Hydrocarbon compositions such as PIB as partial base stock replacements in CVT fluids provide improved scuffing and seizure performance at metal on metal interfaces.
HYDROCARBON COMPOSITIONS TO REDUCE SCUFFING AND SEIZURE OF THE METAL ON METAL INTERFACE FOR CONTINUOUSLY VARIABLE TRANSMISSIONS

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a method for lubricating a continuously variable transmission and a composition thereof.

[0002] Continuously variable transmissions (CVT) represent a radical departure from conventional automatic transmissions. The push belt version of the CVT was invented by Dr. Hub Van Doorne, and since its introduction, many cars have been equipped with the push belt CVT system. CVT push belts are manufactured by Van Doorne’s Transmissie VB of Tilburg, the Netherlands. A more detailed description of such transmissions and belts and lubricants employed therein is found in European Patent Application 753 564, published Jan. 15, 1997, as well as references cited therein.

In brief, a belt and pulley system is central to the operation of this type of transmission. The pulley system comprises a pair of pulleys with a V-shaped cross-section, each consisting of a moveable sheave, a fixed sheave, and a hydraulic cylinder. Between the pulleys runs a belt, which consists of a set of metal elements held together by metal bands. In operation, the driving pulley pushes the belt to the driven pulley, thereby transferring power from the input to the output. The transmission drive ratio is controlled by opening or closing the moveable sheaves so that the belt rides lower or higher on the pulley faces. This manner of operation permits continuous adjustment of gear ratio between the input and output shafts.

[0003] It has become clear from commercial use of the CVT that the fluids used in the CVT are just as important as the mechanical design for satisfactory operation. The lubricant must fulfill several functions: to lubricate the metal belt in its contacts with the pulley assembly, the planetary and other gears, the wet-plate clutches, and the bearings; to cool the transmission; and to carry hydraulic signals and power.

The hydraulic pressure controls the belt traction, transmission ratio, and clutch engagement. The lubricant must provide the appropriate degree of friction between the belt and pulley assembly, to avoid the problem of slipage on one hand, and binding on the other, all the while providing protection to the metal surfaces from pitting, scuffing, scratching, flaking, polishing, and other forms of wear. Accordingly, the fluid should maintain a relatively high coefficient of friction for metal/metal contact, as well as exhibiting a suitable degree of shear stability.

[0004] U.S. Pat. No. 4,734,446, Tipton, Mar. 29, 1988, discloses a lubricant mixture suitable for an automatic transmission fluid, comprising a homopolymer of an non-aromatic monolein or a copolymer of said non-aromatic monolein with an aromatic monolein, a nitrogen containing ester, an oil-soluble acrylate polymerization product, and an oil of lubricating viscosity. Other typical ingredients may be included.

[0005] U.S. Pat. No. 5,759,964, Sumiejski, Jun. 2, 1998, discloses an antiwear enhancing composition for lubricants and functional fluids such as automatic transmission fluids. It comprises a boron-containing overbased material, a phosphorus acid, ester, or derivative thereof, and a borated epoxide or borated fatty acid ester of glycerol.

[0006] U.S. Pat. No. 4,792,410, Dec. 20, 1988, Schwind et al., discloses a lubricant mixture suitable for a manual transmission fluid, comprising a boronated overbased alkali or alkaline earth metal salt, a friction modifier or mixture of friction modifiers such as e.g. fatty acid amides and borated derivatives, and an oil of lubricating viscosity. Other typical ingredients may be included.

[0007] The present invention solves the problem of metal on metal scuffing or seizing in a continuously variable transmission by providing a suitable CVT fluid with improved resistant to metal on metal scuffing or seizing by including in the CVT lubricant combinations of alkylated aromatic hydrocarbons, isobutylene polymer, and optionally olefin co-polymer.

