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(54) Lubriciant compositions

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Compositions lubrifiantes

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(73) Proprietor: **L & S Fluids Limited**
West Cluden Mill
Irongray
Dumfries DG2 9UW (GB)

(72) Inventors:
- **Hutchinson, Richard**
Burnley
Lancashire, BB10 4TX (GB)
- **Reid, Steven**
Irongray
Dumfries, DG2 9UW (GB)

(74) Representative: **Wilson, Gary et al**
Harrison Goddard Foote
106 Hope Street
Glasgow
G2 6PH (GB)

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Description

[0001] The present invention relates to lubricant compositions. More particularly, this invention relates to dry-film lubricant compositions for high temperature applications. More particularly still, this invention relates to boron nitride-containing lubricants, in which the boron nitride is dispersed in a polyglycol base material. The base material is water-insoluble.

[0002] A number of different lubricants currently exist for use in high temperature environments, typically at temperatures over 260°C, and potentially up to 2000°C, such as on conveyor chains and bearings subjected to high temperatures in, for example, bakery ovens, kilns and paint stoving ovens. When selecting a lubricant for such uses, extreme pressure performance, operating temperature range, coefficient of friction and even the colour of the film are all relevant considerations. In addition, when working at high temperatures, particularly in baking ovens, safety is of paramount importance; the lubricant should not, of course, be flammable, nor should it produce toxic vapours. Furthermore, downtime for the machinery should be kept to a minimum, for economic reasons, and thus the lubricant should be easy to apply, not leave behind deposits or require cleaning, and it must maintain its lubricity for as long as possible.

[0003] Such known products include synthetic ester-based formulations: liquid lubricants enhanced with chemical additives to improve wear resistance and protect them from thermal degradation. Such compositions are generally limited to maximum operating temperatures of approximately 260°C, and their use will eventually lead to the formation of lacquers, gums and carbon deposits on the equipment being lubricated, which necessitates periodic cleaning (which, in turn, necessitates periodic shut-down of the equipment). In addition, being liquid products, synthetic ester-based formulations have a tendency to attract dust and dirt, which adheres to the lubricant film and, over time, will contribute to abrasive wear.

[0004] Another known lubricant for high-temperature use comprises a polyglycol-borne solid lubricant, typically graphite and/or molybdenum, dispersed in a high molecular weight, water-insoluble polypropylene glycol (typically having molecular weights of greater than 250). These fluids are designed to deposit a dry film of the solid lubricant; the polyglycol fluid acts, initially, as a conventional fluid lubricant, but depolymerises at a high-temperature and evaporates, thereby avoiding the formation of lacquers, and also avoiding gummy or carbon deposits. Following the evaporation of the polyglycol, a dry film of lubricating solids remains on the lubricated surfaces, which has little tendency to attract dust and dirt. Both graphite and molybdenum provide good load carrying capacity, and can withstand temperatures of up to approximately 450°C and 350°C, respectively. However, both are black in colour, and are electrically conductive, which can be disadvantageous in some uses. Such solid lubricants over time cake the equipment and thus form a barrier inhibiting the penetration of subsequent applications of lubricant. Regular application is necessary in view of the fact that graphite/molybdenum do not provide sufficient lubricity once the polyglycol base fluid has evaporated. In some applications, polyglycol bases can also carry their own disadvantages, which are mentioned more fully below.

[0005] Graphite and molybdenum can also be dispersed in water, in place of the polyglycol. However, aqueous dispersions tend to be very low viscosity fluids and accordingly have a tendency to drip from machinery and require frequent re-application, increasing downtime. In addition, aqueous dispersions exhibit "spitting" at raised temperatures, which is undesirable.

[0006] A further known class of lubricants are the polytetrafluoroethylene (PTFE) greases/dispersions. PTFE greases are dispersions of PTFE in perfluorinated polyether fluids (PFPE). PTFE is also used to enhance conventional ester-based lubricants, and is supplied as a dry film lubricant deposited in a similar manner to graphite and molybdenum. However, when supplied in ester fluids, the same problems occur as mentioned above. In addition, PTFE and PFPE lubricants cannot be recommended for continuous use above 260°C due to thermal degradation and emission of corrosive and toxic fumes. They are also extremely expensive.

[0007] Boron nitride particles are also used as the basis of various commercially available lubricant compositions, including lubricants for high temperature applications. Boron nitride is commercially available in various forms, either as a concentrate (in water, alcohol, oil or polyalphaolefin), for dilution with preferred base materials, or as a finished lubricant. Boron nitride can withstand extremely high temperatures and high loads, it is also non-reactive, thermally conductive, electrically insulating, and is white in appearance. Oil dispersions and those in polyalphaolefin are unacceptable due to carbonaceous deposit formation at high temperatures (i.e. over 260°C), which, over time, require extensive cleaning (ultrasonic or dry-ice). Furthermore, alcohol dispersions give rise to flammable vapours in use and are also unsuitable. Water-based (i.e. aqueous) dispersions are disadvantageous, as discussed above. In addition, dispersing agents present in such compositions are generally not approved for food grade use.

