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(54) **Additive concentrate**

(57) The present invention provides an additive concentrate comprising:
- a Fischer-Tropsch derived base oil;
- at least 3.0 wt.% of a viscosity modifier, based on the total weight of the additive concentrate; and
- less than 5.0 wt.% of a solvency booster, based on the total weight of the additive concentrate.

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Description

[0001] The present invention relates to an additive concentrate comprising a base oil and a viscosity modifier, for the incorporation into a 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 an additive concentrate.

[0003] As acknowledged in WO 2009/074572, Fischer-Tropsch derived base oils are usually not suitable as base oils to prepare additive concentrates for additives such as polymeric viscosity modifiers due to the low solvency of these Fischer-Tropsch derived base oils. Therefore, WO 2009/074572 suggests to include an alkylated aromatic compound (e.g. "KR 008", commercially available from King Industries) as a solvency booster in the additive concentrate. According to WO 2009/074572, the solvency booster is preferably present in an amount of from 25 wt.% to 75 wt.%, based on the weight of the additive concentrate.

[0004] The present applicant has now surprisingly found that it is possible to prepare additive concentrates containing a viscosity modifier using Fischer-Tropsch derived base oils, which additive concentrates are suitable for use in e.g. transmission oils and engine oils and other lubricants (including industrial lubricants such as hydraulic oils) for which a viscosity modifier is desired, but without the need of significant amounts of solvency boosters, or even without the need of solvency boosters at all.

[0005] To this end the present invention provides an additive concentrate comprising:

- a Fischer-Tropsch derived base oil;
- at least 3.0 wt.% of a viscosity modifier, based on the total weight of the additive concentrate; and
- less than 5.0 wt.% of a solvency booster, based on the total weight of the additive concentrate.

[0006] Fischer-Tropsch derived base oils are known in the art. 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. A Fischer-Tropsch derived base oil may also be referred to as a GTL (Gas-To-Liquids) base oil. The term "base oil" may refer to a mixture containing more than one base oil.

[0007] For further information on the Fischer-Tropsch derived base oil and the preparation thereof reference is made to the above-mentioned WO 2009/074572, the teaching of which is hereby incorporated by specific reference.

[0008] Typically, 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.%. 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.%.

[0009] Typically, the Fischer-Tropsch derived base oil has a kinematic viscosity at 100°C (as measured by ASTM D 7042) of from 1 to 25 mm^2/s (cSt), preferably above 2.5 more preferably above 3.0 mm^2/s. Preferably, the Fischer-Tropsch derived base oil has a kinematic viscosity at 100°C of below 5.0 mm^2/s, preferably below 4.5 mm^2/s, more preferably below 4.2 mm^2/s.

[0010] Further, the Fischer-Tropsch derived base oil typically has a kinematic viscosity at 40°C (as measured by ASTM D 7042) of from 10 to 100 mm^2/s (cSt), preferably from 15 to 50 mm^2/s.

[0011] Also, the Fischer-Tropsch derived base oil preferably has a pour point (as measured according to ASTM D 5950) of below -30°C, more preferably below -40°C, and most preferably below -45°C.

[0012] The flash point (as measured by ASTM D92) of the Fischer-Tropsch derived base oil is preferably greater than 120°C, more preferably even greater than 140 °C.

[0013] The Fischer-Tropsch derived base oil preferably has a viscosity index (according to ASTM D 2270) in the range of from 100 to 200. Preferably, the Fischer-Tropsch derived base oil has a viscosity index of at least 125, preferably 130. Also it is preferred that the viscosity index is below 180, preferably below 150.

[0014] In the event the Fischer-Tropsch derived base oil contains a blend of two or more Fischer-Tropsch derived base oils, the above values apply to the blend of the two or more Fischer-Tropsch derived base oils.

[0015] In addition to the Fischer-Tropsch derived base oil, the additive concentrate may comprise one or more non-Fischer-Tropsch derived base oils, such as mineral derived base oils and so-called synthetic base oils (such as PAOs) including Group I-V base oils according to the definitions of American Petroleum Institute (API). These API categories are defined in API Publication 1509, 15th Edition, Appendix E, July 2009.

