carbon atoms. This hydrocarbon product will comprise normal paraffins, iso-paraffins, oxygenated products and unsaturated products. I

[0019] It may be advantageous to use a relatively heavy Fischer-Tropsch derived feed. The relatively heavy Fischer-Tropsch derived feed has at least 30 wt%, preferably at least 50 wt%, and more preferably at least 55 wt% of compounds having at least 30 carbon atoms. Furthermore the weight ratio of compounds having at least 60 or more carbon atoms and compounds having at least 30 carbon atoms of the Fischer-Tropsch derived feed is preferably at least 0.2, more preferably at least 0.4 and most preferably at least 0.55. Preferably the Fischer-Tropsch derived feed comprises a C20+ fraction having an ASF-alpha value (Anderson-Schulz-Flory chain growth factor) of at least 0.925, preferably at least 0.935, more preferably at least 0.945, even more preferably at least 0.955. Such a Fischer-Tropsch derived feed can be obtained by any process, which yields a relatively heavy Fischer-Tropsch product as described above. Not all Fischer-Tropsch processes yield such a heavy product. An example of a suitable Fischer-Tropsch process is described in WO A 9934917.

[0020] The process will generally comprise a Fischer-Tropsch synthesis, a hydroisomerisation step and an optional pour point reducing step, wherein said hydroisomerisation step and optional pour point reducing step are performed as: (a) hydrocracking/hydroisomerising a Fischer-Tropsch product, (b) separating the product of step (a) into at least one or more distillate fuel fractions and a base oil or base oil intermediate fraction.

[0021] If the viscosity and pour point of the base oil as obtained in step (b) is as desired no further processing is necessary and the oil can be used as the base oil according the invention. If required, the pour point of the base oil intermediate fraction is suitably further reduced in a step (c) by means of solvent or preferably catalytic dewaxing of the oil obtained in step (b) to obtain oil having the preferred low pour point. The desired viscosity of the base oil may be obtained by isolating by means of distillation from the intermediate base oil fraction or from the dewaxed oil the suitable boiling range product corresponding with the desired viscosity. Distillation may be suitably a vacuum distillation step.

[0022] The hydroconversion/hydroisomerisation reaction of step (a) is preferably performed in the presence of hydrogen and a catalyst, which catalyst can be chosen from those known to one skilled in the art as being suitable for this reaction of which some will be described in more detail in EP-A-1368446 and EP-A-1366134. Also the conditions of step (a) are disclosed in EP-A-1368446 and EP-A-1366134. The conversion in step (a) is defined as the weight percentage of the feed boiling above 370 °C which reacts per pass to a fraction boiling below 370 °C, is at least 20 wt%, preferably at least 25 wt%, but preferably not more than 80 wt%, more preferably not more than 65 wt%. The feed as used above in the definition is the total hydrocarbon feed fed to step (a), thus also any optional recycle of a high boiling fraction which may be obtained in step (b).

[0023] In step (b) the product of step (a) is preferably separated into one or more distillate fuels fractions and a base oil or base oil precursor fraction having the desired viscosity properties. If the pour point is not in the desired range the pour point of the base oil is further reduced by means of a dewaxing step (c), preferably by catalytic dewaxing. In such an embodiment it may be a further advantage to dewax a wider boiling fraction of the product of step (a). From the

resulting dewaxed product the base oil and oils having a desired viscosity can then be advantageously isolated by means of distillation. Dewaxing is preferably performed by catalytic dewaxing as for example described in WO-A-02070629, EP-A-1368446 and EP-A-1366134.

[0024] The final boiling point of the feed to the dewaxing step (c) may be the final boiling point of the product of step (a) or lower if desired.

[0025] The pour point of the base oil component (a) is preferably below -30°C, more preferably below -40°C, and most preferably below -45°C.

[0026] The flash point of the base oil component (a) as measured by ASTM D92 preferably is greater than 120 °C, more preferably even greater than 140 °C.

[0027] The base oil component (a) preferably has a viscosity index in the range of from 100 to 200, more preferably a viscosity index in the range of from 110 to 180, and even more preferably a viscosity index in the range of from 120 to 150. The carrier oil composition according to the present invention preferably comprises of from 25% wt. to 75% wt. of the paraffinic base oil (a).