[0008] The selection of the base material for the lubricant is of considerable importance. The production of corrosive and/or toxic fumes from a lubricant is a significant problem in all circumstances, and particularly in baking ovens. Baking ovens must not, of course, produce toxic fumes during baking, and enforced downtime to enable re-lubrication is undesirable, for economic reasons. In addition, baking ovens are often located in small premises where it is impractical to install the necessary ventilation equipment to remove any fumes which are produced during the lubricating process. As mentioned above, polyglycols, in particular polypropylene glycol, have been used as a base fluid. However, it has been found that application of high molecular weight polyglycol-based lubricants can be difficult, and a great care must be taken in order to avoid the generation of dense smoke and fumes when the oven is first heated to working temperature after re-application. Indeed, in some circumstances, it is practice to turn off the building's fire alarm whilst this process is carried out.

[0009] Whilst there are several commercially available lubricants which are labelled as "food glade", the majority of these products are listed as FDA H2 approved (no possibility of contact with food). As these products may clearly come into contact with food, or with food preparation surfaces, it is clearly desirable to have at least FDA H1 approval (incidental contact with food). There are commercially available products which are listed as FDA H1 approved, but these products, as discussed above, are based on synthetic esters, medicinal quality white oils, polyalphaolefins, or a combination of these, all of which form deposits when used at high temperatures in excess of 260°C.

[0010] The base fluid must provide a suitable suspension of the lubricant material therein. The inventors of the present invention have found that typical lubricant base fluids which are suitable for use in food ovens are unsuitable or unsatisfactory in this respect, particularly when the solid lubricant material is boron nitride.

[0011] Thus, there is a continuing need to provide an improved lubricant composition, particularly one comprised of food quality components and being suitable for use at high temperatures in baking or cooking ovens.

[0012] US3,196,109 relates to a lubricating grease containing boron nitride. The greases are used in a wide variety of applications such as high temperature applications including that of aviation greases, greases for various apparatus associated with missiles, rockets, greases for lubricating apparatus subject to gamma radiation etc.

[0013] DE202004020067 relates to a nonoceramic lubricant composition comprising an (oligo) alkylene glycol, a ceramic component and an activator.

[0014] US2006/0154830 relates to a high temperature lubricant composition suitable for high temperature applications. The high temperature lubricant composition contains a neopolyol ester, boron nitride powder and a linker/surfactant.

[0015] EP1808477 relates to a boron nitride based lubricant additive which is suitable for food use.

[0016] The present invention solves or alleviates the problems of the prior art.

[0017] In the first aspect of the invention, there is provided a lubricant composition for food ovens comprising boron nitride particles dispersed in a base material comprised of one or more polyglycols, a rheology modifier and a corrosion inhibitor and/or extreme pressure and anti-wear additive, the boron nitride being present in an amount of 1% to 10% by weight of the composition, the base being present in an amount ranging from 87.5% to 97.4% by weight of the composition, the rheology modifier being present in an amount ranging from 0.1% to 5% and the corrison inhibitor and/or extreme pressure and anti-wear additive being present in an amount ranging from 0.1% to 2% by weight of the composition, the or each polyglycol being a water insoluble polyglycol having a molecular weight ranging from 1400 to 2800 amu and a viscosity ranging from 75 to 400 cSt at 40°C, and wherein the water-insoluble polyglycol evaporates at higher temperatures without leaving carbonaceous residues or lacquers.

[0018] The lubricant composition of the present invention may operate as a dry-film lubricant, as a wet-film lubricant, or as both a dry-film and wet-film lubricant. Preferably the lubricant composition is both a dry-film and wet-film lubricant.

[0019] The base material is preferably non-toxic. More preferably, the base material is approved by the regulatory authorities for use where incidental contact with food may occur. In particular, the base material preferably has FDA approval for use as a lubricant where incidental contact with food may occur.

[0020] Preferably the water-insoluble polyalkylene glycol is a polypropylene glycol. The polypropylene glycol may be butyl terminated.

[0021] The viscosity of suitable polyglycols increases with the molecular weight of the polyglycol (which in turn increases with the length of the polymerisation reaction time). Preferably, the water-insoluble polyglycol has a viscosity in the range of 75 to 350 cSt at 40°C.

[0022] Preferred water-insoluble polyglycols are butanol-initiated (monol-initiated) propylene oxide homo-polymers. Such compounds are obtained by the reaction between butanol and propylene oxide only. The reaction is terminated when the desired molecular weight of the polymer is attained. Preferred butanol-initiated propylene oxide homopolymers have a viscosity of from 75 to 350 cSt at 40°C.

[0023] Preferred propylene glycols are selected from one or more of the Cognis™ Breox range. Most preferred are the butanol-initiated propylene oxide homopolymers marketed as the Cognis™ Breox B-Range (for instance, those market under the trade names Breox B75, B125, B225 and B335, wherein the "B number" corresponds approximately to the viscosity, in centipoises, at 40°C), which are FDA compliant. Further preferred water-insoluble polyalkylene glycols are those marketed under the trade name Emkarox VG by Uniquema™.

[0024] In one embodiment the polyglycol has a molecular weight of around 1400 to 2500 amu. The most preferred polyalkylene glycols have molecular weights of 1403, 1710, 2117 and 2446. The viscosity of such materials is 75 cSt, 122 cSt, 224 cSt and 330 cSt, respectively. These viscosities are representative of the materials Breox B75, B 125, B225 and B335 respectively.

