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(54) LUBRICATING COMPOSITION

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(57) **ABSTRACT**

There is disclosed a lubricant composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

LUBRICATING COMPOSITION

DESCRIPTION OF THE DISCLOSURE

[0001] 1. Field of the Disclosure

[0002] The present disclosure relates to a lubricating composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400, and methods of use thereof.

[0003] 2. Background of the Disclosure

[0004] In recent years, compositional differences between lubricants has become an increasingly important issue as changing engine and industrial applications demand higher quality lubricants which can provide improved functions. For example, there has been a growing concern to produce lubricants that can increase power transmission, such as by increasing torque, in a machine. Moreover, modern engine oil specifications require lubricants to demonstrate fuel efficiency in standardized engine tests.

[0005] Historically, in order to meet new performance requirements, formulators enhanced lubricants by selecting and including more robust additive packages. However, it is known that some additives are very expensive. And, the use of additional amounts of an additive to a lubricant composition to achieve various functions, such as to reduce thin-film friction or to prolong the useful life of a lubricant, can be quite costly to the manufacturer.

[0006] A major component of a lubricant composition can be the base oil, which is relatively inexpensive. Base oils are known and have been categorized under Groups I-V. The base oils are placed in a given Group based upon their % saturates, % sulfur content, and viscosity index. For example, all Group III base oils have greater than 90% saturates, less than 0.03% sulfur, and a viscosity index greater than or equal to 120. However, the proportions of aromatics, paraffinics, and naphthenics can vary substantially within a Group of base oils. It is now known that the difference in these proportions can affect the properties of a lubricant composition, such as increased torque.

[0007] What is needed is a lubricant composition that is inexpensive and can provide at least one of increased torque, reduced high temperature high shear viscosity, and increased fuel economy.

SUMMARY OF THE DISCLOSURE

[0008] In accordance with the disclosure, there is provided a lubricant composition comprising a base oil, wherein the ratio of the isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

[0009] In an aspect, there is provided a method of improving torque in a machine comprising providing to the machine a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

[0010] In another aspect, there is provided a method of improving torque in a machine comprising providing to the machine a composition comprising a base oil having reduced high temperature high shear viscosity as compared to another base oil.

[0011] In a further aspect, there is provided a method of increasing fuel economy in a vehicle comprising providing to the vehicle a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

[0012] In yet another aspect, there is provided a method of reducing thin-film friction of a fluid between surfaces comprising providing to the surfaces a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

[0013] Additional objects and advantages of the disclosure will be set forth in part in the description which follows, and can be learned by practice of the disclosure. The objects and advantages of the disclosure will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[0014] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the disclosure, as claimed.

DESCRIPTION OF THE EMBODIMENTS

[0015] The present disclosure relates to lubricant compositions comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

[0016] As used herein, the term “isoparaffins” refers to paraffins comprising branched hydrocarbyl chains.

[0017] As used herein, the term “normal paraffins” refers to paraffins comprising straight hydrocarbyl chains.

[0018] As used herein, the term “I/N ratio” refers to the ratio of isoparaffins to normal paraffins.

[0019] As used herein, the term “hydrocarbyl,” “hydrocarbyl substituent” or “hydrocarbyl group” is used in its ordinary sense, which is well-known to those skilled in the art. Specifically, it refers to a group having a carbon atom directly attached to the remainder of the molecule and having predominantly hydrocarbon character. Examples of hydrocarbyl groups include:

[0020] (1) hydrocarbon substituents, that is, aliphatic (e.g., alkyl or alkenyl), alicyclic (e.g., cycloalkyl, cycloalkenyl) substituents, and aromatic-, aliphatic-, and alicyclic-substituted aromatic substituents, as well as cyclic substituents wherein the ring is completed through another portion of the molecule (e.g., two substituents together form an alicyclic radical);

[0021] (2) substituted hydrocarbon substituents, that is, substituents containing non-hydrocarbon groups which, in the context of this invention, do not alter the predominantly hydrocarbon substituent (e.g., halo (especially chloro and fluoro), hydroxy, alkoxy, mercapto, alkylmercapto, nitro, nitroso, and sulfoxy);

[0022] (3) hetero substituents, that is, substituents which, while having a predominantly hydrocarbon character, in the context of this invention, contain other than carbon in a ring or chain otherwise composed of carbon atoms. Heteroatoms include sulfur, oxygen, nitrogen, and encompass substituents as pyridyl, furyl, thienyl and imidazolyl. In general, no more than two, for example no more than one, non-hydrocarbon substituent will be present for every ten carbon atoms in the hydrocarbyl group; typically, there will be no non-hydrocarbon substituents in the hydrocarbyl group.