[0028] Component (b) of the carrier oil composition is an alkylated aromatic compound. Suitable alkylated aromatic compounds include alkylated benzenes, alkylated anthracenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated naphthalenes and the like. Preferably, the carrier oil composition according to the present invention comprises of from 25% wt. to 75% wt. of the alkylated aromatic component.

Preferably, the alkylated aromatic component is selected from alkylated benzenes, alkylated anthracenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated naphthalenes, or any mixtures thereof.

Alkylated naphthalenes may be produced by any suitable means known in the art, from naphthalene itself or from substituted naphthalenes which may contain one or more short chain alkyl groups having up to about eight carbon atoms, such as methyl, ethyl, or propyl, etc. Suitable alkyl-substituted naphthalenes include alphasubstituted naphthalene, dimethylnaphthalene, and ethylnaphthalene. Naphthalene itself is especially suitable since the resulting monoalkylated products have better thermal and oxidative stability than the more highly alkylated materials. Suitable Alkylated naphthalene lubricant compositions are described in US-B-3812036, and US-A-5602086. The preparation of alkylated naphthalenes is further disclosed in US-A-4714794.

The alkyaromatic component preferably comprises alkylbenzene and/or alkylated naphthalene compounds.

[0029] The alkyaromatic component preferably has a kinematic viscosity at 100°C in the range of from 3 to 12 mm²/s, more preferably in the range of from 3.8 to 7 mm²/s. Preferably the viscosity index of the alkyaromatic component is above 40, more preferably at or above 70.

[0030] The amount of alkylated aromatic components such as alkylated naphthalenes in the lubricant composition preferably may range from about 20 to about 75 percent by weight of the total weight of the carrier oil composition.

[0031] In a further aspect, the present invention relates to a concentrate comprising a carrier oil composition as set out above, and at least one additive. Preferably, the additive in the concentrate comprises a viscosity modifier. The concentrate preferably comprises of from 0.1 wt.% to 20 wt. % of the viscosity modifier.

[0032] Due to its high shear stability, the viscosity modifier comprises a hydrogenated polyisoprene star polymer.

[0033] The present invention further relates to the use of a carrier oil composition according to the invention for the preparation of additive concentrates.

[0034] The concentrate preferably comprises a viscosity improver in an amount of from 0.01 to 30% by weight. Viscosity index improvers (also known as VI improvers, viscosity modifiers, or viscosity improvers) provide lubricants with high- and low-temperature operability. These additives impart acceptable viscosity at low temperatures and are preferably shear stable.

[0035] The viscosity modifier may be of the solid type or a concentrate in a natural or synthetic base stock and can be defined as a substance, usually a polymer, which substantially improves (e.g. by at least 5 units) the viscosity index (e.g. as determined by ASTM procedure D2270) by its incorporation. These can all be incorporated into the final lubricant formulation to give the desired performance properties thereof. Examples of such viscosity modifiers are linear or star-shaped polymers of a diene such as isoprene or butadiene, or a copolymer of such a diene with optionally substituted styrene. These copolymers are suitably block copolymers and are preferably hydrogenated to such an extent as to saturate most of the olefinic unsaturation. A number of other types of viscosity modifier are known in the art, and many of these are described in Proceedings of Conference "Viscosity and flow properties of multigrade engine oils", Esslingen, Germany, December 1977. It is also known in the art that viscosity modifiers can be functionalised to incorporate dispersancy (e.g. dispersant viscosity index improvers based on block copolymers, or polymethacrylates) and/or antioxidant functionality as well as viscosity modification and they can also have pour point depressants mixed in to give handleable products in cold climates.