[0025] The flash point of the polyalkylene glycol component is typically from 211°C to 225°C.

[0026] The use of a base material having a relatively high boiling point enables the lubricant to operate as a wet-film lubricant in cooler end-uses.

[0027] The lubricant composition comprises a suspension of boron nitride particles in said base material. The boron nitride particles are preferably substantially evenly dispersed in said base material.

[0028] Preferably the composition comprises between 2% and 10% by weight boron nitride. More preferably, the composition comprises between 4% and 7.5% by weight boron nitride. Most preferably, the composition comprises approximately 5% by weight boron nitride.

[0029] The base is present in an amount from 87.5 to 97.4% by weight of the composition, preferably from 90.0 to 95.0% by weight. More preferably the base is present in an amount of approximately 93.5% by weight.

[0030] The lubricant composition may comprise additional components.

[0031] The lubricant composition additionally comprises a suspending agent (also known as a rheology modifier). In an embodiment, the composition comprises 0.1 to 3.0% by weight of the rheology modifier. Preferably the composition comprises approximately 0.5 to 2.0% by weight of the rheology modifier. Preferably the composition comprises approximately 1.0% by weight of the rheology modifier. A preferred inert rheology modifier is hydrophilic fumed silica. One such product is marketed as HDK®-N20 hydrophilic fumed silica by Wacker Silicones (HDK®-N20P, HDK®-T30 or HDK®-T40 could also be used)..

[0032] The lubricant composition further comprises a corrosion inhibitor and/or an extreme pressure and anti-wear additive. The composition comprises from 0.1 to 2.0% of the corrosion inhibitor/anti-wear additive. More preferably the corrosion inhibitor/anti-wear additive is present in an amount of from 0.1 to 0.5% by weight of the composition. Still more preferably the composition comprises approximately 0.5% by weight of the corrosion inhibitor. A preferred corrosion inhibitor/anti-wear additive comprises phosphoric acid, mono and dihexyl esters and compounds with alkylamines. A particularly preferred corrosion inhibitor/extreme pressure anti-wear additive is marketed under the trade name Irgalube®349 by Ciba® Speciality Chemicals.

[0033] In one embodiment, the lubricant composition comprises, by weight: from 2.0% to 10% boron nitride particles; from 87.5% to 97.4% base; from 0.1 % to 0.5% corrosion inhibitor and extreme pressure and anti-wear additive; and from 0.5% to 2.0% suspending agent.

[0034] In a preferred embodiment, the lubricant composition comprises, by weight, 5.0% boron nitride particles; 93.5% base; 0.5% corrosion inhibitor and extreme pressure and anti-wear additive; and 1.0 % inert suspending agent.

[0035] Typically the water-insoluble polyalkylene glycol will slowly depolymerise after application and exposure to heat, and will evaporate at higher temperatures without leaving carbonaceous residues or lacquers. The base fluid will remain for a sufficient length of time such that it carries the boron nitride particles into the moving components of the equipment, such as chain linkages and bearings.

[0036] Alternatively, the lubricant composition of the present invention can be used as a highly effective wet-film lubricant, when used at temperatures, below the temperature at which the base material evaporates.

[0037] The particular choice of polyalkylene glycol component will depend on the end use/working temperature of the oven. The desired level of lubricity, viscosity, etc. can be adjusted by variation of the choice of polyalkylene glycol and level of boron nitride, in particular.

[0038] The boron nitride particles may be of any size suitable to operate as a lubricant material. Preferred boron nitride particles have a diameter of less than around 15μm, preferably less than 13 μm. In a preferred embodiment, the boron nitride particles have a particle diameter range of 12 to 13μm. Such a material is available from GB Advanced Ceramics of Ohio, under the trade name AC6004, which is NSF approved for food contact. In another preferred embodiment, the boron nitride particles preferably have an average diameter of less than 5 microns, more preferably less than 1 micron. Preferably the boron nitride particles are hexagonal. Hexagonal boron nitride particles are also commercially available from Acheson Colloids Company, of Michigan, USA.

[0039] The base material acts as a carrier for the boron nitride particles in the composition.

[0040] The base material is preferably non-toxic. The components of the composition, in particular the corrosion inhibitor, dispersing agent and rheology modifier (where present) are preferably approved by regulatory authorities (FDA) for use in circumstances where incidental contact with food may occur. More preferably, the base material is approved by the regulatory authorities for use where incidental contact with food may occur. In particular, the base material preferably has FDA approval for use as a lubricant where incidental contact with food may occur.

[0041] The present invention provides a lubricating composition which can operate at temperatures up to 2200°C.

[0042] In another aspect of the invention, there is provided the use of a lubricant composition as described above for lubricating components in a baking oven. The components may be moving parts of said baking ovens. The oven will typically operate at a working temperature of 260°C or more, and is typically a food-baking oven.

[0043] The lubricant composition of the present invention may be used in a method of lubricating a baking oven, the method comprising the steps of applying the composition according to the invention to a baking oven.

[0044] The composition will generally be applied to the moving parts of said oven.