[0023] Base oils suitable for use herein can be selected from any of the synthetic or mineral oils or mixtures thereof. Mineral oils include animal oils and vegetable oils (e.g., castor oil, lard oil) as well as other mineral lubricating oils such as liquid petroleum oils and solvent treated, acid-treated, hydroisomerized, or hydrocracked mineral lubricating oils of the paraffinic, naphthenic or mixed paraffinic-naphthenic types. Oils derived from coal or shale are also suitable. Further, oils derived from a gas-to-liquid process are also suitable.

[0024] The base oil can be present in a major amount, wherein "major amount" is understood to mean greater than or equal to 50%, for example from about 80 to about 98 percent by weight of the lubricant composition.

[0025] The base oil can have any desired viscosity that is suitable for the intended purpose. Examples of suitable engine oil kinematic viscosities can range from about 2 to about 150 cSt and, as a further example, from about 5 to about 15 cSt at 100° C. Thus, fully finished oils can be rated to have viscosity ranges of about SAE 15 to about SAE 250, and as a further example, from about SAE 20W to about SAE 50. Suitable automotive oils and gear oils also include multigrade oils such as 15W-40, 20W-50, 75W-140, BOW-90, 85W-140, 85W-90, and the like.

[0026] Non-limiting examples of synthetic oils include hydrocarbon oils such as polymerized and interpolymerized olefins (e.g., polybutylenes, polypropylenes, propylene isobutylene copolymers, etc.); polyalphaolefins such as poly (1-hexenes), poly(1-octenes), poly(1-decenes), etc. and mixtures thereof; poly internal olefins such as poly(2-butenes), poly(2-pentenes), poly(3-hexenes), etc. and mixtures thereof; poly alkylbenzenes (e.g., dodecylbenzenes, tetradecylbenzenes, di-nonylbenzenes, di-(2-ethylhexyl)benzenes, etc.); polyphenyls (e.g., biphenyls, terphenyl, alkylated polyphenyls, etc.); alkylated diphenyl ethers and alkylated diphenyl sulfides and the derivatives, analogs and homologs thereof and the like.

[0027] Alkylene oxide polymers and interpolymers and derivatives thereof where the terminal hydroxyl moieties have been modified by esterification, etherification, etc., constitute another class of known synthetic oils that can be used. Such oils are exemplified by the oils prepared through polymerization of ethylene oxide or propylene oxide, the alkyl and aryl ethers of these polyoxyalkylene polymers (e.g., methyl-polyisopropylene glycol ether having an average molecular weight of about 1000, diphenyl ether of polyethylene glycol having a molecular weight of about 500-1000, diethyl ether of polypropylene glycol having a molecular weight of about 1000-1500, etc.) or mono- and polycarboxylic esters thereof, for example, the acetic acid esters, mixed C_{3-8} fatty acid esters, or the C_{13} Oxo acid diester of tetraethylene glycol.

[0028] Another class of synthetic oils that can be used includes the esters of dicarboxylic acids (e.g., phthalic acid, succinic acid, alkyl succinic acids, alkenyl succinic acids, maleic acid, azelaic acid, suberic acid, sebacic acid, fumaric acid, adipic acid, linoleic acid dimer, malonic acid, alkyl malonic acids, alkenyl malonic acids, etc.) with a variety of alcohols (e.g., butyl alcohol, hexyl alcohol, dodecyl alcohol, 2-ethylhexyl alcohol, ethylene glycol, diethylene glycol monoether, propylene glycol, etc.) Specific examples of these esters include dibutyl adipate, di(2-ethylhexyl)sebacate, di-n-hexyl fumarate, dioctyl sebacate, diisooctyl azelate, diisodecyl azelate, dioctyl phthalate, didecyl phthalate, dieicosyl sebacate, the 2-ethylhexyl diester of linoleic acid dimer, the complex ester formed by reacting one mole of sebacic acid with two moles of tetraethylene glycol and two moles of 2-ethylhexanoic acid and the like.

