ENHANCED LUBRICANT COMPOSITION

Field

[0001] The invention relates to enhanced lubricant composition that comprises a base oil with graphene derived from a carbon containing gas and methods of forming such a lubricant composition.

Background

[0002] Lubricants are important in mechanical devices to mitigate wear such as by reducing friction and wear and improving heat transfer between mechanical components and reducing corrosion and providing heat protection to mechanical components.

[0003] It is desirable to provide lubricants with enhanced properties, such as having increased lubricity, and/or co-efficient of friction to provide enhanced protection to mechanical components.

[0004] It is an object of the invention to address one or more shortcomings of the prior art and/or provide a useful alternative.

[0005] Reference to any prior art in this specification is not, and should not be taken as, an acknowledgement or any form of suggestion that the prior art forms part of the common general knowledge of a person skilled in the art.

Summary

[0006] In the disclosure, there is provided lubricant composition comprising:

a base oil or fully formulated lubricant; and

graphene nanoparticles derived from a carbon containing gas dispersed in the base oil or fully formulated lubricant.

[0006a] In one aspect of the disclosure, there is provided a lubricant composition comprising:

a base oil or a fully formulated lubricant; and

graphene nanoparticles derived from a carbon containing gas dispersed in the base oil or the fully formed lubricant;

and wherein the graphene nanoparticles are present at a concentration of from about 0.001 wt% up to about 0.01 wt% of the total weight of the lubricant composition.

[0007] In the disclosure, there is provided a method for preparing a lubricant composition comprising:

dispersing graphene nanoparticles derived from a carbon containing gas in a base oil or fully formulated lubricant.

[0007a] In another aspect of the disclosure, there is provided a method for preparing a lubricant composition comprising:

dispersing graphene nanoparticles derived from a carbon containing gas in a base oil or a fully formulated lubricant;

wherein the graphene nanoparticles are present at a concentration of from about 0.001 wt% up to about 0.01 wt% of the total weight of the lubricant composition.

[0008] In one example, the lubricant composition is a lubricant concentrate. In another example, the lubricant composition is a finished lubricant.

[0009] In an example, the graphene nanoparticles are present in an amount of from about 0.001 wt%. Preferably, the graphene nanoparticles are present in an amount of from about 0.01 wt%. More preferably, the graphene nanoparticles are present in an amount of from about 0.1 wt%. Even more preferably, the graphene nanoparticles are present in an amount of from about 1 wt%. Still more preferably, the graphene nanoparticles are present in an amount of from about 10 wt%.

[0010] In an example, the graphene nanoparticles are present in an amount of up to about 20 wt%. However, in some examples, the graphene nanoparticles are present in an amount of up to about 10 wt%, 2 wt%, 1 wt% or 0.01 wt%. For example, in one or more forms the composition may comprise graphene nanoparticles in an amount of: 0.001 wt% up 0.01 wt%, or 0.01wt% up to 1 wt% or, 0.1 wt% up to 1 wt%, or 1 wt% up 2 wt%, or 2 wt% up to 10 wt%, or 10wt% to 20wt%

[0011] The skilled person will appreciate that the weight proportion of graphene nanoparticles will depend on the intended application, and for example, whether the lubricant composition is in the form of a concentrate or a fully formulated lubricant.

[0012] In an example, the graphene is substantially free of metal and semi-metal impurities. In one form, the metal or semi-metal impurities are selected from the group

consisting of: Fe, Co, Cu, Mo, Ni, Si, and oxides thereof. By substantially free it is meant that there is less than 1 ppm total of the metal or semi-metal impurities. Preferably less than 1 ppb total of the metal or semi-metal impurities. Even more preferably, the metal or semi-metal impurities are less than the detectable limit.

[0013] In an example, the lubricant composition is substantially free of graphene oxide and/or reduced graphene oxide. By substantially free it is meant that the graphene nanoparticles comprise graphene oxide and/or reduced graphene oxide in an amount of 1 wt% or less of the

graphene, preferably 0.1 wt% or less, more preferably 0.01 wt% or less, and most preferably less than the detectable limit.

[0014] In an example, the graphene nanoparticles have a size of from about 2 nm up to about 250 nm.

[0015] In an example, the graphene nanoparticles comprise, consist essentially of, consist of, or are in the form of platelets or flakes.

[0016] In an example, the graphene nanoparticles comprise, consist essentially of, consist of, or are formed from multiple layers of graphene.

[0017] In an example, the lubricant composition further comprises a dispersant. Although in other forms, the lubricant composition does not comprise a dispersant. In examples in which a dispersant is present, it is preferred that the dispersant is present in an amount of from about 0.001 wt% up to about 2 wt%.

[0018] In one form of the above example, the dispersant is selected from the group consisting of: polyisobutylene succinimides, (2-methoxymethylethoxy) propanol, octadecanoic acid, 12-hydroxy-polymer with alpha-hydro-omega-hydroxypoly (oxy1,2-ethanediyl, catalytic reformer fractionator, sulfonated, polymers with formaldehyde, sodium salts, Poly(oxy-1,2-ethanediyl), a-sulfo-w-[2,4,6tris(1-phenylethyl) phenoxy]-ammonium salt, Tristyrylphenol ethoxylates, polyalkylene oxide derivatives of alcohols, propane-1,2-diol, naphtha, base oil, and mineral oil combinations thereof.

[0019] In the disclosure, the method comprises providing graphene nanoparticles derived from a carbon containing gas.

[0020] In the disclosure, the step of dispersing the graphene nanoparticles comprises:

forming a mixture of graphene nanoparticles in the base oil or fully formulated lubricant; and

subjecting the mixture to high-shear mixing.

[0021] In one form of the above example, the high-shear mixing is carried out at a shear rate of from about 40,000 to about 60,000 s^{-1}.

[0022] In one form of the above example, the step of subjecting the mixture to high-shear mixing is carried out for a time of from about 5minutes to about 72 hours.

[0023] In the disclosure, the method further comprises adding a dispersant to the mixture.

[0024] In the disclosure, the method further comprises producing graphene nanoparticles from a carbon containing gas.

[0025] In the disclosure, there is provided a lubricant composition formed according to the method as disclosed herein, and/or examples thereof, and/or forms thereof. In another aspect of the disclosure, there is provided a lubricant composition formed according to the method as disclosed herein.

[0026] In the disclosure, there is provided the use of a lubricant composition as disclosed herein, and/or examples thereof, and/or forms thereof as a lubricant concentrate or a finished lubricant. In another aspect of the disclosure, there is provided use of a lubricant composition as disclosed herein as a concentrate or a finished lubricant.

[0027] Any of the features described herein can be combined in any combination with any one or more of the other features described herein within the scope of the disclosure.

[0028] Preferred features, examples and variations of the disclosure may be discerned from the following Detailed Description which provides sufficient information for those skilled in the art to perform the disclosure. The Detailed Description is not to be regarded as limiting the scope of the preceding Summary in any way.

Detailed Description

[0029] The present invention relates to a lubricant composition that comprises a base oil or fully formulated lubricant with graphene derived from a carbon containing gas dispersed therein and

methods of forming such a lubricant composition. The inventors have found that the use of graphene derived from a carbon containing gas enables longer and better dispersion of the