[0036] Preferably, the viscosity modifier is a viscosity modifying polymer, for example polyisobutylenes, olefin copolymers, polymethacrylates and polyalkylstyrenes, and more preferably hydrogenated polyisoprene star polymers. Hydrogenated polyisoprene star polymers are commercially available under the tradename SHELLVIS 50, 150, 200, 250 or 260 (SHELLVIS is a registered tradename of the INFINEUM INTERNATIONAL LIMITED). For instance, Shellvis 150

(SV150) is a styrene/isoprene copolymer having a softening temperature of 110° C., a relative particle density of 0.83g/cm³ at 20°C, and a bulk density of 593 kg/m³. Most preferably, the viscosity modifier is Shellvis 150. The content of SV150 preferably is in the range of from 4 to 10 wt.% more preferably 5 to 7 wt.% and most preferably 5.5 to 6.5 wt.%.

[0037] A further preferred polymeric viscosity modifiers for use in the present formulations are the block copolymers produced by the anionic polymerization of unsaturated monomers including styrene, butadiene, and isoprene. Block copolymers may be linear or star type copolymers and for the present purposes, the linear block polymers are preferred. The preferred polymers are the isoprene-butadiene and isoprene-styrene anionic diblock and triblock copolymers. Particularly preferred high molecular weight polymeric components are the ones sold under the designation SHELLVIS 40, SHELLVIS 50 and SHELLVIS 90 by Shell Chemical Company, which are linear anionic copolymers.

[0038] The concentrate preferably comprises of from 45 to 48 wt.% of base oil (a), of from 45 to 48 wt.% of the alkylated aromatic component (b), and of from 4 to 10 wt. % of the viscosity modifier. The component (b) in such a concentrate is preferably an alkylated naphthalene component. The concentrate may further contain a pour point depressant to improve pumpability. The pour point depressant preferably is present in a range of from 0.5 to 3 wt.%, more preferably from 1 to 2 wt.%, and most preferably from 1.1. to 1.4 wt.%.

[0039] In a further aspect the present invention also relates to a lubricant composition comprising the concentrate, and further comprising one or more of the additives selected from an extreme pressure agent, an antiwear agent, a rust inhibitor, a corrosion inhibitor, and a defoamer.

[0040] Preferably, the lubricant composition is a multigrade crankcase lubricant composition comprising, or prepared by admixing: (i) a major amount of a base oil having lubricating viscosity, comprised of at least 50% wt., more preferably at least 60% wt., yet more preferably at least 70% wt., again more preferably 80% wt., and most preferably 95 % wt. of a Fischer-Tropsch derived base oil; and (ii) a concentrate comprising a carrier oil and at least one additive. The additive preferably is a viscosity modifier as disclosed above. Further additives comprise dispersants, such as an ashless dispersant; metal detergents, such as a calcium and/or magnesium detergent; one or more other lubricant additive components selected from anti-oxidants, anti-wear agents; and friction modifiers.

[0041] The lubricant composition according to the invention may further comprise any one or more additives as disclosed on pages 8-10 of WO-A-2005/123887 according to formula I. These one or more compounds of formula I are preferably present in an amount in the range of from 0.01 to 10.00 wt. %, based on the total weight of the lubricant composition. The lubricant composition further preferably comprises one or more zinc dithiophosphates, preferably zinc dialkyl dithiophosphates, and/or one or more salicylate detergents, more preferably alkaline earth metal salicylates.

[0042] The lubricant composition further preferably has a Sulphated ash content in the range of 0.6 to 1.0 wt. %, based on the total weight of the lubricant composition. The lubricant composition further preferably has a sulphur content in the range of 0.12 to 0.20 wt. %, based on the total weight of the lubricant composition. The lubricant composition further preferably has a TBN value in the range of from 5.0 to 12.0 mg.KOH/g, as measured by ASTM D2896.