[0029] Esters useful as synthetic oils also include those made from C_{5-12} monocarboxylic acids and polyols and polyol ethers such as neopentyl glycol, trimethylol propane, pentaerythritol, dipentaerythritol, tripentaerythritol, etc.

[0030] Hence, the base oil used which can be used to make the compositions as described herein can be selected from any of the base oils in Groups I-V as specified in the American Petroleum Institute (API) Base Oil Interchangeability Guidelines. Such base oil groups are as follows:

[0031] Group I contain less than 90% saturates and/or greater than 0.03% sulfur and have a viscosity index greater than or equal to 80 and less than 120; Group II contain greater than or equal to 90% saturates and less than or equal to 0.03% sulfur and have a viscosity index greater than or equal to 80 and less than 120; Group III contain greater than or equal to 90% saturates and less than or equal to 0.03% sulfur and have a viscosity index greater than or equal to 120; Group IV are polyalphaolefins (PAO); and Group V include all other basestocks not included in Group I, II, III or IV. In an embodiment, the base oil comprises a Group II+base oil. In another embodiment, the base oil comprises a Group III base oil.

[0032] The test methods used in defining the above groups are ASTM D 2007 for saturates; ASTM D 2270 for viscosity index; and one of ASTM D 2622, 4294, 4927 and 3120 for sulfur.

[0033] Group IV basestocks, i.e. polyalphaolefins (PAO) include hydrogenated oligomers of an alpha-olefin, the most important methods of oligomerisation being free radical processes, Ziegler catalysis, and cationic, Friedel-Crafts catalysis.

[0034] The polyalphaolefins typically have viscosities in the range of 2 to 100 cSt at 100° C., for example 4 to 8 cSt at 100° C. They can, for example, be oligomers of branched or straight chain alpha-olefins having from about 2 to about 30 carbon atoms, non-limiting examples include polypropenes, polyisobutenes, poly-1-butenes, poly-1-hexenes, poly-1-octenes and poly-1-decene. Included are homopolymers, interpolymers and mixtures.

[0035] Regarding the balance of the basestock referred to above, a "Group I basestock" also includes a Group I basestock with which basestock(s) from one or more other groups can be admixed, provided that the resulting admixture has characteristics falling within those specified above for Group I basestocks.

[0036] Exemplary basestocks include Group I basestocks and mixtures of Group II basestocks with Group I bright stock.

[0037] Basestocks suitable for use herein can be made using a variety of different processes including but not limited to distillation, solvent refining, hydrogen processing, oligomerisation, esterification, and re-refining.

[0038] The base oil can be an oil derived from Fischer-Tropsch synthesized hydrocarbons. Fischer-Tropsch synthesized hydrocarbons can be made from synthesis gas containing H_2 and CO using a Fischer-Tropsch catalyst. Such hydrocarbons typically require further processing in order to be useful as the base oil. For example, the hydrocarbons can be hydroisomerized using processes disclosed in U.S. Pat. No. 6,103,099 or 6,180,575; hydrocracked and hydroisomerized using processes disclosed in U.S. Pat. No. 4,943,672 or 6,096,940; dewaxed using processes disclosed in U.S. Pat. No. 5,882,505; or hydroisomerized and dewaxed using processes disclosed in U.S. Pat. Nos. 6,013,171; 6,080,301; or 6,165,949.

[0039] Unrefined, refined and rerefined oils, either mineral or synthetic (as well as mixtures of two or more of any of these) of the type disclosed hereinabove can be used in the base oils. Unrefined oils are those obtained directly from a mineral or synthetic source without further purification treatment. For example, a shale oil obtained directly from retorting operations, a petroleum oil obtained directly from primary distillation or ester oil obtained directly from an esterification process and used without further treatment would be an unrefined oil. Refined oils are similar to the unrefined oils except they have been further treated in one or more purification steps to improve one or more properties. Many such purification techniques are known to those skilled in the art such as solvent extraction, secondary distillation, acid or base extraction, filtration, percolation, etc. Rerefined oils are obtained by processes similar to those used to obtain refined oils applied to refined oils which have been already used in service. Such rerefined oils are also known as reclaimed or reprocessed oils and often are additionally processed by techniques directed to removal of spent additives, contaminants, and oil breakdown products.