[0008] The compositions of the present invention can be used as lubricating oils and greases in industrial applications and in automotive engines, transmissions, and axles. These compositions are effective in a variety of applications including crankcase lubricating oils for spark-ignited and compression-ignited internal combustion engines, including automobile and truck engines, two-cycle engines, aviation piston engines, marine and low-load diesel engines, and the like. They are also useful as additives for traction fluids. Also, automatic transmission fluids, manual transmission fluids, transaxle lubricants, gear lubricants, metalworking lubricants, hydraulic fluids, and other lubricating oil and grease compositions can benefit from the incorporation of the compositions of this invention. The inventive functional fluids are particularly effective as automatic transmission fluids, particularly fluids for continuously variable transmissions, including push-belt type and toroidal traction drive transmissions.

SUMMARY OF THE INVENTION

[0009] The present invention provides formulations and a method suitable for lubricating a continuously variable transmissions, comprising:

[0010] (a) an oil of lubricating viscosity;

[0011] (b) a isobutylene polymer present in an amount of at least 0.5 percent by weight; and

[0012] (c) an alkylated naphthalene or an alkylated benzene present in an amount of at least 0.1 percent by weight.

[0013] The present invention further provides a method for lubricating a continuously variable transmission, comprising imparting to said transmission the aforesaid described formulation.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Various preferred features and embodiments will be described below by way of non-limiting illustration.

[0015] Oil of Lubricating Viscosity

[0016] The first component of the present invention is an oil of lubricating viscosity which is generally present in a major amount (i.e. an amount greater than 50% by weight). Generally, the oil of lubricating viscosity is present in an
amount of greater than 80% by weight of the composition, typically at least 85%, preferably 90 to 95%. Such oil can be derived from a variety of sources, and can include natural and synthetic lubricating oils and mixtures thereof.

[0017] The natural oils useful in making the inventive lubricants and functional fluids include animal oils and vegetable oils (e.g., lard oil, castor oil) as well as mineral lubricating oils such as liquid petroleum oils and solvent treated or acid-treated mineral lubricating oils of the paraffin, naphthenic or mixed paraffinic/naphthenic types which may be further refined by hydrocracking and hydrofinishing processes and are dewaxed. Oils of lubricating viscosity derived from coal or shale are also useful. Useful natural base oils may be those designated by the American Petroleum Institute (API) as Group I, II, or III oils. Group I oils contain >90% saturates and/or >0.03% sulfur and have a viscosity index (VI) of ≥80. Group II oils contain ≥90% saturates, ≤0.09% sulfur, and have a VI of ≥80. Group III oils are similar to Group II but have a VI ≥120.

[0018] Upon occasion, highly refined or hydrocracked natural oils have been referred to as “synthetic” oils. More commonly, however, synthetic lubricating oils are understood to include hydrocarbons oils and halogen-substituted hydrocarbon oils such as polymerized and interpolymerized olefins (e.g., polybutylenes, propylene-propyleneisobutylene copolymers, chlorinated polybutylenes; poly(1-hexenes), poly(1-olefins), poly(1-decenes), and mixtures thereof; alkyl-benzenes (e.g., decydolizebenzenes, tetradecylbenzenes, dinonylbenzenes, di-(2-ethylhexyl)benzenes); polyphenyls (e.g., biphenyls, terphenyls, allylated polyphenyls); allylated diphenyl ethers and alkylated diphenyl sulfides and the derivatives, analogs and homologs thereof and the like. Polyalkaph olefin oils are also referred to as API Group IV oils.

[0019] Alkyone oxide polymers and interpolymers and derivatives thereof where the terminal hydroxyl groups have been modified such as by esterification or etherification constitute another class of known synthetic lubricating oils that can be used. These 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, diethylene glycol having a molecular weight of 1000 to 10000, or diethylene glycol propylene glycol having a molecular weight of 1000-1500) or mono- and polycarboxylic esters thereof, for example, the acetic acid esters, mixed C<sub>18</sub>-fatty acid esters, or the C<sub>18</sub>Oxo acid diester of tetrathyleneglycol.