[0045] After the application step, the method may include the further step of heating said lubricant composition to a temperature at which the (poly)glycol component evaporates. In this manner, the boron nitride lubricant composition forms a thin dry film on the lubricated components, and leaves behind no form of dirty residue.

[0046] The term "glycol" as used herein describes an essentially aliphatic carbon chain comprising two hydroxyl groups, for example propylene glycol ($C_3H_6(OH)_2$).

[0047] Glycols can be polymerised by dehydration. The resultant polymers and co-polymers are typically referred to as "polyglycols" (or polyalkylene glycols), and include, for example, dipropylene glycol or tripropylene glycol, polypropylene glycol and co-polymers of ethylene glycol and propylene glycol.

[0048] The solubility of a propylene and higher alkylene glycols decreases as the molecular weight of the molecule increases. Thus, propylene glycol is more water soluble than, for example, tetrapropylene glycol.

[0049] The invention utilised polyglycols which are water-insoluble in all proportions at 20°C. Such polyglycol based lubricants can be used as dry or wet film lubricants. The water-insolubility of such compositions allows them to be used in steam ovens and the like, where high levels of moisture are present. In addition, the higher boiling point - when compared to the watersoluble glycols/polyglycols - water insoluble polyglycols will de-polymerise and evaporate at higher temperatures and thus provide extended time for the boron nitride to penetrate linkages. By correct application, lacquers and deposits can also be avoided.

[0050] The lubricant compositions of the present invention are stable dispersions of boron nitride in the base material. By careful selection of the base material and the suspending agent and other materials the inventors of the present invention have provided stable dispersions of boron nitride particles. The lubricant compositions of the present invention will not separate (i.e. the boron nitride will not separate from the base material) for substantial periods of time - and considerably longer than the lubricants of the prior art. For example, compositions prepared according to the present invention do not separate for at least 4 months. Prior art compositions for equivalent purposes typically separate into solid lubricant and base material within a few days or 1 to 2 weeks at most.

[0051] The invention will now be further described with reference to the Examples and Figures 1 to 3, in which:

Figure 1 is graphical representation of the results of comparative testing of a composition according to an embodiment of the present invention with known polyol ester and graphited polyglycol lubricants;

Figure 2 is a photographic depiction of the results of weight loss testing at 280°C with the lubricants used in Figure 1; and

Figure 3 is a graphical representation of the change in friction coefficient over time of a composition according to an embodiment of the present invention.

<u>Example 1 - not illustrative of the present invention</u>

[0052] A dry-film lubricant composition comprising propylene glycol was made up to the specification shown in Table 1 below.

[0053] The composition had the appearance of a white viscous fluid. Solids content was 10 wt%. Viscosity at 20°C : thixotropic. The composition was also odourless and had a pH of 7.5.

Table 1

Component	% by weight
boron nitride particles (pharmaceutical grade)[1]	**10.0%**
water	**9.1%**
Water soluble food quality corrosion inhlbitor[2]	**0.5%**
Ciba™ Dispex™ N40 (food quality dispersant)	**0.3%**
Keltrol™ E (food quality rheology modifier and suspending agent)	**0.1%**
monopropylene glycol (food quality)	**80.0%**
[1] AC6004 GE Advanced Ceramics [2] Ciba ™ Irgacor™ DSS G	

[0054] The lubricating composition of Example 1 was applied to the moving components of a Mecatherm™ baking oven, which had been switched off. The oven was then run up to working temperature (around 280°C to 300°C), prior to the introduction of steam. Re-application of lubricant was carried out as and when necessary - determined by the operators of the oven. Typically the operator will become aware that the lubricating film is breaking down by the audible sound of metal-metal contact between the moving parts within the oven.

[0055] Two commercially available baking oven lubricants were tested in the same manner. Re-application was carried out as and when necessary. The tested products were Rocol™ Foodlube High Temperature Chain Fluid (Comparative lubricant 1 [CL1]) and Kluber™ YF100 (CL2). CL1 is a food grade dry-film lubricant comprising talc particles in a polyalkylene glycol base fluid. It has an off-white appearance, and as a dry-film can operate at temperatures up to 550°C. CL2 is a graphite based lubricant, using a water-insoluble polypropylene glycol as a base fluid.

[0056] In comparative testing, it was found that, after the initial weekly maintenance of the oven (in which around 7.5 litres of lubricant was applied), CL2 must be re-applied (5.0 litres each time) approximately once every 48 hours, each re-application involving an oven downtime of approximately 3 hours. Thus, over the course of a week, the use of CL2 led to a downtime of approximately 6 hours, and used around 17.5 litres of lubricant.

[0057] Lubricant CL1 was applied to ovens at double the dosage rate of the composition of the present invention in order to achieve "silencing" of the chains and conveyors (i.e. 15 litres of CL1 per application). Re-application of CL1 was necessary after approximately 24 hours. On heating, smoke was produced, although to a lesser extent than CL2.

[0058] By comparison, the dry-film lubricant of Example 1 was applied during the weekly maintenance period (7.5 litres lubricant applied) and did not need any further re-application until the next weekly maintenance. Over the course of a year, the downtime could therefore be reduced by 288 hours or more. It was found that re-application of the dry-film lubricant was necessary once per week (a total of 6 hours downtime per week).