[0040] In an aspect, the base oil used herein can conform to the GF-4 standards and above set forth by the International Lubricants Standardization and Approval Committee (ILSAC).

[0041] In an embodiment, the ratio of isoparaffins to normal paraffins in the base oil can range from about 30 to about 400, for example from about 50 to about 300.

[0042] In another aspect, the base oil can further comprise an average paraffin carbon number of less than about 23. The "average paraffin carbon number" can be easily determined by one skilled in the art, for example by multiplying the number of carbon atoms in each type of paraffin in the composition by the weight percent of each type of paraffin and then adding the products.

[0043] The disclosed composition can also comprise a detergent inhibitor ("DI") package which can provide varying amounts of additives, depending on the needs of the application. In an aspect, the DI package can comprise at least one additive selected from the group consisting of oxidation inhibitors, corrosion inhibitors, friction modifiers, antiwear agents, extreme pressure agents, detergents, dispersants, antifoam agents, pour point depressants, deodorizers, seal swell agents, demulsifiers, coloring agents, and fluidizing agents.

[0044] In an embodiment, the DI package can comprise a detergent selected from any of the detergents known to those skilled in the art. Suitable detergents include but are not limited to Mannich bases, polyalkylene amines, polyalkylene succinimides where the polyalkylene group typically has a number average molecular weight of from about 600 to about 2000, such as from about 800 to about 1400, polyether amines, neutral or overbased metal salts of sulfonates, phenates, salicylates, and carboxylates, and mixtures thereof.

[0045] As used herein, the terms "neutral" and "overbased" are used in their ordinary senses, which are well-known to those skilled in the art. Specifically, "neutral" is understood to mean a salt complex which contains a substantially stoichiometric amount of metal to salt. "Overbased" is understood to mean a salt complex which contains metal in stoichiometric excess of what is required to form the neutral salt. In an aspect, the detergents can have a total base number (TBN) ranging from about 40 to about 600, such as from about 100 to about 400, and from about 140 to about 350. TBN is measured according to ASTM D 2896.

[0046] The metal of the neutral or overbased metal salt can be an alkali metal or an alkaline earth metal. Non-limiting examples of alkali and alkaline earth metals include lithium, sodium, potassium, calcium, magnesium, barium, strontium, and mixtures thereof. In an embodiment, the detergent can be an overbased calcium sulfonate.

[0047] In another aspect, the disclosed composition can comprise a pour point depressant selected from any of the pour point depressants known to those skilled in the art. Suitable pour point depressants include, but are not limited to, polymethacrylates, polyacrylates, condensation products of haloparaffin waxes and aromatic compounds, and vinyl carboxylate polymers, such as ethylene vinyl acetate copolymers. Other non-limiting examples of compounds that are useful as pour point depressants include terpolymers made by polymerizing a dialkyl fumarate, vinyl ester of a fatty acid and a vinyl alkyl ether. Techniques for preparing such polymers and their uses are disclosed in U.S. Pat. No. 3,250,715, which is incorporated herein by reference. In an embodiment, the pour point depressant can be a polymethacrylate.

[0048] In yet another aspect, the disclosed composition can comprise a viscosity index improver selected from any of the viscosity index improvers known to those skilled in the art. Suitable viscosity index improvers include, but are not limited to, hydrocarbyl polymers reacted or grafted with nitrogen-containing polymers; copolymers of alkyl methacrylates reacted or grafted with nitrogen-containing monomers, such as vinyl pyridine, N-vinyl pyrrolidone and N,N'-dimethylaminoethylene; polyalkylacrylates obtained from the polymerization or copolymerization of one or more alkyl acrylates; functionalized polymers; and the like. Examples of functionalized polymers include, but are not limited to, olefin copolymers and acrylate or methacrylate copolymers. Functionalized olefin copolymers can be, for example, styrene monomers or copolymers of ethylene and propylene which can be further reacted or grafted with an active monomer, such as maleic anhydride. Such copolymers can be further derivatized with an alcohol or an amine. Other such copolymers can include copolymers of ethylene and an α-olefin, such as propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, 1-decene, and styrene. Said copolymers can be further reacted or grafted with nitrogen-compounds. Other examples of suitable viscosity index improvers include, but are not limited to, polyisobutylene, methacrylate, polyalkylstyrene, and ethylene/propylene/1,4-hexadiene polymers. In an embodiment, the viscosity index improver can be an ethylene-propylene copolymer.