[0016] Preferably the additive concentrate according to the present invention comprises at least 80 wt.% of the Fischer-Tropsch derived base oil, preferably at least 90 wt.%, based on the total weight of the additive concentrate. Also it is preferred that the additive concentrate comprises less than 10.0 wt.% of a non-FT-derived base oil, preferably less than 5.0 wt.%, more preferably less than 2.0 wt.%, even more preferably less than 1.0 wt.%, based on the total weight of the additive concentrate. Most preferably the additive concentrate comprises no non-Fischer-Tropsch derived base oils at all.

[0017] There are no particular limitations regarding the viscosity modifier as used in the additive concentrate according to the present invention. As a person skilled in the art is familiar with the term "viscosity modifier", this is not further discussed in detail. Viscosity modifiers (also known as VI improvers, viscosity index improvers or viscosity improvers) provide lubricants with high- and low-temperature operability; these additives impart acceptable viscosity at low temperatures and are preferably shear stable. Typically, and as meant according to the present invention, a viscosity modifier improves (e.g. by at least 5 units) the viscosity index (e.g. as determined by ASTM D 2270) by its incorporation in the additive concentrate (and/or a fully formulated lubricant composition in which the viscosity modifier is incorporated).

[0018] According to the present invention, the additive concentrate comprises at least 3.0 wt.% of a viscosity modifier, based on the total weight of the additive concentrate. Preferably, the additive concentrate comprises from 5.0 to 25.0 wt.%, preferably from 6.0 to 20.0 wt.% of the viscosity modifier, based on the total weight of the additive concentrate.

[0019] Non-limiting Examples of viscosity modifiers are linear or star-shaped olefin copolymers, polyisobutylenes, polymethacrylates, polymers of a diene such as isoprene or butadiene, or a copolymer of such a diene with optionally substituted styrene. These copolymers 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.

[0020] Preferably, the viscosity modifier is selected from the group consisting of olefin copolymers, polyisoprene polymers and diene-styrene copolymers. Olefin copolymers, are commercially available from Chevron Oronite Company LLC under the trade designation "PARATONE®" (such as "PARATONE® 8921" and "PARATONE® 8941"); from Afton Chemical Corporation under the trade designation "HiTEC®" (such as "HiTEC® 5850B"; and from The Lubrizol Corporation under the trade designation "Lubrizol® 7067C". Polyisoprene polymers are commercially available from Infineum International Limited, e.g. under the trade designation "SV200"; diene-styrene copolymers are commercially available from Infineum International Limited, e.g. under the trade designation "SV 260".

[0021] The additive concentrate according to the present invention comprises less than 5.0 wt.% of a solvency booster, based on the total weight of the additive concentrate. Preferably, the additive concentrate comprises less than 2.0 wt.%, preferably less than 1.0 wt.%, more preferably less than 0.5 wt.%, of the solvency booster, based on the total weight of the additive concentrate. It is even more preferred that the additive concentrate contains no solvency booster at all.

[0022] There are no particular limitations regarding the solvency booster as meant according to the present invention. As a person skilled in the art is familiar with the term "solvency booster", this is not further discussed in detail. Typically, and as meant according to the present invention, a solvency booster is a compound having an aniline point (according to ASTM D 611) of less than 100°C.

[0023] Preferably, the solvency booster is an alkylated aromatic compound. Alkylated aromatic compounds include alkylated benzenes, alkylated anthracenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated naphthalenes or any mixtures thereof. For further description of the alkylated naphthalenes, reference is made to WO 2009/074572.

[0024] The additive concentrate may further contain a pour point depressant to improve pumpability. If present, 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.%.