[0020] Another suitable class of synthetic lubricating oils that can be used comprises 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) with a variety of alcohols (e.g., butyl alcohol, hexyl alcohol, dodecyl alcohol, 2-ethylhexyl alcohol, ethylene glycol, diethylene glycol monoether, or propylene glycol). Specific examples of these esters include dibutyl adipate, di(2-ethylhexyl) sebacate, di-n-hexyl fumarate, dioctyl sebacate, di(octadeylazelate, di(2-ethylhexyl)azelate, di(2-ethylhexyl)phthalate, di(2-ethylhexyl) terephthalate, di(2-ethylhexyl) sebacate, the 2-ethylhexyl diester of linoleic acid dimer, and the complex ester formed by reacting one mole of sebacic acid with two moles of tetraethylene glycol and two moles of 2-ethylhexanoic acid.

[0021] Esters useful as synthetic oils also include those made from C<sub>4</sub> to C<sub>12</sub> monocarboxylic acids and polyols and polyol ethers such as neopentyl glycol, trimethylol propane, pentaerythritol, di(pentaerythritol), or tripentaerythritol.

[0022] Silicon-based oils such as the polyalkyl-, polyaryl-, polyalkoxy-, or polyaryloxy-siloxane oils and silicate oils comprise another useful class of synthetic lubricants (e.g., tetraethyl silicate, tetrakispropyl silicate, tetra-(2-ethylhexyl)-silicate, tetra-(4-methyl-phenyl)silicate, tetra-(p-tert-butylphenyl) silicate, hexyl-(4-methyl-2-pentoxy)disiloxane, poly(methyl) siloxanes, poly-(methylphenyl)siloxanes). Other synthetic lubricating oils include liquid esters of phosphorus-containing acids (e.g., tricresyl phosphate, tricresyl phosphate, diethyl ester of decane phosphonic acid), and polymeric tetrahydro-furans.

[0023] Another class of oils is known as traction oils, which are typically synthetic fluids containing a large fraction of highly branched or cycloaliphatic structures, i.e., cyclohexyl rings. Traction oils or traction fluids are described in detail, for example, in U.S. Pat. Nos. 3,411,369 and 4,704,490.

[0024] Unrefined, refined, and rerefinederd oils, either natural or synthetic (as well as mixtures of two or more of any of these) of the type disclosed hereinabove can be used in the lubricants of the present invention. Unrefined oils are those obtained directly from a natural 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, hydroprocessing, hydrocracking, and hydroreforming. Refined 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 refined oils are also known as reclaimed or reprocessed oils and often are additionally processed by techniques directed to removal of spent additives and oil breakdown products.

[0025] In one embodiment, the oil of lubricating viscosity is a poly-alpha-olefin (PAO). Typically, the poly-alpha-olefins are derived from monomers having 4 to 30, or 4 to 20, or 6 to 16 carbon atoms. Examples of useful PAOs include those derived from 1-decene. These PAOs may have a viscosity of 2 to 150. Example of poly-c-olefins include oligomers of 1-decene. These synthetic base oils are hydrogenated resulting in an oil of stability against oxidation. The synthetic oils may encompass a single viscosity range or a mixture of high viscosity and low viscosity range oils so long as the mixture results in a viscosity which is consistent with the requirements set forth below. Also included as preferred base oils are highly hydrocracked and dewaxed oils. These petroleum oils are generally refined to give enhanced low temperature viscosity and antioxidation performance. Mixtures of synthetic oils with refined mineral oils may also be employed.
Isobutylene Polymer

The second component of the present invention is an isobutylene polymer, which is typically soluble in the lubricant composition. The isobutylene polymer comprises predominately repeating units from isobutylene, and is present in the fully formulated lubricant in an amount of at least 0.5 percent by weight, typically 1 to 10 percent by weight, and will typically have a number average molecular weight of 500 to 3000. In one embodiment, the isobutylene polymer is present in the lubricant composition in two component fractions. The first fraction is present in an amount of 1.0 to 6.0 percent by weight and has a number average molecular weight of 250 to 1600, the second fraction is present at 0.5 to 2.0 percent by weight and has a number average molecular weight of 1600 to 3000. In another embodiment, the first fraction is present an amount of 2.0 to 5.0 percent by weight and has a number average molecular weight of 750 to 1200 and the second fraction is present in an amount of 1.0 to 1.25 percent by weight and has a number average molecular weight of 1750 to 2500.