[0049] Optionally, other components can be present in the lubricant composition. Non-limiting examples of other components include phosphorus-containing compounds, ash-containing detergents, ashless-detergents, overbased detergents, supplemental pour point depressants, supplemental viscosity index improvers, ash-containing friction modifier, ashless friction modifier, nitrogen-containing friction modifier, nitrogen-free friction modifier, esterified friction modifier, supplemental extreme pressure agents, rust inhibitors, supplemental antioxidants, supplemental corrosion inhibitors, supplemental anti-foam agents, titanium compounds, titanium complexes, organic soluble molybdenum compounds, organic soluble molybdenum complexes, boron-containing compounds, and boron-containing complexes, and mixtures thereof.

[0050] The lubricating compositions disclosed herein can be used to lubricate anything. In an aspect, the lubricating composition can be an engine composition that is used to lubricate an engine. However, one of ordinary skill in the art would understand that the disclosed lubricating compositions can be used to lubricate anything, e.g., any surface, such as those where thin-film friction can be present or where torque can be optimized. Moreover, there is disclosed a method of reducing thin-film friction of a fluid between surfaces comprising providing to the fluid the disclosed composition. Also disclosed herein is a method of lubricating a machine, such as an engine, transmission, automotive gear, a gear set, and/or an axle with the disclosed lubricating composition.

[0051] It is further envisioned that the lubricating compositions can be provided to any machinery wherein fuel economy or improving torque is an issue. In particular, there is disclosed a method of increasing fuel economy in a machine comprising providing to a machine a composition comprising a base oil comprising a reduced ratio of isoparaffins to normal paraffins, as compared to the ratio of isoparaffins to normal paraffins in another base oil. In an aspect, the machine is selected from the group consisting of an engine, transmission, automotive gear, a gear set, and an axle. Additionally, there is disclosed a method of improving fuel economy in a machine, such as an engine, transmission, automotive gear, a gear set, and/or an axle, comprising providing to a machine the disclosed composition.

[0052] There is also disclosed a method of improving torque in a machine comprising providing to a machine a composition comprising a base oil comprising a reduced ratio of isoparaffins to normal paraffins, as compared to the ratio of isoparaffins to normal paraffins in another base oil. "Improving torque" is understood to mean enhancing the peak torque in a machine comprising the disclosed composition as compared to a machine that does not comprise the disclosed composition. In an aspect, the machine is selected from the group consisting of an engine, transmission, automotive gear, a gear set, and an axle. Peak torque is specific to every family of engine and can be easily identified by one of ordinary skill in the art, such as by using a chassis dynamometer and measuring the torque produced by the engine through the rear wheels.

[0053] Further disclosed herein is a method of improving torque in a machine comprising providing to the machine a composition comprising a base oil having reduced high temperature high shear viscosity (HTHSV) as compared to another base oil. As used herein, the term "another base oil" refers to a typical base oil that conforms to the categorization standards of a Group I-V base oil. The HTHSV of a base oil can be easily measured by one skilled in the art, such as according to ASTM D 4683 at 100° C. In an aspect, the base oil is a mineral base oil, synthetic base oil, or a mixture thereof a polyalphaolefin, a Group II+base oil, or a Group III base oil.

EXAMPLES

Example 1

[0054] It is known in the industry that Group II or III base oils comprise more than 90% saturates, less than 0.03% sulfur, and have a viscosity index from about 80 to about 120 or greater. However, not all Group II or III base oils have the same power transmission properties. As shown in Table 1, fully finished lubricating compositions comprising various Group II and III base oils were analyzed according to the procedure in Analytical Chemistry, 64:2227 (1992), the disclosure of which is hereby incorporated by reference, in order to determine the type of paraffins, cycloparaffins, and aromatics in the compositions.