[0059] In operation, the base fluid in the lubricating composition of Example 1 volatilises completely on heating to the working temperature, leaving behind a dry, white-coloured film of boron nitride, which is completely free from gums, resins and carbon residues. The (poly)glycol component evaporates clearly, producing no smoke or harmful vapours. CL2 generated dense smoke when the oven was heated to working temperature, and CL1 was observed to leave behind a varnish-like deposit at high operating temperature.

[0060] In addition to the economic advantage, the lubricant is also clean and fume-free, CL 1 and CL2, in contrast, produced dense smoke/fumes when the oven was first heated to working temperature.

Example 2

[0061] A dry- or wet- film lubricant composition according to the present invention was made up to the specification shown in Table 2 below.

Table 2

Component	% by weight
Butanol-initiated propylene oxide homo-polymer[1]	**93.5**
Boron nitride particles[2]	**5.0**
Corrosion inhibitor[3]	**0.5**
Hydrophobic fumed silica[4]	**1.0**

[1] base carrier fluid and lubricant with viscosity of 225 cSt at 40°C;
[2] AC6004 GE Advanced Ceramics
[3] Ciba® Specialities Irgalube® 349
[4] Wacker Silicones HDK®-N20.

[0062] In operation, the base fluid in the lubricating composition of the Example 2 volatilises completely on heating to the working temperature, leaving behind a dry, white-coloured film of boron nitride, which is completely free from gums, resins and carbon residues. The base evaporates cleanly, producing no smoke or harmful vapours.

[0063] The results set out in Table 3 below compare the properties of boron nitride with those of other competitive dry film lubricants and an oil-based wet film lubricant.

Table 3

	Test Method			
Lubricant	Falex Extreme Pressure Failure Load ASTM D3233 Ibs	Four Ball Weld Load ASTM D2783 Kgs	Coefficient of Friction -Falex Mathod	Continuous Operating Temperature (degC)
Boron nitride - dry film	4500	200	0.105	2200

(continued)

	Test Method			
Lubricant	Falex Extreme Pressure Failure Load ASTM D3233 lbs	Four Ball Weld Load ASTM D2783 Kgs	Coefficient of Friction -Falex Mathod	Continuous Operating Temperature (degC)
Graphite - dry film	1250	150	0.123	450
PTFE - dry film	4250	200	0.094	260
Oil based lubricant	750	125	0.159	230

Example 3

[0064] Further comparative testing was carried out on the composition of Example 2 using the ball on reciprocating plate technique under the following conditions:

Ball and plate of ANSI standard steel No. E-52100;
Ball size 12mm
Reciprocating frequency 1Hz
Load applied 100 N
Temperature 280°C.

[0065] The results are shown in Figures 1 and 2. The graphited polyol lubricant, and the polyol ester were Kluber YF100 and APV High Temperature Chain Oil, respectively.
[0066] After 236 minutes at 280°C, the weight loss of the plates was assessed.
[0067] Graphited polyglycol lubricant: -10mg - Figure 2A
[0068] Polyol ester lubricant: N/A due to severe oxidation/degradation - Figure 2B

Example 2: -6mg - Figure 2C

[0069] In terms of stabiliy, the product of the present invention had not noticeably separated after a period of 4 months. In comparison, CL1 separates in a matter of days, and CL2 begins to show deposition within two weeks.

Example 4

[0070] The friction coefficient of the composition of Example 2 was assessed over time, at 280°C and a 100N load. The results of the assessment are shown in Figure 3.
[0071] It is clear that the composition of Example 2 exhibits a steady friction coefficient over a prolonged period of time. By comparison, friction becomes very high with the graphited lubricant, and the polyol severely degrades at 280°C. At high temperature, the wear rate of Example 2 is considerably less than that of the graphited lubricant (the wear rate of the polyol lubricant could not be measured due to the formation of deposits.

Example 5

[0072] Further wear testing was performed at ambient temperature, to assess the performance of Example 2 as a wet-film lubricant. The tests were performed using a portable Reichert Wear Tester having a hardened steel roller, a fixed roller bearing and a 3Kg applied load.
[0073] Example 2 performed as well as perfluorinated polyether alternatives, and outperformed all other currently available, leading brand lubricant products.
[0074] The present invention provides a food-safe lubricant material that is clean, energy efficient, cost effective and decreases downtime and running costs. The lubricants do not form carbonaceous deposits or lacquers, provide excellent lubrication performance at a wide variety of temperatures, and can be manufactured in varying viscosities to meet end needs.
[0075] The above-mentioned examples and specific description are not limiting on the scope of the invention. For instance, the compositions of the present invention may be formulated for administration as aerosols, or as greases (such as a No. 2 grease). It will therefore be appreciated that the embodiments described above may be modified within

the scope of the appended claims.

Claims

1. A lubricant composition for food ovens comprising boron nitride particles dispersed in a base material comprised of one or more polyglycols, a rheology modifier and a corrosion inhibitor and/or extreme pressure and anti-wear additive, the boron nitride being present in an amount of 1% to 10% by weight of the composition, the base being present in an amount ranging from 87.5% to 97.4% by weight of the composition, the rheology modifier being present in an amount ranging from 0.1% to 5% and the corrosion inhibitor and/or extreme pressure and anti-wear additive being present in an amount ranging from 0.1% to 2% by weight of the composition, the or each polyglycol being a water-insoluble polyglycol having a molecular weight ranging from 1400 to 2800 amu and a viscosity ranging from 75 to 400 cSt at 40°C, and wherein the water-insoluble polyglycol evaporates at higher temperatures without leaving carbonaceous residues or lacquers.