[0025] The additive concentrate preferably has - when normalized at a concentration of viscosity modifier of 1.0 wt.% - a dynamic viscosity at -30°C (according to ASTM D 5293) of below 3000 cP and a kinematic viscosity at 100°C (according to ASTM D 7042) of at least 5.5 cSt. Preferably the dynamic viscosity at -30°C is below 2000 cP, more preferably below 1500 cP. Additive concentrates containing different amounts of viscosity modifier can be normalized to a concentration of 1.0 wt.% by diluting the concentrate with the appropriate amount of the same base oil (or base oil blend) used to make the additive concentrate.

[0026] Further it is preferred that the additive concentrate comprises from 5 to 500 ppm of an anti-oxidant, preferably selected from a phenolic and an aminic anti-oxidant, or a mixture thereof.

[0027] In a further aspect the present invention provides a lubricant composition comprising a base oil, one or more additives other than a viscosity modifier and the additive concentrate according to the present invention.

[0028] There are no particular limitations regarding the base oil as used in the lubricant composition according to the present invention. This base oil may be a Fischer-Tropsch derived base oil, a non-Fischer-Tropsch derived base oil or a mixture thereof.

[0029] The one or more additives other than a viscosity modifier may be selected from a broad range of additives such as anti-oxidants, anti-wear additives, dispersants, detergents, over-based detergents, extreme pressure additives, friction modifiers, pour point depressants, metal passivators, corrosion inhibitors, demulsifiers, anti-foam agents, seal compatibility agents and additive diluent base oils, etc. As the person skilled in the art is familiar with the above and other additives, these are not further discussed here in detail. Specific examples of such additives are described in for example Kirk-Othmer Encyclopedia of Chemical Technology, third edition, volume 14, pages 477-526.

[0030] The present invention is described below with reference to the following Examples, which are not intended to limit the scope of the present invention in any way.

EXAMPLES

Additive Concentrates

[0031] Various additive concentrates were formulated. Table 1 indicates the properties for the base oils used in the additive concentrates. Tables 2-5 indicate the composition and properties of the formulated additive concentrates that were tested; the amounts of the components are given in wt.%, based on the total weight of the additive concentrate. Table 6 exemplifies the storage stability properties of an additive concentrate according to the present invention. Further, Table 7 exemplifies a fully formulated lubricating compositions (i.e. a SAE 5W-30 engine oil), comprising the additive concentrate according to the present invention.

[0032] The viscosities and Viscosity Index as measured for the additive concentrates were all measured at a normalized Viscosity Modifier concentration of 1.0 wt.% by dilution with the same base oil used to blend the additive concentrate (as the neat concentrates were too thick and therefore outside the testing range of the indicated test methods).

[0033] All tested additive concentrates contained a combination of a base oil and a viscosity modifier, and optionally an anti-oxidant.

[0034] "Base oil 1" was a Fischer-Tropsch derived base oil ("GTL 4") having a kinematic viscosity at 100°C (ASTM D 7042) of approx. 4 cSt (mm^2/s) . This GTL 4 base oil may be conveniently manufactured by the process described in e.g. WO-A-02/070631, the teaching of which is hereby incorporated by reference.

[0035] "Base oil 2" was a commercially available Group I base oil having a kinematic viscosity at 100°C (ASTM D 7042) of approx. 4 cSt. Base oil 2 is commercially available from ExxonMobil Corporation under the trade designation "Americas SN 115".

[0036] "Base oil 3" was a commercially available Group II base oil having a kinematic viscosity at 100°C (ASTM D 7042) of approx. 4.7 cSt. Base oil 3 is commercially available from Motiva Enterprises LLC under the trade designation "Star 5+".

[0037] "Base oil 4" was a commercially available Group II base oil having a kinematic viscosity at 100°C (ASTM D 7042) of approx. 6.5 cSt. Base oil 4 is commercially available from Motiva Enterprises LLC under the trade designation "Star 6".

[0038] "VM1" was a commercially available olefin copolymer viscosity modifier available from Chevron Oronite Company LLC (Richmond, California, USA) under the trade designation "PARATONE® 8921".

[0039] "VM2" was a commercially available olefin copolymer viscosity modifier available from Afton Chemical Corporation (Richmond, Virginia, USA) under the trade designation "HiTEC® 5850B".