[0055] In this example, a 2003 Chevrolet Silverado pick-up truck was powered by a 5.3 L V8 engine that was lubricated by the lubricating compositions listed in Table 1. The truck was restrained on a Mustang Performance Dynamometer that was programmed with the appropriate inertia and horsepower absorbance factors for the vehicle. Horsepower was measured at the rear wheels while the truck was accelerated at wide-open throttle through first gear on a simulated 25% grade. Between 10 and 15 torque readings were taken on each Example and the data at the torque peak between 3600 and 4200 rpm were corrected to standard conditions in accordance with SAE J1349, the disclosure of which is herein incorporated by reference. A double-flush technique was used to flush each Example in the truck's crankcase to assure minimal carryover from the previous test. This was followed by a 30-minute break-in period, whereby the truck was operated at 60 mph for 30 minutes while in third gear, before taking further torque measurements. The HTHSV of each Example was also measured according to ASTM D 4683 at 100° C. The results are shown below in Table 11

TABLE 1

Examples	Peak Torque (N * m)	100° C. HTHSV (mPa * s)	Avg. Paraffin Carbon Number	I/N Ratio
A	326.1	6.43	20.7	191
B	325.2	6.50	20.5	142
C	324.8	6.54	21.3	169
D	323.8	6.80	21.4	429
E	323.3	7.22	19.3	452

[0056] As shown in Table 1, a linear relationship exists between the torque and 100° C. HTHSV value—the lower the 100° C. HTHSV value, the higher the torque. The linear correlation between torque and 100° C. HTHSV is demonstrated by an R^2 value of 0.845. The results show that Example A had the lowest 100° C. HTHSV value (6.43 mPa*s) and produced the highest amount of torque (326.1 N*m). In comparison, Example E had the highest 100° C. HTHSV value (7.22 mPa*s) and produced the lowest amount of torque (323.3 N*m). Likewise, Example B had a lower 100° C. HTHSV value (6.50 mPa*s) than Example D (6.80 mPa*s) and produced a higher amount of torque (325.2 N*m) than Example D (323.8 N*m). Thus, it can be seen that torque can be improved by decreasing the 100° C. high temperature high shear viscosity of a base oil.

[0057] As can also be seen in Table 1, the Examples which have the lowest 100° C. HTHSV value (and thus produce the highest torques) also have the lowest I/N ratios. For example, in addition to the torque and 100° C. HTHSV values discussed above, Example A also had the lowest I/N ratio (191) while Example E had the highest I/N ratio (452). Thus, it can be seen that torque can also be improved by decreasing the I/N ratio of a base oil. One of ordinary skill in the art would understand that the higher the torque the better the fuel economy.

Example 2

[0058] In this example, fully formulated lubricating compositions were prepared by blending several different Group II and II+base oils with 11.5 wt. % of a DI package (HiTEC®

1136, provided by Afton Chemical Corp.), 8.6 wt. % of an ethylene-propylene olefin copolymer viscosity index improver (Paratone® 8021, provided by Chevron Oronite), and 0.5 wt. % of a polymethacrylate pour point depressant (Viscoplex® 1-440, provided by RohMax). The DI package included a calcium overbased detergent, zinc dialkyldithiophosphate, amine-free organic friction modifier, moldybenum-containing friction modifier, diphenylamine antioxidant, sulfurized olefin antioxidant, antifoam agent, and process oil.

[0059] Each lubricating composition was analyzed according to the procedure described above. The HTHSV of each lubricating composition was also measured according to ASTM D 4683 at 100° C., as described above. The results are shown in Table 2 below.

TABLE 2

Examples	100° C. HTHSV (mPa * s)	Avg. Paraffin Carbon Number	I/N Ratio
F	7.22	22.1	874
G	6.87	22.3	583
H	6.62	21.5	112
I	6.55	22.6	95
J	7.08	24.7	77
K	6.75	23.0	48

[0060] The results in Table 2 demonstrate that as the I/N ratio decreases, so does the 100° C. HTHSV value (and thus the torque should increase as well.) For instance, Example F had a high I/N ratio (874) and a correspondingly high 100° C. HTHSV value (7.22 mPa*s). Therefore, Example F should have low torque, as discussed above in Example 1. In comparison, Example K had a low I/N ratio (48) and a correspondingly low 100° C. HTHSV value (6.75 mPa*s). Therefore, Example K should have high torque, as discussed in Example 1. While Example J has a lower I/N ratio than Example I, Example J has a significantly higher average paraffin carbon number, which offsets the low I/N ratio and results in a higher 100° C. HTHSV value (7.08 mPa*s). Therefore, Example J should have a higher torque value than Example I.