2. A lubricant according to claim 1, wherein the or each water-insoluble polyglycol is a polypropylene glycol.

3. A lubricant according to claim 1 or 2, wherein the or each water-insoluble polyglycol has a viscosity at 40°C of from 75 to 350 cSt.

4. A lubricant according to any one of claims 1 to 3,wherein the or each water insoluble polyglycol is a butanol-initiated propylene oxide homo-polymer.

5. A lubricant according to any preceding claim, comprising, by weight: from 2.0% to 10% boron nitride particles; from 0.1% to 0.5% corrosion inhibitor and/or extreme pressure and anti-wear additive; and from 0.5% to 2.0% rheology modifier

6. The use of a lubricant composition according to any preceding claim for lubricating components in an oven.

Patentansprüche

1. Schmiermittelzusammensetzung für Lebensmittelöfen, beinhaltend Bornitridpartikel, die in einem Grundmaterial dispergiert sind, welches ein oder mehrere Polyglycole, einen Viskositätsveränderer und einen Korrosionshemmer und/oder einen Extremdruck- und Antiverschleißzusatz umfasst, wobei das Bornitrid in einer Menge von 1 Gew.% bis 10 Gew.% der Zusammensetzung vorhanden ist, wobei das Grundmaterial in einer Menge vorhanden ist, die von 87,5 Gew.% bis 97,4 Gew.% der Zusammensetzung reicht, wobei der Viskositätsveränderer in einer Menge vorhanden ist, die von 0,1 Gew.% bis 5 Gew.% reicht, und wobei der Korrosionshemmer und/oder der Extremdruck- und Antiverschleißzusatz in einer Menge vorhanden ist, die von 0,1 Gew.% bis 2 Gew.% der Zusammensetzung reicht, wobei das oder jedes Polyglycol ein wasserunlösliches Polyglycol ist, das ein Molekulargewicht hat, welches von 1400 bis 2800 Atommasseneinheit reicht, und eine Viskosität, die von 75 bis 400 cSt bei 40°C reicht, und wobei das wasserunlösliche Polyglycol bei höheren Temperaturen verdampft, ohne kohlenstoffhaltige Reste oder Lacke zurückzulassen.

2. Schmiermittel nach Anspruch 1, wobei das oder jedes wasserunlösliche Polyglycol ein Polypropylenglycol ist.

3. Schmiermittel nach Anspruch 1 oder 2, wobei das oder jedes wasserunlösliche Polyglycol eine Viskosität bei 40°C von 75 bis 350 cSt hat.

4. Schmiermittel nach einem der Anspruch 1 bis 3, wobei das oder jedes wasserunlösliche Polyglycol ein butanolinitiiertes Propylenoxidhomopolymer ist.

5. Schmiermittel nach einem der vorhergehenden Ansprüche, beinhaltend, auf Gewichtsbasis, von 2,0 % bis 10 % Bornitridpartikel; von 0,1 % bis 0,5 % Korrosionshemmer und/oder Extremdruck- und Antiverschleißzusatz; und von 0,5 % bis 2,0 % Viskositätsveränderer.

6. Verwendung einer Schmiermittelzusammensetzung nach einem der vorhergehenden Ansprüche zum Schmieren von Bauteilen in einem Ofen.

Revendications

1. Composition de lubrifiant pour fours alimentaires, comprenant des particules de nitrure de bore dispersées dans un matériau de base composé d'un ou plusieurs polyglycols, d'un modificateur de rhéologie et d'un inhibiteur de corrosion et/ou additif extrême pression et anti-usure, le nitrure de bore étant présent dans une quantité de 1% à 10% en poids de la composition, la base étant présente dans une quantité se situant dans la plage de 87,5% à 97,4% en poids de la composition, le modificateur de rhéologie étant présent dans une quantité se situant dans une plage de 0,1% à 5% et l'inhibiteur de la corrosion et/ou additif extrême pression et anti-usure étant présent dans une quantité se situant dans la plage de 0,1% à 2% en poids de la composition, le ou chaque polyglycol étant un polyglycol insoluble dans l'eau ayant une masse moléculaire se situant dans la plage de 1400 à 2800 uma et une viscosité se situant dans la plage de 75 à 400 cSt à 40°C, et le polyglycol insoluble dans l'eau s'évaporant à des températures supérieures sans laisser de résidus carbonés ni de laques.

2. Lubrifiant selon la revendication 1, dans lequel le ou chaque polyglycol insoluble dans l'eau est un polypropylène glycol.

3. Lubrifiant selon l'une des revendications 1 ou 2, dans lequel le ou chaque polyglycol insoluble dans l'e au a une viscosité à 40°C de 75 à 350 cSt.