[0040] "VM3" was a commercially available olefin copolymer viscosity modifier available from The Lubrizol Corporation (Wickliffe, Ohio, USA) under the trade designation "Lubrizol® 7067C".

[0041] "VM4" was a commercially available polyisoprene polymer viscosity modifier available from Infineum International Limited (Linden, New Jersey, USA) under the trade designation "SV 200".

[0042] "VM5" was a commercially available diene-styrene copolymer viscosity modifier available from Infineum International Limited under the trade designation "SV 260".

[0043] "Anti-oxidant" was a commercially available aminic anti-oxidant available from Cuba Corporation (Houston, Texas, USA) under the trade designation " Ciba® IRGANOX® L57".

[0044] The compositions of Example 1-8 and Comparative Examples 1-8 were obtained by mixing the base oils with the viscosity modifier using a Silverson high shear mixer and following (conventional) blending procedures recommended by the suppliers of the Viscosity Modifiers.

TABLE 1

	Base oil 1	Base oil 2
Dynamic viscosity at -25°C[1] [cP]	520	1645
Dynamic viscosity at -30°C[1] [cP]	850	3155
Dynamic viscosity at -35°C[1] [cP]	1390	6600
Kinematic viscosity at 40°C[2] [cSt]	16.94	21.30
Kinematic viscosity at 100°C[2] [cSt]	3.93	4.20
Viscosity Index[3]	130	99
Aniline point[4] [°C]	120	97
pour point[5] [°C]	-30	-18
Noack volatility[6] [wt.%]	11.7	26.6
Saturates[7] [wt.%]	99.9	80.0
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270 [4]According to ASTM D 611 [5]According to ASTM D 5950 [6]According to ASTM D 5800B [7]According to IP 368 (modified)		

TABLE 2 - Additive concentrates containing VM1

Component [wt.%]	Example 1	Example 2	Comp. Ex. 1	Comp. Ex. 2
Base oil 1 [GTL 4]	90.91	90.87	-	-
Base oil 2 [Group I]	-	-	90.91	90.87
VM1	9.09	9.09	9.09	9.09
Antioxidant	-	0.04	-	0.04
TOTAL	100	100	100	100
Properties of the additive concentrate (at normalized VM concentration of 1.0 wt.%)				
Dynamic viscosity at -25°C[1] [cP]	750	760	2220	2290
Dynamic viscosity at -30°C[1] [cP]	1180	1200	4170	4260
Dynamic viscosity at -35°C[1] [cP]	1920	1940	8460	8550
Kinematic viscosity at 40°C[2] [cSt	37.30	37.85	53.43	55.35
Kinematic viscosity at 100°C[2] [cSt]	7.83	7.94	9.48	9.75
VI[3]	188	189	163	163
[1]According to ASTM D 5293. NB 1 cP (centi Poise) = 1 mPa.s [2]According to ASTM D 7042 [3]According to ASTM D 2270				

TABLE 3 - Additive concentrates containing VM2

Component [wt. %]	Example 3	Example 4	Comp. Ex. 3	Comp. Ex. 4
Base oil 1 [GTL 4]	92.59	92.55	-	-
Base oil 2 [Group I]	-	-	92.59	92.55

(continued)

Component [wt. %]	Example 3	Example 4	Comp. Ex. 3	Comp. Ex. 4
VM2	7.41	7.40	7.41	7.40
Antioxidant	-	0.05	-	0.05
TOTAL	100	100	100	100
Properties of the additive concentrate (at normalized VM concentration of 1.0 wt.%)				
Dynamic viscosity at -25°C[1] [cP]	840	830	2400	2390
Dynamic viscosity at -30°C[1] [cP]	1280	1270	4420	4370
Dynamic viscosity at -35°C[1] [cP]	2040	2000	8960	8750
Kinematic viscosity at 40°C[2] [cSt	45.12	44.64	63.30	62.14
Kinematic viscosity at 100°C[2] [cSt]	9.22	9.15	10.90	10.78
VI[3]	193	193	165	166
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270				