The isobutylene polymer should exhibit a sufficient solubility in the lubricant composition as a whole, and in the solvent (described below) in particular, in order to be dissolved and remain in solution in the particular concentration employed. The terms “soluble,” “solubility,” “solution,” and the like as referred to throughout this specification, are intended to represent a practical, rather than a theoretical concept. It might be debated whether, under a given set of conditions, an apparent solution of a polymer or another substance is a true solution or is actually a very fine, stable emulsion or dispersion. All such states are intended to be encompassed herein by the concept of solubility. The solutions in question thus are those states in which significant separation or settling of the components does not normally occur over commercially reasonable time periods, e.g., months.

Alkylated Aromatic Hydrocarbon

The third component of the present invention is an alkylated aromatic hydrocarbon, which comprises an alkyl benzene or an alkylated naphthalene or combinations thereof. In one embodiment the amount of alkylated aromatic hydrocarbon is present in the lubricant composition in an amount of at least 0.1 percent by weight, preferably 0.25 to 10 percent by weight, more preferably 0.5 to 4 percent by weight.

The Alkylated Naphthalene

In one embodiment, the alkylated aromatic hydrocarbon comprises an alkylated naphthalene which can include a mixture of products such as alkylated naphthalenes, coupled and bridged naphthalenes, oligomers and dehydrohalogenated waxes. The weight average molecular weight (M_w) is a useful characterization of the final product. A suitable M_w range is 300 to 20,000, or 300 to 10,000. In one embodiment, a M_w is 300 to 6,000, or 400 to 2000. In one embodiment, the amount of alkylated naphthalene is present in the lubricant composition in an amount of 0.25 to 4 percent by weight; in another embodiment 0.5 to 2.5 percent by weight, or 1.0 to 2.0 percent by weight.

The alkylation naphthalene can be of the formula

![Chemical Structure]

wherein R^1, R^2, R^3 and R^4 are the same or different from each other and are each a hydrogen atom or an aliphatic group having from 1 to 20 carbon atoms, with the proviso that the total number of carbon atoms of R^1, R^2, R^3 and R^4 is within the range of 6 to 60, preferably 15 to 50. Preferably the total number of carbon atoms of R^1, R^2, R^3 and R^4 is more than 40 and most preferably not more than 30.

Preferable aliphatic groups represented by R^1, R^2, R^3 and R^4 include alkyl and alkenyl groups. Alkyl groups containing 1 to 20 carbon atoms are methyl, ethyl, the isomers of propyl, the isomers of butyl, the isomers of pentyl, the isomers of hexyl, the isomers of heptyl, the isomers of octyl, the isomers of nonyl, the isomers of decyl, the isomers of undecyl, the isomers of dodecyl, the isomers of tridecyl, the isomers of tetradecyl, the isomers of pentadecyl, the isomers of hexadecyl, the isomers of heptadecyl, the isomers of octadecyl, the isomers of nonadecyl, and the isomers of eicosyl.

Alkenyl groups containing from 2 to 20 carbon atoms include vinyl, the isomers of propenyl, the isomers of butenyl, the isomers of pentenyl, the isomers of hexenyl, the isomers of heptenyl, the isomers of octenyl, the isomers of nonenyl, the isomers of decenyl, the isomers of undecenyl, the isomers of dodecenyl, the isomers of tridecenyl, the isomers of tetradecenyl, the isomers of pentadecenyl, the isomers of hexadecenyl, the isomers of heptadecenyl, the isomers of octadecenyl, the isomers of nonadecenyl and the isomers of eicosenyl.