[0061] At numerous places throughout this specification, reference has been made to a number of U.S. patents, published foreign patent applications and published technical papers. All such cited documents are expressly incorporated in full into this disclosure as if fully set forth herein.

[0062] For the purposes of this specification and appended claims, unless otherwise indicated, all numbers expressing quantities, percentages or proportions, and other numerical values used in the specification and claims, are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the following specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by the present disclosure. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques.

[0063] It is noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the," include plural referents unless expressly and unequivocally limited to one referent. Thus, for example, reference to "an antioxidant" includes two or more different antioxidants. As used herein, the term "include" and its grammatical variants are intended to be non-limiting, such that recitation of items in a list is not to the exclusion of other like items that can be substituted or added to the listed items.

[0064] While particular embodiments have been described, alternatives, modifications, variations, improvements, and substantial equivalents that are or can be presently unforeseen can arise to applicants or others skilled in the art. Accordingly, the appended claims as filed and as they can be amended are intended to embrace all such alternatives, modifications variations, improvements, and substantial equivalents.

What is claimed is:

1. A lubricant composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

2. The lubricant composition of claim **1**, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 50 to about 300.

3. The lubricant composition of claim **1**, wherein the base oil further comprises an average paraffin carbon number less than about 23.

4. The lubricant composition of claim **1**, further comprising a detergent inhibitor package comprising at least one additive selected from the group consisting of oxidation inhibitors, corrosion inhibitors, friction modifiers, antiwear agents, extreme pressure agents, detergents, dispersants, antifoam agents, pour point depressants, deodorizers, seal swell agents, demulsifiers, coloring agents, and fluidizing agents.

5. The lubricant composition of claim **3**, wherein the detergent is selected from the group consisting of overbased phenates, overbased salicylates, overbased sulfonates, overbased carboxylates, and mixtures thereof.

6. The lubricant composition of claim **3**, wherein the viscosity index improver is selected from the group consisting of a nitrogen-containing polymeric viscosity index improver dispersant, an ester-containing polymeric viscosity index improver dispersant, and a non-dispersant viscosity index improver.

7. The lubricant composition of claim **3**, wherein the viscosity index improver is a copolymer of ethylene and an α-olefin selected from the group consisting of propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, 1-decene, and styrene.

8. The lubricant composition of claim **3**, wherein the pour point depressant is selected from the group consisting of polymethacrylates, polyacrylamides, condensation products of haloparaffin waxes and aromatic compounds, vinyl carboxylate polymers, and terpolymers of dialkylfumarates, vinyl esters of fatty acids, and alkyl vinyl ethers.

9. The lubricant composition of claim **1**, further comprising at least one additive selected from the group consisting of phosphorus-containing compounds, ash-containing detergents, ashless-detergents, overbased detergents, supplemental pour point depressants, supplemental viscosity index improvers, ash-containing friction modifier, ashless friction modifier, nitrogen-containing friction modifier, nitrogen-free friction modifier, esterified friction modifier, supplemental extreme pressure agents, rust inhibitors, supplemental antioxidants, supplemental corrosion inhibitors, supplemental anti-foam agents, titanium compounds, titanium complexes, organic soluble molybdenum compounds, organic soluble molybdenum complexes, boron-containing compounds, and boron-containing complexes.

10. A method of improving torque in a machine comprising:

providing to the machine a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

11. The method of claim **16**, wherein the base oil is mineral, synthetic, and a mixture thereof.

12. The method of claim **16**, wherein the base oil is a polyalphaolefin.

13. The method of claim **16**, wherein the base oil is a Group II+base oil.

14. The method of claim **16**, wherein the base oil is a Group III base oil.

15. A method of improving torque in a machine comprising:

providing to the machine a composition comprising a base oil having reduced high temperature high shear viscosity as compared to another base oil.

16. A method of increasing fuel economy in a vehicle comprising:

providing to the vehicle a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

17. A method of reducing thin-film friction of a fluid between surfaces comprising:

providing to the surfaces a composition comprising a base oil, wherein the ratio of isoparaffins to normal paraffins in the base oil ranges from about 30 to about 400.

18. An engine, transmission, or gear set lubricated with the lubricant composition according to claim **1**.

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