[0043] The lubricant according to the invention further preferably comprises a viscosity improver in an amount of from 0.01 to 30% by weight. Viscosity index improvers (also known as VI improvers, viscosity modifiers, or viscosity improvers) provide lubricants with high- and low-temperature operability. These additives impart shear stability at elevated temperatures and acceptable viscosity at low temperatures. The lubricant used in the package according to the invention further preferably comprises at least one other additional lubricant component in effective amounts, such as for instance polar and/or non-polar lubricant base oils, and performance additives such as for example, but not limited to, metallic and ashless oxidation inhibitors, metallic and ashless dispersants, metallic and ashless detergents, corrosion and rust inhibitors, metal deactivators, metallic and non-metallic, low-ash, phosphorus- containing and non-phosphorus, sulphur-containing and non-sulphur-containing anti-wear agents, metallic and non-metallic, phosphorus-containing and non-phosphorus, sulphur-containing and non-sulphurous extreme pressure additives, anti-seizure agents, pour point depressants, wax modifiers, seal compatibility agents, friction modifiers, lubricity agents, anti-staining agents, chromophoric agents, anti foaming agents, demulsifiers, and other usually employed additive packages. For a review of many commonly used additives, reference is made to D. Klamann in *Lubricants and Related Products*, Verlag Chemie, Deerfield Beach, FL; ISBN 0-89573-177-0, and to "Lubricant Additives" by M. W. Ranney, published by Noyes Data Corporation of Parkridge, N.J. (1973).

[0044] The lubricant composition preferably has a sulphur content of from 0.01 to 0.3 wt. %, a phosphorus content of from 0.01 to 0.1 wt. % and a sulphated ash content of from 0.1 to 1.2 wt. %, based on the total weight of the lubricant composition, which comprises a base oil or base oil blend.

[0045] Preferably, the lubricant composition has a kinematic viscosity at 100 °C of more than 5.0 mm²/s (cSt), a cold cranking simulated dynamic viscosity according to ASTM D 5293 at or -30°C of less than 6200 mPas, or at -35°C less than 6600 mPas (cP) and a mini rotary viscosity test value of less than 60000 mPas at 40 or -35°C according to ASTM D 4684.

[0046] The present invention further relates to a process to prepare an additive concentrate as described above, comprising blending components (a) and (b), and dissolving the additive in the blend.

[0047] The present invention also relates to a process to prepare a lubricant composition as set out above, comprising

adding the additive concentrate to further additives and/or base oils.

[0048] The lubricant according to the invention further preferably comprises at least one additional performance additive such as for example, metallic and ashless oxidation inhibitors, ashless dispersants, metallic and ashless detergents, corrosion and rust inhibitors, metal deactivators, metallic and non-metallic, low-ash, phosphorus-containing and non-phosphorus, sulphur-containing and non-sulphur-containing anti-wear agents, metallic and non-metallic, phosphorus-containing and non-phosphorus, sulphur-containing and non-sulphurous extreme pressure additives, anti-seizure agents, pour point depressants, wax modifiers, viscosity modifiers, seal compatibility agents, friction modifiers, lubricity agents, anti-staining agents, chromophoric agents, anti foaming agents, demulsifiers, and other usually employed additive packages. For a review of many commonly used additives, reference is made to D. Klamann in Lubricants and Related Products, Verlag Chemie, Deerfield Beach, FL; ISBN 0-89573-177-0, and to "Lubricant Additives" by M. W. Ranney, published by Noyes Data Corporation of Parkridge, N.J. (1973).

[0049] The invention will be further illustrated by the following, non-limiting examples.

Example 1

[0050] A carrier oil was formulated by blending a Fischer-Tropsch derived base oil and an alkylated naphthalene (KR 008, commercially available from King Industries) in a weight/weight ratio of 50/50, in comparison to a mineral based carrier oil. A mineral base oil was used as comparison. The properties were as follows (see Table 1):

Table 1: Carrier oil Properties

Property	Method	Unit	FT Base oil 1	Alkyl Naphthalene (KR 008)	Carrier composition blend (50/50 (wt/wt) FT base oil/Alkyl naphthalene)	Mineral Base oil
Vk100	D 445	mm ² / s	4.029	5.57	4.57	4.84
Vk40	D 445	mm ² / s	17.25	36.61	23.25	26.02
VI	D 2270		135	90	111	107.4
Vd-30°C (CCS)	D 5293	mPas	1008	9030	2320	5172
Vd-35°C (CCS)	D 5293	mPas	1646	25159	4321	11402
Density @ 15°C	ISO 12185	kg/m ³	815.7	904	859	860
Flash point	D 93	°C	228	Nd	nd	nd
Pour point	D 97	°C	-30	-33	-33	nd
Aniline point	D611	°C	Nd	50	88	99.8
Noack	CEC L40-A-93	%m	12.1	8.4	10.25	16.9

[0051] A concentrate comprising 6 wt.% of ShellVIS (SV) 150 was prepared from the blend of FT base oil 1 and alkyl naphthalene, and from the mineral base oil. The FT base oil could not be used to prepare such concentrate due to limited solvency.