Of the alkyl groups and alkenyl groups, preferred are the alkyl groups. The total number of carbon atoms of R^1, R^2, R^3 and R^4 is preferably 8 to 60, especially 12 to 20, especially 16 to 18. Alkyl groups also can include alkyl chains derived from chlorinated long chain paraffins. All of R^1, R^2, R^3 and R^4 may be aliphatic groups, or at least one of R^1, R^2, R^3 and R^4 may be aliphatic groups while the rest thereof may be hydrogen atoms. It is preferable that 1 to 3 of R^1, R^2, R^3 and R^4 are aliphatic groups while the rest thereof are hydrogen.

When two out of R^1, R^2, R^3 and R^4 are aliphatic groups, the combination of R^1, R^2, R^3 and R^4 may be arbitrarily selected. Both aliphatic groups may be attached to the same ring as in the case where R^1 and R^2 are respectively aliphatic groups. Alternatively, a single aliphatic group may be attached to each of the different rings as in the case where R^2 and R^3 are respectively aliphatic groups.

The aliphatic substituted naphthalene can be manufactured by any conventional method. For example, the aliphatic substituted naphthalenes can be obtained by attaching (or addition reacting) to a naphthalene nucleus compounds selected from the group consisting of halides of alky1 groups having 1 to 20 carbon atoms and olefins having 2 to 20 carbon atoms. A particularly preferred aliphatic substituted naphthalene is MCP-917™, which is an alkyl naphthalene alkylated with a C_{18} group, available from Mobil Chemical.
[0040] The Alkyl Benzene

[0041] In another embodiment the alkylated aromatic hydrocarbon can comprise one or more alkyl benzenes. The alkyl groups of the alkyl benzene typically contain a total of 8 to 40 carbon atoms and preferably 12 to 36 carbon atoms. The alkyl group may be straight chained or branched. Alkyl benzenes are prepared by well-known procedures, one of which is the Friedel-Crafts alkylation utilizing a Lewis acid. In one embodiment the alkylated benzene is present in the lubricant composition in an amount of 0 to 4 percent by weight, in another embodiment 0.5 to 3.5 percent by weight, or 1.0 to 2.5 or to 2.0 percent by weight.

[0042] The alkyl benzenes desirably have a molecular weight of 100 to 500 and more desirably 200 to 350, and preferably 200 to 300. Desirably the alkylbenzenes have a viscosity of 1 to 15 mm²/s (cSt) at 40°C and more desirably 3 to 10 and preferably 3 to 7 mm²/s (cSt) at 40°C. Desirably at least 50 mole %, more desirably at least 75, and preferably at least 85 mole % of the alkylbenzene is monoalkyl substituted. Desirably at least 50 mole %, more desirably at least 75, and preferably at least 85 mole % of the alkyl groups of said alkylbenzene have two or more methyl and/or ethyl branches extending from the alkyl backbone. Since the alkylbenzenes are reaction products from alkylation reactions, desirably at least 50 or 60% of the alkyl benzenes, more desirably at least 75 % and preferably at least 85% have 5 to 40, more desirably 7 to 30, and preferably 8 to 16 total carbon atoms in the alkyl groups attached to the benzene.

[0043] The alkylbenzenes as a class of materials also vary widely including mono and polyalkyl functionalized benzenes of very low viscosity to relatively high viscosity.

[0044] Copolymer

[0045] In one embodiment of the lubricant composition an olefin copolymer is present, other than the isobutylene copolymer, which is typically an ethylene/propylene copolymer. In one embodiment the ethylene/propylene copolymer is present in an amount of 0.25 to 2.0 percent by weight; in another embodiment 0.5 to 1.25 percent by weight, and 1.0 to 1.20 percent by weight.