TABLE 4 - Additive concentrates containing VM3

Component [wt.%]	Example 5	Example 6	Comp. Ex. 5	Comp. Ex. 6
Base oil 1 [GTL 4]	88.50	88.46	-	-
Base oil 2 [Group I]	-	-	88.50	88.46
VM3	11.50	11.50	11.50	11.50
Antioxidant	-	0.04	-	0.04
TOTAL	100	100	100	100
Properties of the additive concentrate (at normalized VM concentration of 1.0 wt.%)				
Dynamic viscosity at -25°C[1] [cP]	760	750	2210	2170
Dynamic viscosity at -30°C[1] [cP]	1200	1190	4160	4070
Dynamic viscosity at -35°C[1] [cP]	1950	1920	8480	8230
Kinematic viscosity at 40°C[2] [cSt	32.30	32.09	43.62	43.29
Kinematic viscosity at 100°C[2] [cSt]	6.89	6.84	7.90	7.82
VI[3]	191	180	154	152
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270				

TABLE 5 - Additive concentrates containing VM4 or VM5

Component [wt.%]	Example 7	Example 8	Camp. Ex. 7	Comp. Ex. 8
Base oil 1 [GTL 4]	87.68	90.87	-	-
Base oil 2 [Group I]	-	-	87.68	90.87
VM4	12.27	-	12.27	-
VM5	-	9.09	-	9.09

(continued)

Component [wt.%]	Example 7	Example 8	Camp. Ex. 7	Comp. Ex. 8
Antioxidant	0.05	0.04	0.05	0.04
TOTAL	100	100	100	100
Properties of the additive concentrate (at normalized VM concentration of 1.0 wt.%)				
Dynamic viscosity at -25°C[1] [cP]	660	660	1940	2010
Dynamic viscosity at -30°C[1] [cP]	1030	1050	3640	3830
Dynamic viscosity at -35°C[1] [cP]	1660	1710	7360	8000
Kinematic viscosity at 40°C[2] [cSt	31.95	37.84	44.02	53.51
Kinematic viscosity at 100°C[2] [cSt]	6.92	8.02	8.07	9.55
VI[3]	186	192	158	164
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270				

Storage Stability

[0045] In order to demonstrate the storage stability properties of the additive concentrates according to the present invention, separate samples of the additive concentrate of Example 1 were stored for 30 days at temperatures of 70°C, ambient (20°C), 0°C and -20°C, respectively. The measured viscosities after 30 days of storage are indicated in Table 6 below. Similar good stability properties were obtained for the additive concentrates of Examples 2-8.

TABLE 6 - Storage stability of additive concentrate of Example 1

	When prepared (see Table 2)	After 30 days storage at 70°C	After 30 days storage at 20°C	After 30 days storage at 0°C	After 30 days storage at -20°C
Properties of the additive concentrate (at normalized VM concentration of 1.0 wt.%)					
Kinematic viscosity at 40°C[2] [cSt	37.30	33.25	37.15	37.08	36.85
Kinematic viscosity at 100°C[2] [cSt]	7.83	7.06	7.80	7.78	7.75
VI[3]	188	182	187	187	187
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270					

SAE 5W30 engine oils

[0046] Whilst using the additive concentrates of Example 2 and 4 above and a conventional additive package, two SAE 5W-30 engine oil formulations (Examples 9 and 10) were prepared meeting the so-called SAE J300 Specifications (as revised in January 2009). SAE stands for Society of Automotive Engineers.

[0047] The amounts of the components and the properties of the 5W-30 engine oil are indicated in Table 7 below.

[0048] The additive package contained a pour point depressant and other typical additives for use in a SAE 5W-30 engine oil.