[0052] An additional pour point depressant to enable the concentrate to be pumped at high temperature at a concentration of treat rate of 1.3% wt. (High-Temperature High-Shear Viscometer measurements (HTHSV) at 150°C and 106s-1 shear rate, according to ASTM D 5481).

Comparative Example 1

[0053] A comparative concentrate was prepared by dissolving SHELLVIS 150 (6% wt.) in a mineral derived base oil. An additional pour point depressant was added to the carrier oil to enable the concentrate to be pumped at high temperature, as set out above. The composition of the concentrates is given in Table 2.

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Table 2: Viscosity modifier concentrate

Base oils		Example 1	Comparative Example 1
SV150	%wt.	6	6
FT Base oil 1	%wt.	46.35	-
KR008	%wt.	46.35	-
Mineral Base Oil	%wt.		92.7
Pour Point depressant	%wt.	1.3	1.3

[0054] It was found that the carrier oil composition outperformed the mineral derived alternative in CCS and Noack volatility performance, both of which cannot be improved via additive treatment. Specifically, the viscosity index was increased, while the Noack volatility was reduced by more than 15% wt., while at the same time achieving an aniline point below 100°C. Furthermore, the VK 100 was 4.6 mm²/s, and a lower natural pour point below -30°C (i.e. without additives). This was surprising since KR008 exhibits a low Noack volatility and a low pour point, but high CCS figures at -30 and -35°C due to its relatively low viscosity index (90) combined with a higher viscosity at 100°C.

[0055] The thickening power of both concentrates was assessed by incorporating an amount equal to 1.2% wt. of the SHELLVIS2 viscosity modifier SV150 in the FT/KR088 blend, as compared to the mineral carrier oil base concentrate into a Fischer-Tropsch derived base oil 2 (with slightly higher viscosity than FT BO 1), and a Mineral Base oil. The results are given in Table 3.

Table 3: Thickening power assessment

Base oil type for thickening assessment		FT Base oil 2			Mineral Base oil		
FT Base Oil 2	%wt.	100	80	80			
Mineral BO	%wt.				100	80	80
SV150 in FT BO 1/KR008	%wt.	0	20	-	-	20	-
SV150 in Mineral BO	%wt.	0	-	20	-	-	20
SV150 content	%wt.	0	1.2	1.2	0	1.2	1.2
Properties							
VK 100	mm ² /s	5.18 2	10.14	10.01	4.841	10.99	10.86
CCS -35	mPas	3142	3702	4384	11402	11334	15538
VM thickening effect in FT base oil							
Delta Vk100	mm ² /s	0	4.96	4.83	0	6.15	6.02
Delta CCS	mPas	0	560	1242	0	-68	4136
Thickening ratio (at 100°C)			1.03	1.00		1.02	1.00

[0056] The results show that the concentrate in the carrier oil blend according to the invention exhibits a far lower CCS increase combined with a slightly higher thickening power at 100°C as compared to the comparative mineral oil based concentrate, in both mineral base oil and Fischer-Tropsch derived base oil. This lower CCS thickening will allow the use of base oil blends of higher viscosity to be used, resulting in lower Noack volatility and reduced additive polymer content.

Example 2

[0057] 0W-40 Engine oil formulations were blended with the concentrate according to the invention, using commercially available additive packages. Properties of the blends are given Table 4.

Example 3a is the initial oil blended at polymer content identical to that of the Comparative Example 3 showed an improvement in CCS and Noack performance.

[0058] This formulation was further improved in Example 3b by adding a slightly higher increase in viscosity modifier treat and an increase in the amount of the slightly higher viscous FT base oil 2, resulting in a further improvement of the Noack volatility.