[0046] Ethylene-propylene copolymers, generally referred to as OCP’s, can be prepared by copolymerizing ethylene and propylene, generally in a solvent, using known catalysts such as a Ziegler-Natta catalyst or a metalloocene catalyst. The ratio of ethylene to propylene in the polymer influences the oil-solubility, oil-thickening ability, low temperature viscosity, pour point depressant capability, and performance of the product. The common range of ethylene content is 40-60% by weight and typically is 45 to 55% by weight. Some commercial OCP’s are terpolymers of ethylene, propylene and a small amount of non-conjugated diene such as 1,4-hexadiene or ethylidene norbornene (ENB). In the rubber industry, such terpolymers are referred to as EPDM (ethylene propylene diene monomer).

[0047] Miscellaneous

[0048] Other materials can be included in the compositions of the present invention, provided that they are not incompatible with the aforementioned required components or specifications. Such optional materials include dispersants (sometimes referred to as “ashless dispersants”), which may be included, for instance, in amounts of up to 10 weight percent on an oil free basis. Examples of dispersants include carboxylic dispersants, which can be the reaction product of carboxylic acylating agents with nitrogen- or hydroxy-containing compounds, amine dispersants, Mannich dispersants, post-treated dispersants, and polymeric dispersants. Other optional materials include antioxidants, including hindered phenolic antioxidants, secondary aromatic amine antioxidants, sulfurized phenolic antioxidants, oil-soluble copper compounds, phosphorus-containing antioxidants, organic sulfides, disulfides, and polysulfides. Other optional components include seal swell compositions, such as iso-decyl sulfonate, which are designed to keep seals pliable. Also permissible are pour point depressants, such as polymethacrylates, vinyl acetate/fumarate or/maleic copolymers, and styrene/maleate copolymers. These optional materials are known to those skilled in the art, are generally commercially available, and are described in greater detail in published European Patent Application 761,805. Also included can be corrosion inhibitors, dyes, fluidizing agents, and antifoam agents.

[0049] As used herein, the term “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: 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 a ring); substituted hydrocarbon substituents, that is, substituents containing non-hydrocarbon groups which, in the context of this invention, do not alter the predominantly hydrocarbon nature of the substituent (e.g., halo [especially chloro and fluoro], hydroxy, alkoxy, mercapto, alkylmercapto, nitro, nitroso, and sulfoxyl); 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, thiencyl and imidazoyl. In general, no more than two, preferably 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.

[0050] It is known that some of the materials described above may interact in the final formulation, so that the components of the final formulation may be different from those that are initially added. For instance, metal ions (of, e.g., a detergent) can migrate to other acidic or anionic sites of other molecules. The products formed thereby, including the products formed upon employing the composition of the present invention in its intended use, may not be susceptible of easy description. Nevertheless, all such modifications and reaction products are included within the scope of the present invention; the present invention encompasses the composition prepared by admixing the components described above.
EXAMPLES

[0051] A base formulation is prepared in an API Group 2 hydrotreated base oil, comprising the following additive components, amounts expressed in percent by weight:

[0052] 7.5% viscosity modifier (including about 28% diluent oil), 0.1% pour point depressant, 3.5% succinimide dispersant(s) (including about 42% diluent oil), 1.14% antioxidant(s), 0.88% detergent(s) (including about 45% diluent oil), 0.6% seal swell agent, 0.3% antioxidant(s), 0.24% friction modifiers and smaller amounts of other conventional components.

[0053] To the base formulation is added the components in the amounts indicated in Table 1 found below.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Ex. 1</th>
<th>Ex. 2</th>
<th>Ex. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene alkylated with C16–C18</td>
<td>3.00</td>
<td>1.00</td>
<td>1.25</td>
</tr>
<tr>
<td>olefine with chlorinated paraffin  (wt. %)</td>
<td>1.00</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>C10-C16 alkyl benzene (wt. %)</td>
<td>0.50</td>
<td>1.00</td>
<td>1.25</td>
</tr>
<tr>
<td>Ethylene/propylene copolymer</td>
<td>0.50</td>
<td>1.00</td>
<td>1.25</td>
</tr>
<tr>
<td>2006 X1, polyisobutylene (wt. %)</td>
<td>1.00</td>
<td>2.00</td>
<td>1.25</td>
</tr>
<tr>
<td>1000 X4, polyisobutylene (wt. %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity @ 100 °C. mm²/s (cSt.)</td>
<td>8.01</td>
<td>8.56</td>
<td>9.30</td>
</tr>
<tr>
<td>Minutes to seizure (mm)</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