TABLE 7 - SAE 5W-30 engine oils

Component [wt.%]	5W-30 specification	Example 9	Example 10
Base oil 3	-	75.9	76.8
Base oil 4	-	5.6	5.4
Additive package	-	10.5	10.4
Additive concentrate of Example 2	-	8.0	-
Additive concentrate of Example 4	-	-	7.4
TOTAL	-	100	100
Properties of the 5W-30 engine oil			
Dynamic viscosity at -30°C[1] [cP]	<6600	5500	5370
Kinematic viscosity at 40°C[2] [cSt	-	58.73	57.32
Kinematic viscosity at 100°C[2] [cSt]	9.3 to 12.5	10.09	9.95
VI[3]	-	160	161
MRV[4] at -35°C [cP]	<60000	21100	19900
HTHS[5] at 150°C [cP]	>2.9	2.976	2.955
[1]According to ASTM D 5293 [2]According to ASTM D 7042 [3]According to ASTM D 2270 [4]According to ASTM D 4684 [5]According to ASTM D 4683			

Discussion

[0049] As can be learned from Tables 2-5, the present invention now surprisingly provides the possibility to prepare additive concentrates containing a viscosity modifier using Fischer-Tropsch derived base oils, but without significant amounts of solvency boosters or even without the use of solvency boosters at all. Also, it can be seen that the additive concentrates according to the present invention show, when compared with conventional additive concentrates using mineral derived Group I (i.e. non-Fischer-Tropsch derived) base oils, significantly better low temperature properties, which is highly desirable for formulating multi-grade lubricants.

[0050] Furthermore, as exemplified by Table 6, the additive concentrates according to the present invention have excellent storage stability at various temperatures for extended periods of time.

[0051] The additive concentrates according to the present invention are suitable for use in a wide range of lubricants, such as in e.g. engine oils and transmission fluids and other lubricants for which a viscosity modifier is desired. As shown in Table 7, SAE 5W-30 formulations can be formulated when using the additive concentrates according to the present invention.

Claims

1. An additive concentrate comprising:

- a Fischer-Tropsch derived base oil;
- at least 3.0 wt.% of a viscosity modifier, based on the total weight of the additive concentrate; and
- less than 5.0 wt.% of a solvency booster, based on the total weight of the additive concentrate.

2. Additive concentrate according to claim 1, wherein the additive concentrate comprises at least 80 wt.% of the Fischer-Tropsch derived base oil, preferably at least 90 wt.%, based on the total weight of the additive concentrate.

3. Additive concentrate according to claim 1 or 2, wherein the additive concentrate comprises less than 10.0 wt.% of a non-Fischer-Tropsch derived base oil, preferably less than 5.0 wt.%, more preferably less than 2.0 wt.%, even

more preferably less than 1.0 wt.%, based on the total weight of the additive concentrate.

4. Additive concentrate according to any one of claims 1 to 3, wherein the Fischer-Tropsch derived base oil has a kinematic viscosity at 100°C (according to ASTM D7042) of below 5.0 mm^2/s, preferably below 4.5 mm^2/s, more preferably below 4.2 mm^2/s.

5. Additive concentrate according to any one of claims 1 to 4, wherein the Fischer-Tropsch derived base oil has a Viscosity Index (according to ASTM D 2270) of at least 125, preferably at least 130.

6. Additive concentrate according to any one of claims 1 to 5, wherein the additive concentrate comprises from 5.0 to 25 wt.%, preferably from 6.0 to 20.0 wt.% of the viscosity modifier, based on the total weight of the additive concentrate.

7. Additive concentrate according to any one of claims 1 to 6, wherein the additive concentrate comprises less than 2.0 wt.%, preferably less than 1.0 wt.%, more preferably less than 0.5 wt.%, of the solvency booster, based on the total weight of the additive concentrate.

8. Additive concentrate according to any one of claims 1 to 7, wherein the solvency booster has an aniline point (according to ASTM D 611) of less than 100°C.

9. Additive concentrate according to any one of claims 1 to 8, wherein the solvency booster is an alkylated aromatic component.

10. Additive concentrate according to claim 9, wherein the alkylated aromatic component is selected from alkylated benzenes, alkylated anthracenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated naphthalenes, or any mixtures thereof.

11. Additive concentrate according to any one of claims 1 to 10, wherein the additive concentrate when normalized at a concentration of viscosity modifier of 1.0 wt.% has a dynamic viscosity at -30°C (according to ASTM D 5293) of below 3000 cP and a kinematic viscosity at 100°C (according to ASTM D 7042) of at least 5.5 cSt.