Table 4: Properties of 0W40 Engine Oil Formulations

		Example 3a	Example 3b	Comparative Example 2
5	Additive package 1	%wt.	12.85	12.85
	Additive package 2	%wt.	1.95	1.95
	Pour point depressant	%wt.	0.5	0.5
10	Antioxidant	%wt.	0.3	0.3
	Mineral Oil based SV200 Concentrate (6% wt. of additive)	%wt.		6.55
	Mineral Oil based SV150 Concentrate (6% wt. of additive)	%wt.		6.55
15	SV200 Concentrate in FT BO 2(6% wt. of additive)	%wt.	6.55	6.6
	SV150 Concentrate (6% wt. of additive) (FTBO 1/KR008)	%wt.	6.55	6.6
20	FT BO 1	%wt.	52.8	43.5
	FT BO 2	%wt.	18.5	27.7
	Antifoamant	%wt.	30 ppm	30 ppm
25	Characteristics	Unit		
	VK100	mm ² /s	12.94	13.28
	CCS (-35°C)	Mpas	5556	5895
	MRV-40	Mpas	22300	20400
30	Pour point	°C	-42	-45
	HTHSV(CEC 150°C, and 106s-1 shear, ASTM D 5481)	MPas	3.46	3.54
35	Noack	%m	9.66	9.29

Claims

- 40 1. A carrier oil composition comprising at least one base oil (a) having a paraffin content of greater than 80 wt% paraffins and a saturates content of greater than 98 wt% and comprising a continuous series of iso-paraffins having n, n+1, n+2, n+3 and n+4 carbon atoms, wherein n is between 15 and 35, and (b) an alkylated aromatic component.
2. A carrier oil composition according to claim 1, wherein the paraffinic base oil is a Fischer-Tropsch derived base oil.
- 45 3. A carrier oil composition according to claim 1 or claim 2, wherein the paraffinic base oil has a kinematic viscosity at 100°C of from 3 to 25 mm²/s.
4. A carrier oil composition according to any one of claims 1 to 3, comprising of from 25% wt. to 75% wt. of the paraffinic base oil.
- 50 5. A carrier oil composition according to any one of claims 1 to 4, comprising of from 25% wt. to 75% wt. of the alkylated aromatic component.
- 55 6. A carrier oil composition according to any one of claims 1 to 5, wherein the alkylated aromatic component is selected from alkylated benzenes, alkylated anthracenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated naphthalenes, or any mixtures thereof.

7. A concentrate comprising a carrier oil composition according to any one of claims 1 to 6, and at least one additive.
8. A concentrate according to claim 7, wherein the additive is a viscosity modifier.
- 5 9. A concentrate according to claim 7 or claim 8, wherein the component (b) is an alkylated naphthalene.
- 10 10. A concentrate according to any one of claims 7 to 9, comprising of from 0.1 wt.% to 20 wt. % of the viscosity modifier.
11. A concentrate according to any one of claims 7 to 10, wherein the viscosity modifier comprises a hydrogenated polyisoprene star polymer.
12. A concentrate according to any one of claims 7 to 11, comprising of from 45 to 48 wt.% of base oil (a), of from 45 to 48 wt.% of the alkylated aromatic component (b), and of from 4 to 10 wt. % of the viscosity modifier.
- 15 13. A lubricant composition comprising the concentrate according to claim 7 to 10, further comprising one or more of the additives selected from an extreme pressure agent, an antiwear agent, a rust inhibitor, a corrosion inhibitor, and a defoamer.
- 20 14. A lubricant composition according to claim 13, having a sulphur content of from 0.01 to 0.3 wt. %, a phosphorus content of from 0.01 to 0.1 wt. % and a sulphated ash content of from 0.1 to 1.2 wt. %, based on the total weight of the lubricant composition.
- 25 15. A process to prepare an additive concentrate according to claims 1 to 12, comprising blending components (a) and (b), and dissolving the additive in the blend.
- 30 16. A process to prepare a lubricant composition according to claims 13 or 14, comprising adding the additive concentrate to further additives and/or base oils.
17. Use of a carrier oil composition according to any one of claims 1 to 6 for the preparation of additive concentrates.



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EUROPEAN SEARCH REPORT

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