[0054] Table 1 reports the kinematic viscosity at 100 °C. and the minutes to seizure. Minutes to seizure is determined by the Element on Ring Seizure test, developed by the Lubrizol Corporation. A standard Falex Block-on-Ring Test Apparatus is used. The test fixture consists of a CVT element embedded within a standard test block. The two halves of the block are held together by block anchor bolts. The test configuration consists of the test fixture loaded against the surface of a standard F-25061-V Timken ring. The test is run at a speed of 1200 rpm with 225 pounds of load at 100 °C. for two hours with the elements being lubricated by the test fluid. The primary measurement of the test is the minutes to seizure.

[0055] The results show that formulations within the scope of the present invention exhibit good results by this test.

[0056] Each of the documents referred to above is incorporated herein by reference. Except in the Examples, or where otherwise explicitly indicated, all numerical quantities in this description specifying amounts of materials, reaction conditions, molecular weights, number of carbon atoms, and the like, are to be understood as modified by the word “about.” Unless otherwise indicated, each chemical or composition referred to herein should be interpreted as being a commercial grade material which may contain the isomers, by-products, derivatives, and other such materials which are normally understood to be present in the commercial grade. However, the amount of each chemical component is presented exclusive of any solvent or diluent oil, which may be customarily present in the commercial material, unless otherwise indicated. It is to be understood that the upper and lower amount, range, and ratio limits set forth herein may be independently combined. Similarly, the ranges and amounts for each element of the invention can be used together with ranges or amounts for any of the other elements. As used herein, the expression “consisting essentially of” permits the inclusion of substances that do not materially affect the basic and novel characteristics of the composition under consideration.

What is claimed is:

1. A method for lubricating a continuously variable transmission, comprising supplying thereto a lubricant comprising:
   (a) an oil of lubricating viscosity;
   (b) a polyisobutylene polymer present in an amount of at least 0.5 percent by weight; and
   (c) an alkylated naphthalene or an alkylated benzene or a combination thereof present in an amount of at least 0.1 percent by weight.

2. The method of claim 1, wherein said alkylated benzene is present in an amount of 0 to about 4 percent by weight.

3. The method of claim 1, wherein said alkylated naphthalene is present in an amount of about 0.5 to about 4 percent by weight.

4. The method of claim 1, wherein the lubricant further comprises an olefin copolymer other than the polyisobutylene copolymer of (b).

5. The method of claim 5, wherein said olefin copolymer is an ethylene/propylene copolymer.

6. The method of claim 5, wherein said olefin co-polymer is present in an amount of about 0.25 to about 2 percent by weight.

7. The method of claim 1, wherein said polyisobutylene is polyisobutylene, which is present in an amount of about 1 to about 10 percent by weight and comprises polyisobutylene of a number average molecular weight of about 500 to about 3000.

8. The method of claim 7, wherein said polyisobutylene comprises a mixture of polyisobutylene of:
   about 1.0 to 6.0 percent by weight of polymer of a number average molecular weight of about 250 to about 1600 and
   about 0.5 to 2.0 percent by weight of polymer of a number average molecular weight of about 1600 to about 3000.

9. A composition suitable for lubricating a continuously variable transmission, comprising:
   (a) an oil of lubricating viscosity;
   (b) about 0.5 to about 4 percent by weight of an alkylated naphthalene;
   (c) 0 to about 4.0 percent by weight of an alkyl benzene;
   (d) about 0.25 to about 2.0 percent by weight of an olefin copolymer;
   (e) about 1 to about 10 percent by weight of polyisobutylene polymer of a number average molecular weight of about 500 to about 3000.

* * * * *