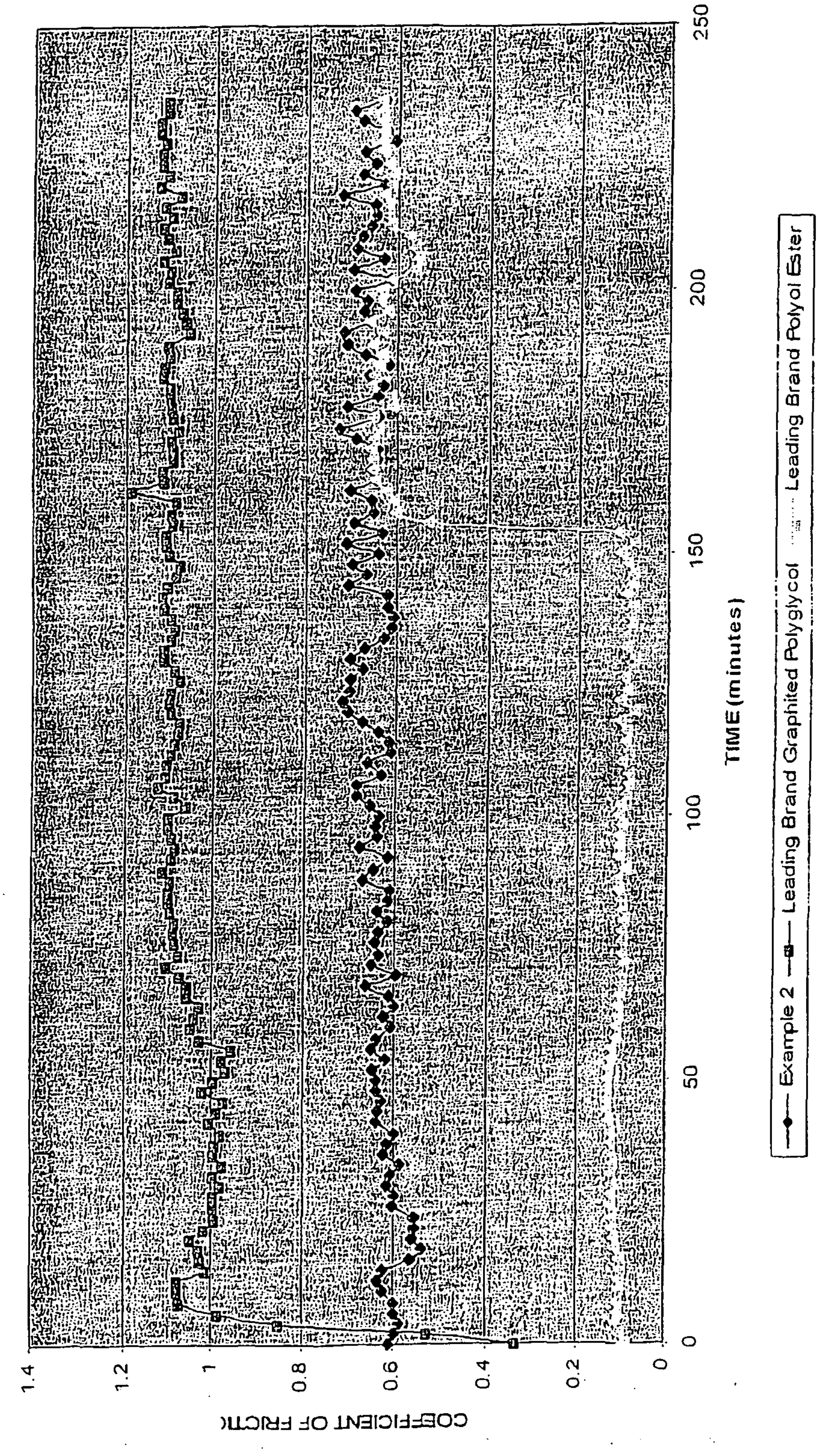
4. Lubrifiant selon l'une quelconque des revendications 1 à 3, dans lequel le ou chaque polyglycol insoluble dans l'eau est un homopolymère d'oxyde de propylène amorcé par le butanol.

5. Lubrifiant selon l'une quelconque des revendications précédentes, comprenant, en poids : de 2,0% à 10% de particules de nitrure de bore ; de 0,1% à 0,5% d'inhibiteur de corrosion et/ou additif extrême pression et anti-usure ; et de 0,5% à 2,0% de modificateur de rhéologie.

6. utilisation d'une composition de lubrifiant selon l'une quelconque des revendications précédentes pour lubrifier des composants dans un four.