12. Additive concentrate according to any one of claims 1 to 11, further comprising 5 to 500 ppm of an anti-oxidant, preferably selected from a phenolic and aminic anti-oxidant, or a mixture thereof.

13. A lubricant composition comprising a base oil, one or more additives other than a viscosity modifier and the additive concentrate according to any one of claims 1 to 12.

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 7029

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/133407 A1 (ABERNATHY SUSAN M [US] ET AL) 23 June 2005 (2005-06-23) * paragraph [0147]; tables II, IV * -----	1-13	INV. C10M169/04 C10M171/02
X	WO 02/064710 A2 (SHELL INT RESEARCH [NL]; DANIEL MERVYN FRANK [US]; GERMAINE GILBERT RO) 22 August 2002 (2002-08-22) * claims; example 3; tables 4,5 * -----	1-13	ADD. C10N30/02 C10N20/02 C10N40/04
X	EP 1 688 476 A1 (CHEVRON ORONITE CO [US]) 9 August 2006 (2006-08-09) * claims; examples 1,2; tables 1,2 * -----	1-13	
X	US 2009/088352 A1 (ZAKARIAN JOHN A [US] ET AL) 2 April 2009 (2009-04-02) * claims; example 7; tables 2,3 * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)
C10M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 April 2010	Glod, Guy

CATEGORY OF CITED DOCUMENTS

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1 EPO FORM 1503 03.82 (P04C01)

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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16-04-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005133407 A1	23-06-2005	AU 2004312303 A1	21-07-2005
		BR PI0417998 A	27-04-2007
		CN 1906273 A	31-01-2007
		GB 2409461 A	29-06-2005
		JP 2007516337 T	21-06-2007
		NL 1027827 C2	09-05-2006
		NL 1027827 A1	27-06-2005
		WO 2005066314 A1	21-07-2005
		ZA 200605618 A	28-11-2007
WO 02064710 A2	22-08-2002	AR 032803 A1	26-11-2003
		AT 302258 T	15-09-2005
		AT 307865 T	15-11-2005
		AU 2002249198 B2	12-10-2006
		AU 2002308283 B2	21-09-2006
		BR 0207091 A	20-01-2004
		BR 0207092 A	20-01-2004
		CA 2437858 A1	22-08-2002
		CA 2437862 A1	22-08-2002
		DE 60205596 D1	22-09-2005
		DE 60205596 T2	24-05-2006
		DE 60206891 D1	01-12-2005
		DE 60206891 T2	21-09-2006
		DK 1370633 T3	21-11-2005
		DK 1368446 T3	06-03-2006
		WO 02064711 A1	22-08-2002
		EP 1370633 A1	17-12-2003
		EP 1368446 A2	10-12-2003
		ES 2248538 T3	16-03-2006
		ES 2252469 T3	16-05-2006
		JP 2004521976 T	22-07-2004
		JP 2004521977 T	22-07-2004
		MX PA03007088 A	18-11-2003
		MX PA03007160 A	18-11-2003
		NO 20033559 A	10-10-2003
		NZ 526900 A	28-10-2005
		NZ 527127 A	30-09-2005
		US 2004118744 A1	24-06-2004
		US 2004077505 A1	22-04-2004
EP 1688476 A1	09-08-2006	CA 2534615 A1	31-07-2006
		JP 2006213921 A	17-08-2006
		SG 124409 A1	30-08-2006
		US 2006172898 A1	03-08-2006
US 2009088352 A1	02-04-2009	WO 2009042396 A1	02-04-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2009074572 A **[0003] [0007] [0023]**
- WO 02070631 A **[0034]**

Non-patent literature cited in the description

- Viscosity and flow properties of multigrade engine oils. *Proceedings of Conference,* December 1977 **[0019]**
- Kirk-Othmer Encyclopedia of Chemical Technology. vol. 14, 477-526 **[0029]**