FIGURE 1

Coefficient of Friction vs Time @ 280 Degrees Centigrade



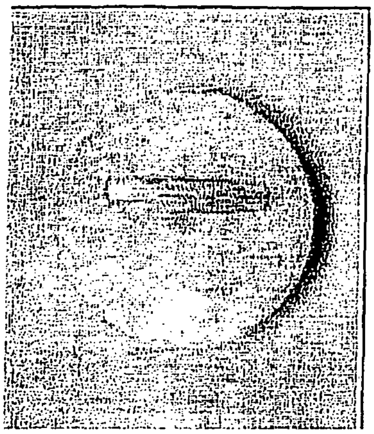


Figure 2C

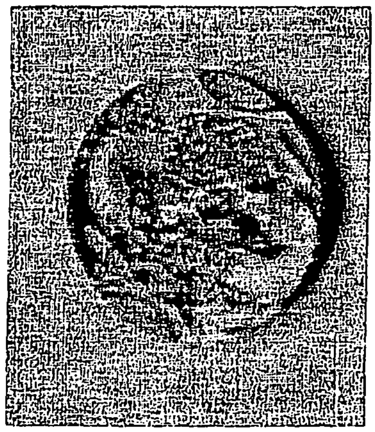


Figure 2B

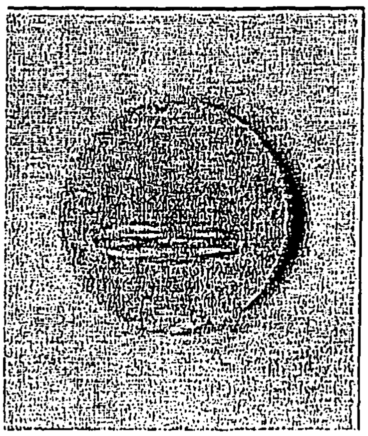
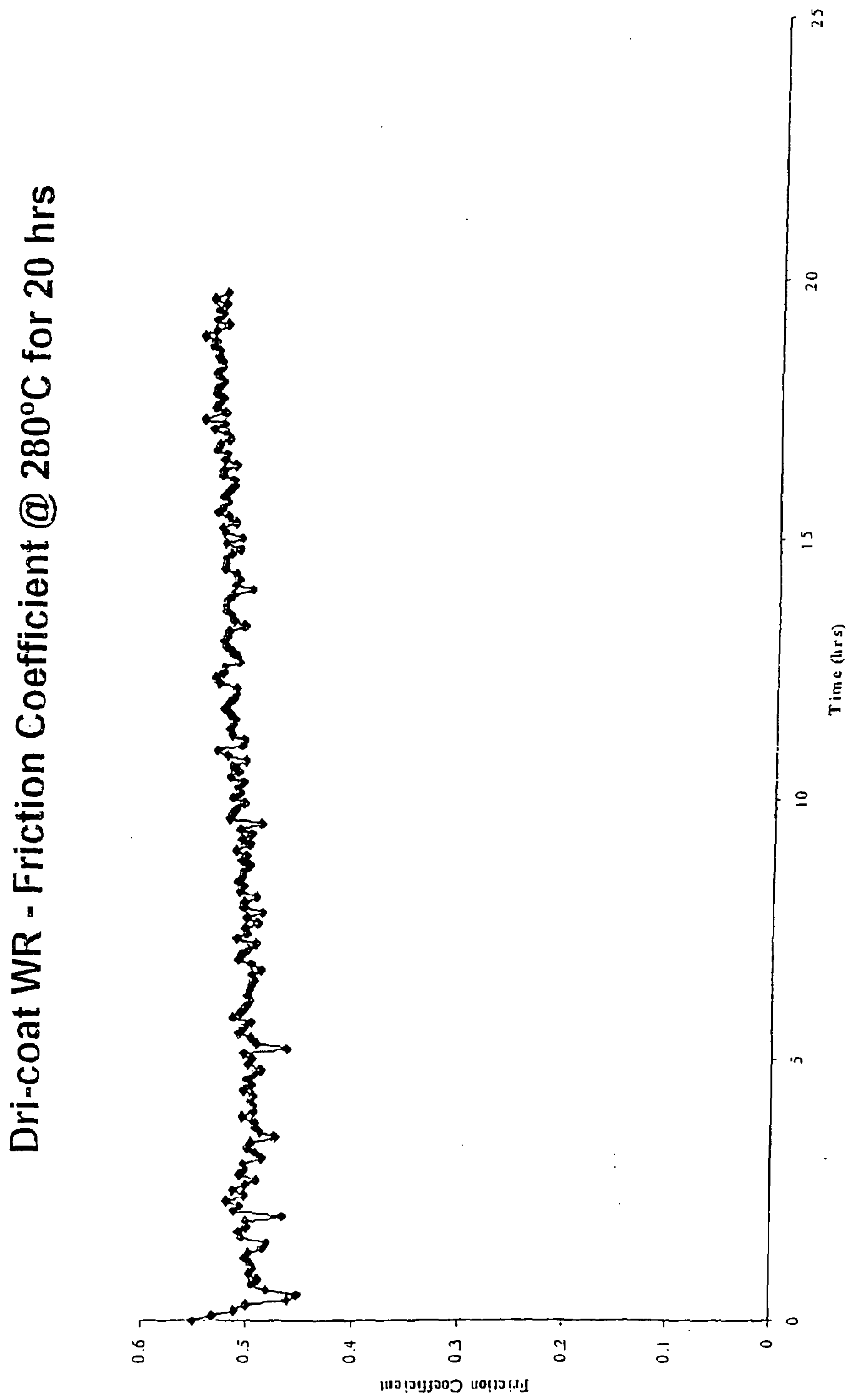


Figure 2A

FIGURE 3


Dri-coat WR - Friction Coefficient @ 280°C for 20 hrs
Friction Coefficient
0.6
0.5
0.4
0.3
0.2
0.1
0
Time (hrs)
0
5
10
15
20
25

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- DE 202004020067 **[0013]**
- US 20060154830 A **[0014]**
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